APPENDIX A

Notice of Intent to Remediate and Report Notifications

Sunoco Inc.
3144 Passyunk Avenue
Philadelphia PA 19145-5299
215 339 2000

October 12, 2006

Mr. Robert Day-Lewis
Pennsylvania DEP
2 East Main Street
Norristown, PA 19401

Mr. Steve O'Neil
Pennsylvania DEP
2 East Main Street
Norristown, PA 19401

Re: Sunoco Inc. (R&M) Philadelphia Refinery
Philadelphia, Philadelphia County

Dear Mr. Day-Lewis and Mr. O'Neil:

In accordance with the Land Recycling and Environmental Remediation Standards Act (Act 2), enclosed are two copies of a Notice of Intent to Remediate (NIR) for the Sunoco Inc. (R&M) Philadelphia Refinery. This NIR covers remediation being done as part of the 2003 Consent Order and Agreement (CO&A) at Point Breeze, Girard Point and Schuylkill River Tank Farm. Remediation at Belmont Terminal, which is part of the CO&A, is not part of this NIR since this site is not subject to RCRA Corrective Action. Sunoco is considering submitting a separate NIR for this area under the Act 2 program only.

This NIR is being submitted with the intent to enter the Sunoco Philadelphia Refinery into the One Cleanup Program with PaDEP and the USEPA. All remediation work at the Philadelphia refinery will be completed under the 2003 Consent Order & Agreement (CO&A), however, RCRA Corrective Action measures will be addressed concurrently with work performed under the CO&A and within the Act 2 program.

Please call me at 610-859-1881 or email me at jroppenheim@sunocoinc.com with any questions or comments.

Best Regards,

James Oppenheim, PE
Sr. Environmental Consultant

Cc: Sunoco Legal Dept.
Philadelphia Refinery Environmental Central File
David Burke, PADEP
Walter Payne, PADEP
Hon Lee, USEPA Region III
Colleen Costello, Langan

Will remediation be to a site-specific standard ☒ or as a special industrial area ☐? If so, the municipality or municipalities must be provided 30-day comment period.
Remediator/Property Owner/Consultant. For each of these recipients of the approval of the final report, complete form below.

Remediator
Contact Person: James R. Oppenheim
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Remediation Project Manager
Phone Number: (610) 859-1881
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 100 Green St., Marcus Hook, PA 19061
Email Address: jroppenheim@sunocoinc.com
Property Owner
Contact Person: Scott Baker
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Environmental Manager
Phone Number: (215) 339-2074
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 3144 Passyunk Ave. Philadelphia, PA 19145
Email Address: sabaker@sunocoinc.com
Consultant
Contact Person: Colleen Costello
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Consultant
Phone Number: (215) 864-0640
Company Name: Langan Engineering and Environmental Services
Address (street, city, state, zip): 30 South 17th St., Suite 1500, Philadelphia, PA 19103
Email Address: ccostello@langan.com

Preparer of Notice of Intent to Remediate:

Name: James Oppenheim

Title: Project Manager

Address: 100 Green Street
Marcus Hook, PA 19061

Telephone: (610) 859-1881

Email Address: jroppenheim@sunocoinc.com

Email Image File of Site Map showing property lines and general area of site(s) to be remediated to: (landrecycling@state.pa.us)

Sunoco Inc.
3144 Passyunk Avenue
Philadelphia PA 19145-5299
215 339 2000

October 12, 2006

Manager
Philadelphia Department of Public Health
Environmental Health Services
321 University Avenue
Philadelphia, PA 19104

Re: Sunoco, Inc. (R&M) Philadelphia Refinery
Philadelphia, Philadelphia County

Dear Sir/Madam:

The Land Recycling and Environmental Remediation Standards Act (Act 2) requires that a Notice of Intent to Remediate (NIR) be provided to the municipality in which the site is located when a site is being remediated to a site-specific Standard. The municipality is afforded a 30-day comment period. In accordance with this provision of the Act, Sunoco, Inc. (R&M) is formally notifying you of its intent to remediate the subject site under Act 2. A copy of the NIR, which will be sent to the Pennsylvania Department of Environmental Protection (PaDEP), is enclosed. This notice will also be published in the Pennsylvania Bulletin, and a summary of the notice appeared in the Philadelphia Daily News on October 16, 2006.

Publication of this notice in the Philadelphia Daily News initiates the 30-day public and municipal comment period. During the next thirty days, your municipality may request to become involved in the development of the remediation plans for the site. If the municipality wishes to become involved in this project, please send your comments to Sunoco to my attention.

Please call me at (610) 859-1881 if you have any questions concerning the proposed remediation.

Best Regards,

James R. Oppenheim, P.E.
Senior Environmental Consultant

Cc: Sunoco Legal Dept.
Philadelphia Refinery Environmental Central File
Steve O'Neil, PaDEP
Colleen Costello, Langan

Will remediation be to a site-specific standard ☒ or as a special industrial area ☐? If so, the municipality or municipalities must be provided 30-day comment period.
Remediator/Property Owner/Consultant. For each of these recipients of the approval of the final report, complete form below.

Remediator
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Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Remediation Project Manager
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Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 100 Green St., Marcus Hook, PA 19061
Email Address: jroppenheim@sunocoinc.com
Property Owner
Contact Person: Scott Baker
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Environmental Manager
Phone Number: (215) 339-2074
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 3144 Passyunk Ave. Philadelphia, PA 19145
Email Address: sabaker@sunocoinc.com
Consultant
Contact Person: Colleen Costello
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Consultant
Phone Number: (215) 864-0640
Company Name: Langan Engineering and Environmental Services
Address (street, city, state, zip): 30 South 17th St., Suite 1500, Philadelphia, PA 19103
Email Address: ccostello@langan.com

Preparer of Notice of Intent to Remediate:

Name: James Oppenheim
Title: Project Manager
Address: 100 Green Street
Marcus Hook, PA 19061
Telephone: (610) 859-1881
Email Address: jroppenheim@sunocoinc.com

Email Image File of Site Map showing property lines and general area of site(s) to be remediated to: (landrecycling@state.pa.us)

Proof of Publication in The Philadelphia Daily News
Under Act. No 587, Approved May 16, 1929

STATE OF PENNSYLVANIA
COUNTY OF PHILADELPHIA

Anna Dickerson being duly sworn, deposes and says that **The Philadelphia Daily News** is a newspaper published daily, except Sunday, at Philadelphia, Pennsylvania, and was established in said city in 1925, since which date said newspaper has been regularly issued in said County, and that a copy of the printed notice of publication is attached hereto exactly as the same was printed and published in the regular editions and issues of the said newspaper on the following dates:

October 16, 2006

Affiant further deposes and says that he is an employee of the publisher of said newspaper and has been authorized to verify the foregoing statement and that he is not interested in the subject matter of the aforesaid notice of publication, and that all allegations in the foregoing statement as to time, place and character of publication are true.

Anna Dickerson

Sworn to and subscribed before me this 16th day of October 2006

Mary Anne Logan
Notary Public

My Commission Expires:

NOTARIAL SEAL
Mary Anne Logan, Notary Public
City of Philadelphia, Phila. County
My Commission Expires March 30, 2009

Copy of Notice of Publication

Newspaper Notice of Intent to Remediate to an Environmental Standard. (Sections 302(e)(1)(ii), 303(h)(1)(ii), 304(n)(1)(i), and 305(c)(1))

Pursuant to the Land Recycling and Environmental Remediation Standards Act (Act), the act of May 19, 1995, P.L. 4, No. 1995-2, notice is hereby given that Sunoco Inc.(R&M) has submitted to the Pennsylvania Department of Environmental Protection a Notice of Intent to Remediate a site located at 3144 Passyunk Ave., Philadelphia, Philadelphia County, Pennsylvania. This Notice of Intent to Remediate states that the site is a petroleum refinery. It has been determined that petroleum compounds have impacted soil and groundwater at the site. Sunoco, Inc. (R&M) has indicated that proposed remediation measures will include source reduction and engineered boundary controls. The proposed future use of the property is industrial for continued operation as a petroleum refinery.

Sunoco Inc. (R&M) plans to use the site-specific remediation standard at the site. The Act provides for a 30-day public comment period for site-specific standard remediation. The 30-day comment period is initiated with the publication of this notice. Until November 16, 2006, the City of Philadelphia may submit a request to Sunoco Inc. (R&M) to be involved in the development of the remediation and reuse plans for the site. The City of Philadelphia may also submit a request to Sunoco Inc. (R&M) during this 30-day comment period to develop and implement a public involvement plan. Copies of these requests and of any comments should also be submitted to the Department of Environmental Protection at 2 East Main Street, Norristown, PA 19401 to the attention of Mr. Walter Payne. All correspondence with Sunoco Inc. (R&M) should be addressed to the Public Relations Dept., Sunoco Inc. (R&M) at 3144 Passyunk Ave, Philadelphia, PA, 19145.

LEGAL NOTICES

Newspaper Notice of Intent to Remediate
to an Environmental Standard.
(Sections 302(e)(1)(ii), 303(h)(1)(ii),
304(n)(1)(i), and 305(c)(1))

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Appeared in: ***Philadelphia Inquirer & Philadelphia Daily News*** on Monday, 10/16/2006

Back

LANGAN
ENGINEERING & ENVIRONMENTAL SERVICES

David T. Gockel, P.E., P.P.
George P. Kelley, P.E.
George E. Derrick, P.E.
Michael A. Semeraro, Jr., P.E.
Nicholas De Rose, P.G.
Andrew J. Ciancia, P.E.
George E. Leventis, P.E.
Rudolph P. Frizzi, P.E., G.E.
Ronald A. Fuerst, C.L.A.
Colleen Costello, P.G.
Cristina M. González, P.E.
Gerald J. Zambrella, C.E.M.
Gregory M. Elko, P.E.
Steven Ueland, P.E.

Caryn L. Barnes
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Michael D. Szura, C.L.A., A.S.L.A.
Stewart H. Abrams, P.E.
Brian M. Conlon, P.E.
Jeffrey A. Smith, P.G.

September 2, 2011

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Manager
Philadelphia Department of Public Health
Environmental Health Services
321 University Avenue
Philadelphia, Pennsylvania 19104

RE: Notice of Submittal of Site Characterization/ Remedial Investigation Report
Area of Interest (AOI) 11
Sunoco, Inc. (R&M) Philadelphia Refinery
Philadelphia, Philadelphia County, Pennsylvania
Langan Project No.: 2574601

Dear Sir/Madam:

Notice is hereby given that Sunoco, Inc. (R&M) (Sunoco) is in the process of submitting a Site Characterization/Remedial Investigation Report to the Pennsylvania Department of Environmental Protection for AOI 11 located at the Sunoco Philadelphia Refinery, Philadelphia, Philadelphia County, Pennsylvania. The report indicates that the remediation planned will attain compliance with a combination of site-specific and the statewide health cleanup standards.

This notice is made under the provision of the Land Recycling and Environmental Standards Act, the Act of May 19, 1995, P.L. #4, No. 2.

Sincerely,
Langan Engineering and Environmental Services, Inc.

Colleen Costello

Colleen Costello, P.G.
Senior Principal

cc: Jim Oppenheim, Sunoco
Kevin Dunleavy, Sunoco

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7011 1150 0001 9432 0515

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For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$ .44
Certified Fee	2.85
Return Receipt Fee (Endorsement Required)	2.30
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 5.59

DOYLESTOWN PA 18901 USPS Postmark Here SEP 2 2011

Sent To: Manager
Philadelphia Dept. of Public Health
Street, Apt. No.; or PO Box No.: Environmental Health Services
321 University Avenue
City, State, ZIP+4: Philadelphia, Pennsylvania 19104

PS Form 3800, August 2006 See Reverse for Instructions

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Manager
Philadelphia Dept. of Public Health
Environmental Health Services
321 University Avenue
Philadelphia, Pennsylvania 19104

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☑ Agent ☐ Addressee

B. Received by (Printed Name)

C. Date of Delivery 9/7/11

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☑ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number *(Transfer from service label)* 7011 1150 0001 9432 0515

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

Notification of Receipt
of Site Characterization/Remedial Investigation Report

Notice is hereby given that Sunoco Inc. (R&M) (Sunoco) is in the process of submitting a Site Characterization/Remedial Investigation Report to the Pennsylvania Department of Environmental Protection (PADEP), Southeast Regional Office for Area of Interest (AOI 11) located at the Sunoco Philadelphia Refinery, Philadelphia, Pennsylvania. Sunoco has indicated in the report that site characterization activities have been completed at AOI 11 in accordance with the Land Recycling and Environmental Remediation Standards Act and the 2004 Memorandum of Agreement between the PADEP and U.S. Environmental Protection Agency (EPA) (a.k.a., the PA One Cleanup Program). This notice is made under the provision of the Land Recycling and Environmental Remediation Standards Act, the Act of May 19, 1995, P.L. #4, No. 2.

Proof of Publication in The Philadelphia Daily News
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STATE OF PENNSYLVANIA
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Anna Dickerson being duly sworn, deposes and says that **The Philadelphia Daily News** is a newspaper published daily, except Sunday, at Philadelphia, Pennsylvania, and was established in said city in 1925, since which date said newspaper has been regularly issued in said County, and that a copy of the printed notice of publication is attached hereto exactly as the same was printed and published in the regular editions and issues of the said newspaper on the following dates:

September 9, 2011

Affiant further deposes and says that she is an employee of the publisher of said newspaper and has been authorized to verify the foregoing statement and that she is not interested in the subject matter of the aforesaid notice of publication, and that all allegations in the foregoing statement as to time, place and character of publication are true.

Anna Dickerson

Sworn to and subscribed before me this 9th day of September, 2011.

Mary Anne Logan
Notary Public

My Commission Expires:

NOTARIAL SEAL
Mary Anne Logan, Notary Public
City of Philadelphia, Phila. County
My Commission Expires March 30, 2013

Copy of Notice of Publication

Notification of Receipt of Site Characteriza - tion / Remedial Investigation Report

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APPENDIX B

Regional Geologic Reference Figures

he Woodbridge clay, the
, the Old Bridge sand, and
members can be correlated
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stratigraphic relations, and
members is discussed in the

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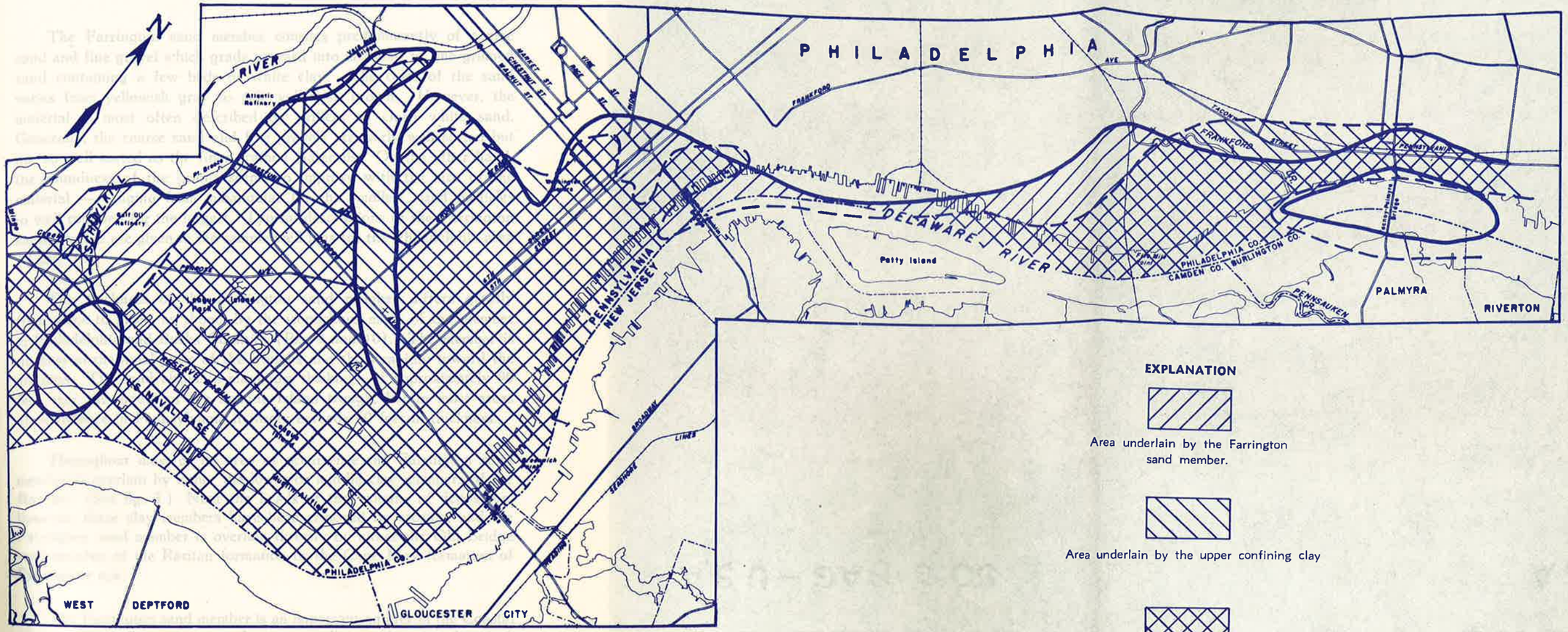
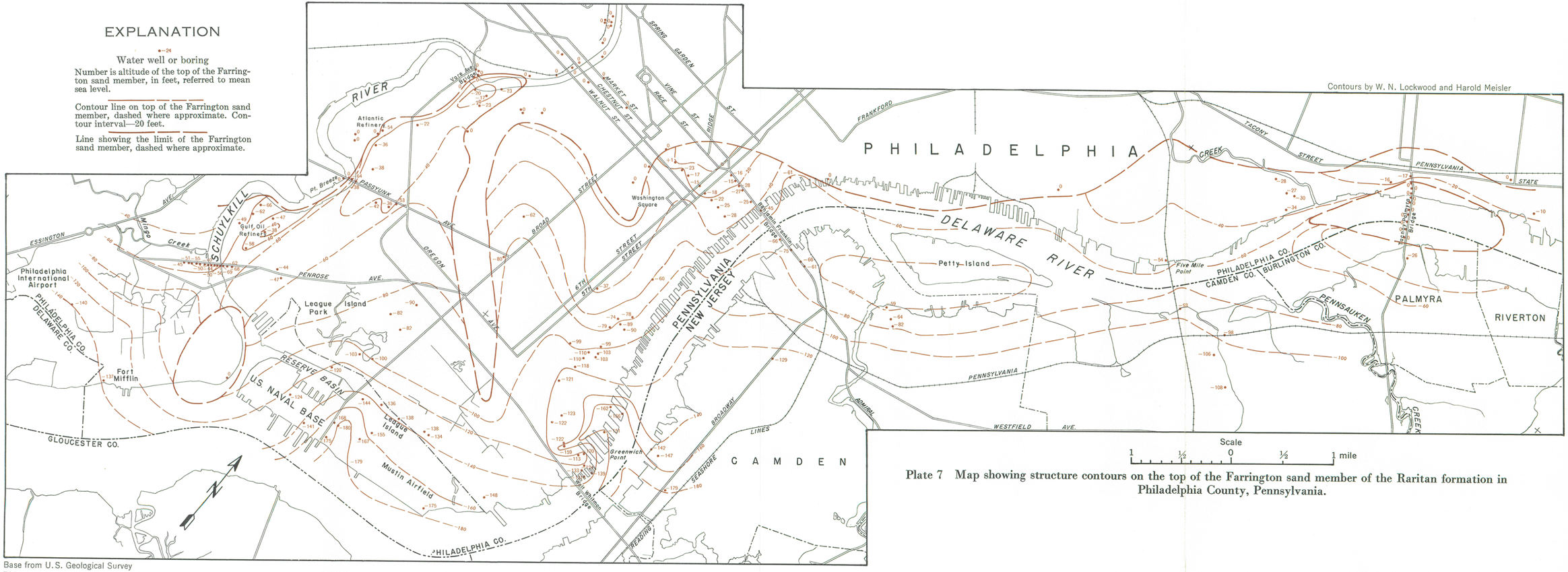


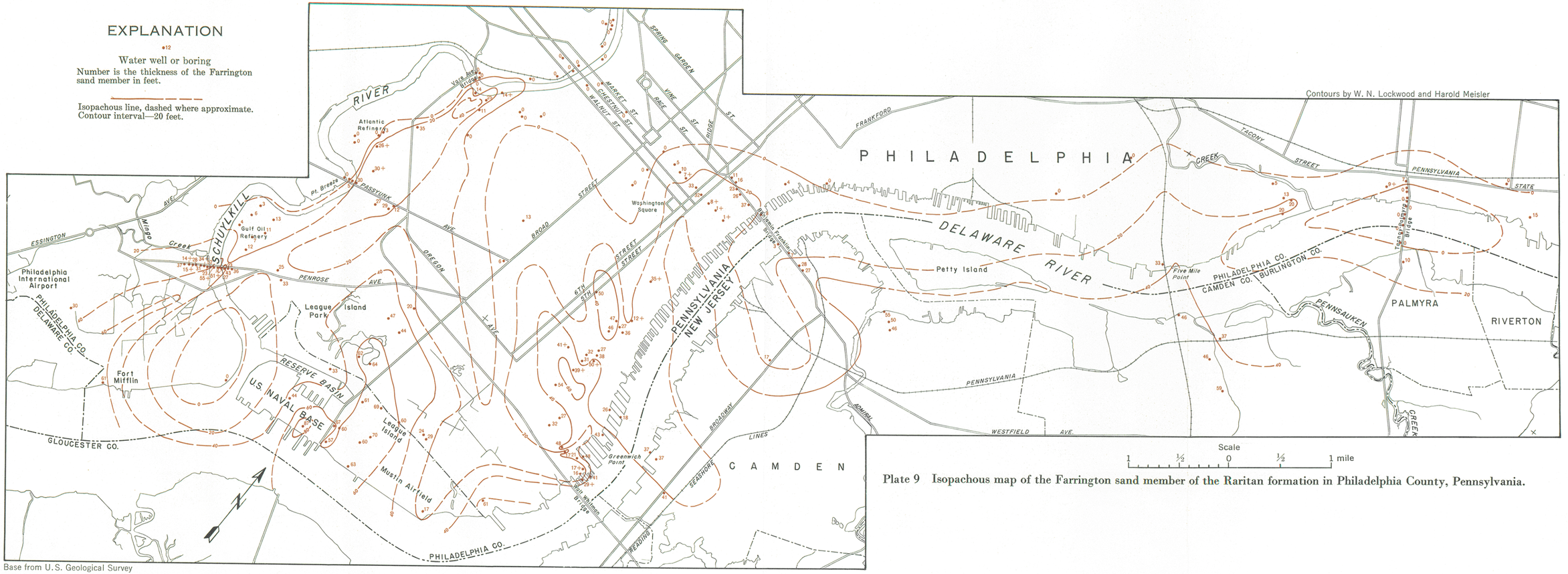
Base from U. S. Geological Survey 7½ minute quadrangle topographic maps.

Figure 3.
Map showing the area in Philadelphia underlain by the Farrington sand member of the Raritan formation and its overlying confining area.



Base from U.S. Geological Survey
7½ minute quadrangle topographic maps.

Plate 7 Map showing structure contours on the top of the Farrington sand member of the Raritan formation in Philadelphia County, Pennsylvania.



Base from U.S. Geological Survey
7½ minute quadrangle topographic maps.

Plate 9 Isopachous map of the Farrington sand member of the Raritan formation in Philadelphia County, Pennsylvania.

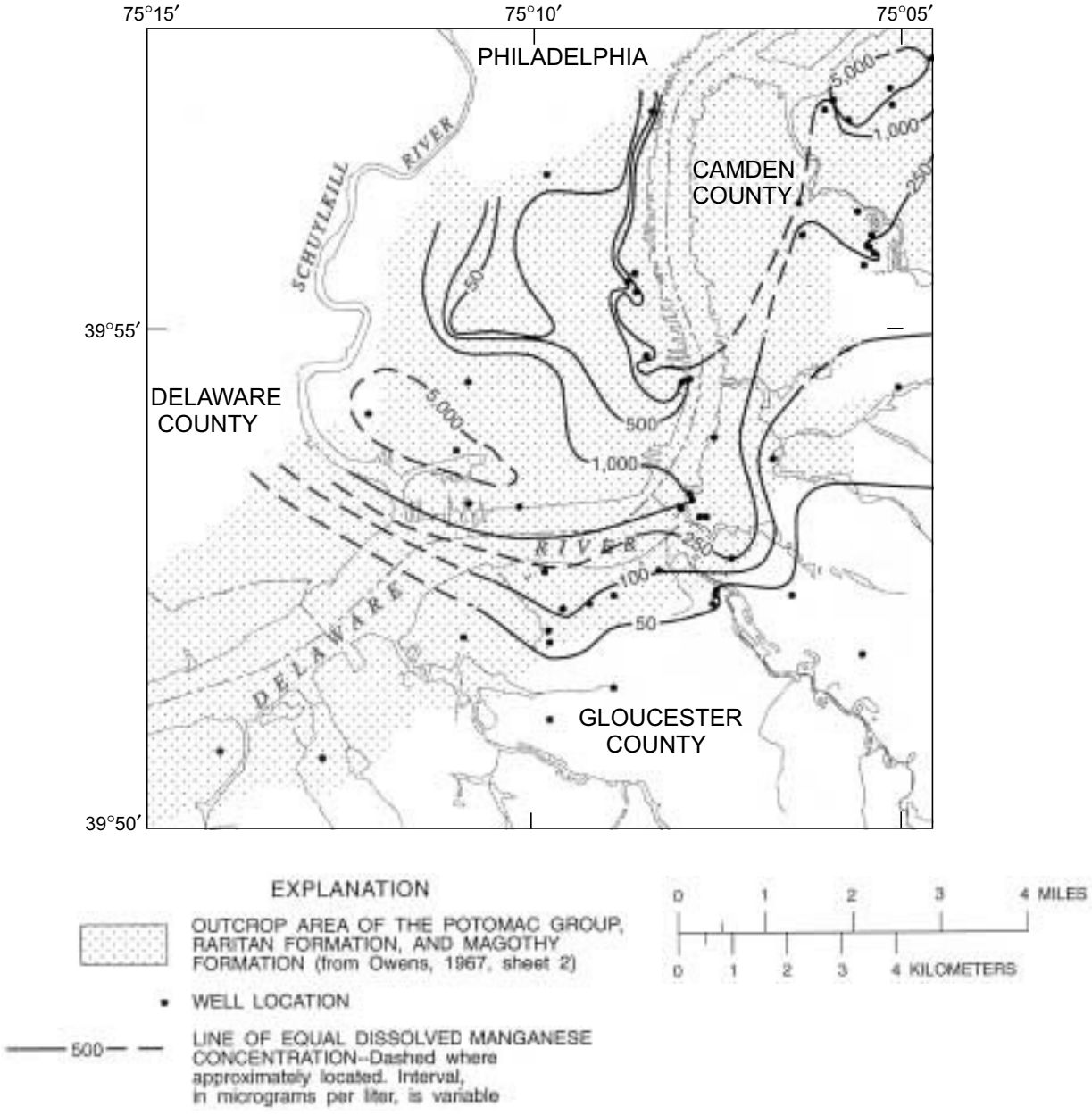


Figure 23. Concentrations of dissolved manganese in water from the lower aquifer of the Potomac-Raritan-Magothy aquifer system, Philadelphia, Pa., and Camden and Gloucester Counties, N.J., 1980-86 (from Ervin and others, 1994, p. 75).

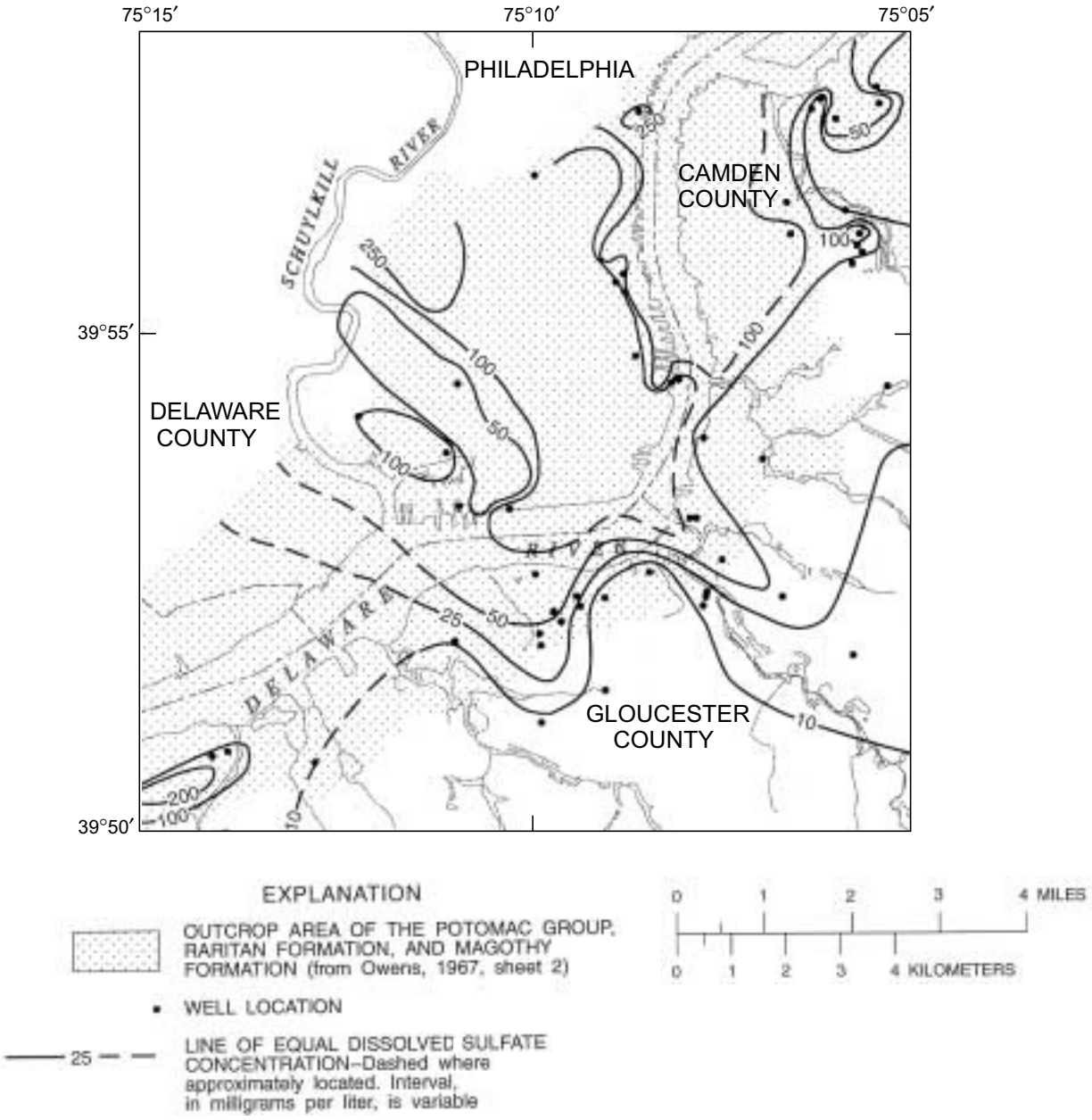
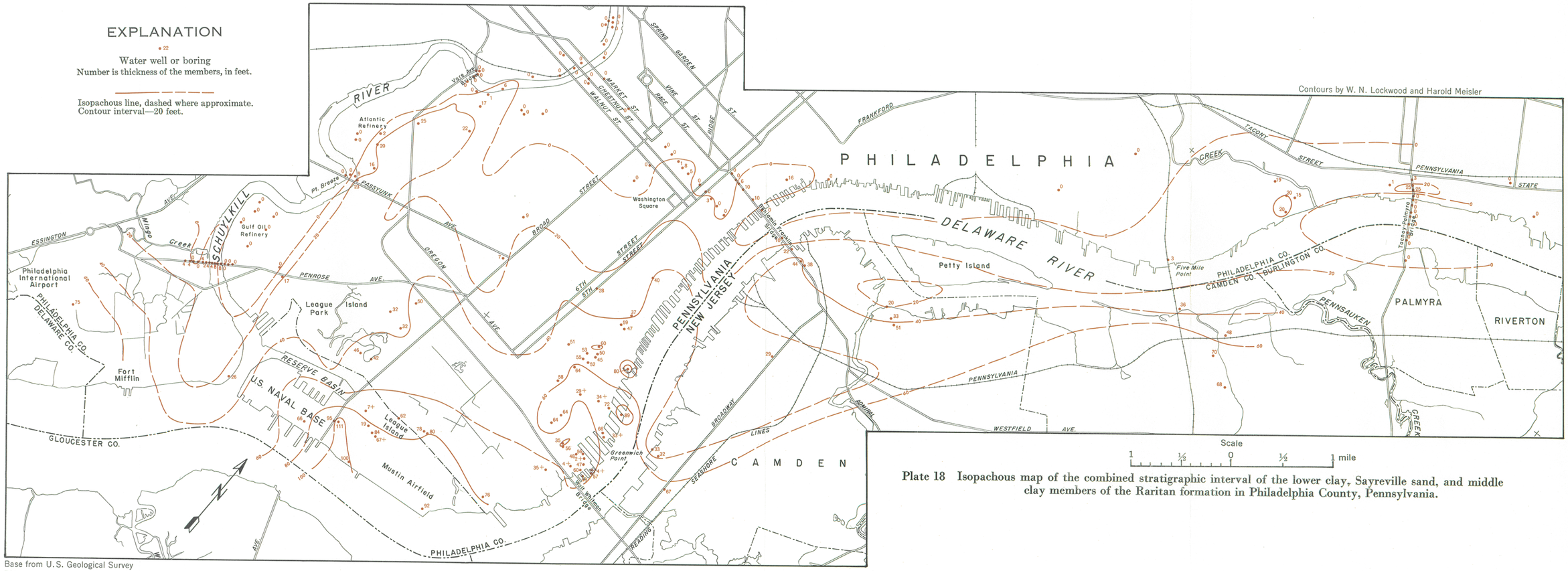
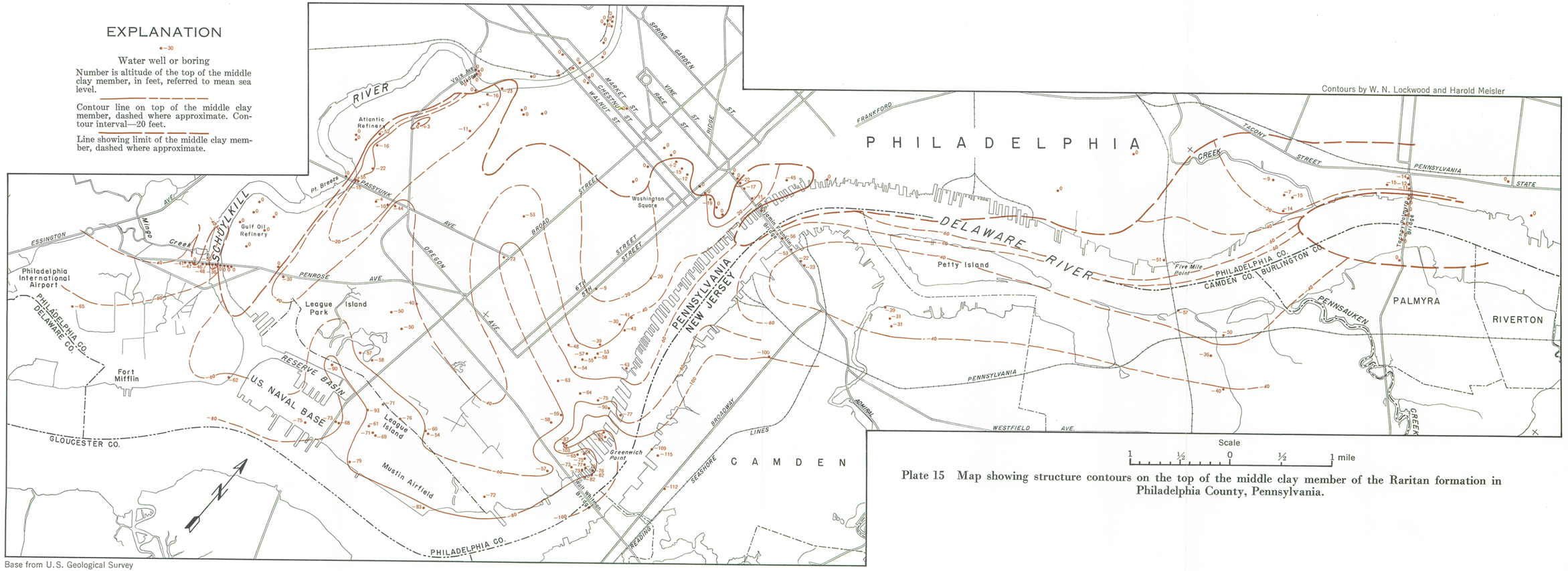


Figure 24. Concentrations of dissolved sulfate in water from the lower aquifer of the Potomac-Raritan-Magothy aquifer system, Philadelphia, Pa., and Camden and Gloucester Counties, N.J., 1980-86 (from Ervin and others, 1994, p. 77).



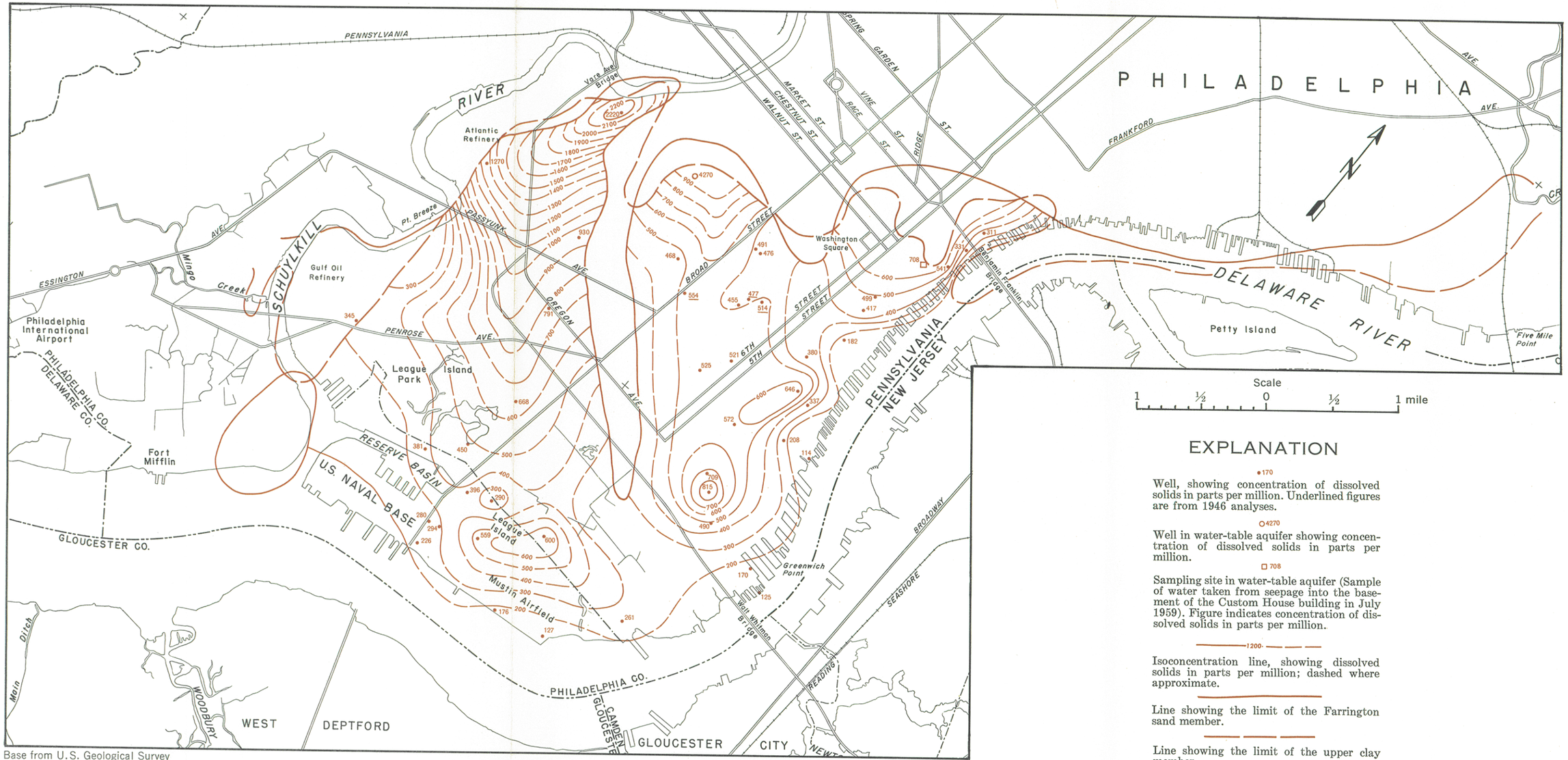
Base from U.S. Geological Survey
7½ minute quadrangle topographic maps.

Plate 18 Isopachous map of the combined stratigraphic interval of the lower clay, Sayreville sand, and middle clay members of the Raritan formation in Philadelphia County, Pennsylvania.



Base from U.S. Geological Survey
7½ minute quadrangle topographic maps.

Plate 15 Map showing structure contours on the top of the middle clay member of the Raritan formation in Philadelphia County, Pennsylvania.



EXPLANATION

170
Well, showing concentration of dissolved solids in parts per million. Underlined figures are from 1946 analyses.

4270
Well in water-table aquifer showing concentration of dissolved solids in parts per million.

708
Sampling site in water-table aquifer (Sample of water taken from seepage into the basement of the Custom House building in July 1959). Figure indicates concentration of dissolved solids in parts per million.

1200
Isoconcentration line, showing dissolved solids in parts per million; dashed where approximate.

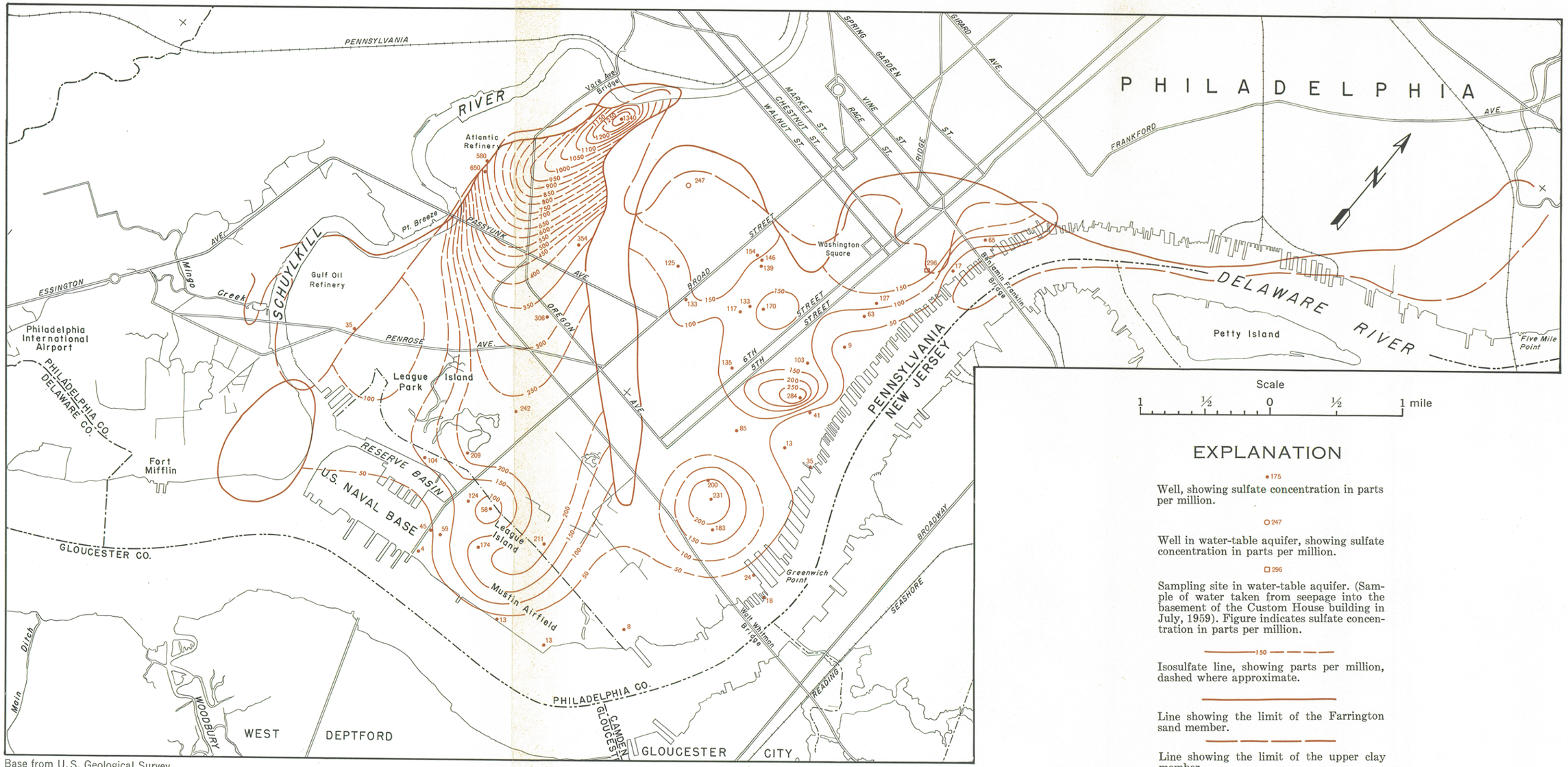
Line showing the limit of the Farrington sand member.

Line showing the limit of the upper clay member.

Base from U.S. Geological Survey
7½ minute quadrangle topographic maps.

Contours by W. N. Lockwood and Harold Meisler

Plate 21 Map of the Philadelphia area showing the variation in the dissolved mineral content of water from the Farrington sand member of the Raritan formation, 1956.



Base from U.S. Geological Survey
7½ minute quadrangle topographic maps.

Contours by W. N. Lockwood and Harold Meisler

Plate 22 Map of Philadelphia area showing the variation of the concentration of sulfate of water from the Farrington sand member of the Raritan Formation.

Plate 20 Cross sections showing probable directions of ground water movement in and between aquifers under natural conditions near the junction of the Delaware and Schuylkill Rivers in Pennsylvania.

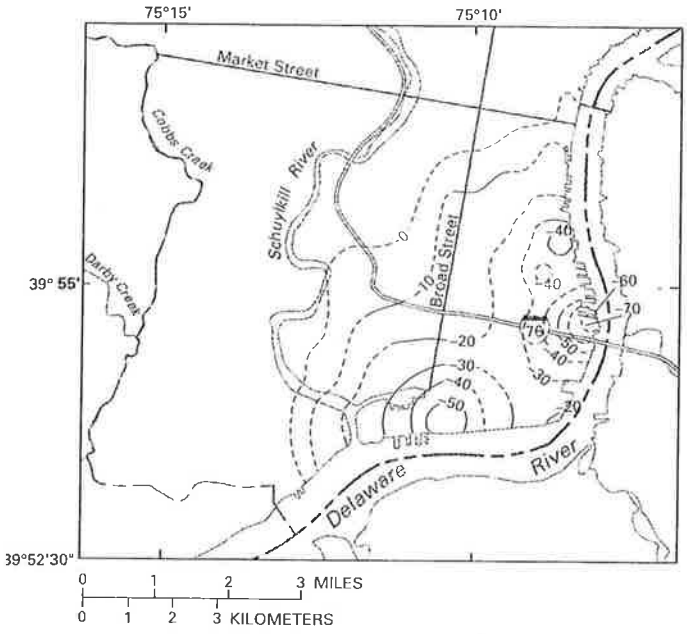


Figure 43. Potentiometric surface of the lower sand unit of the Potomac-Raritan-Magothy aquifer system, March 24, 1954. (Modified from Greenman and others, 1961.)

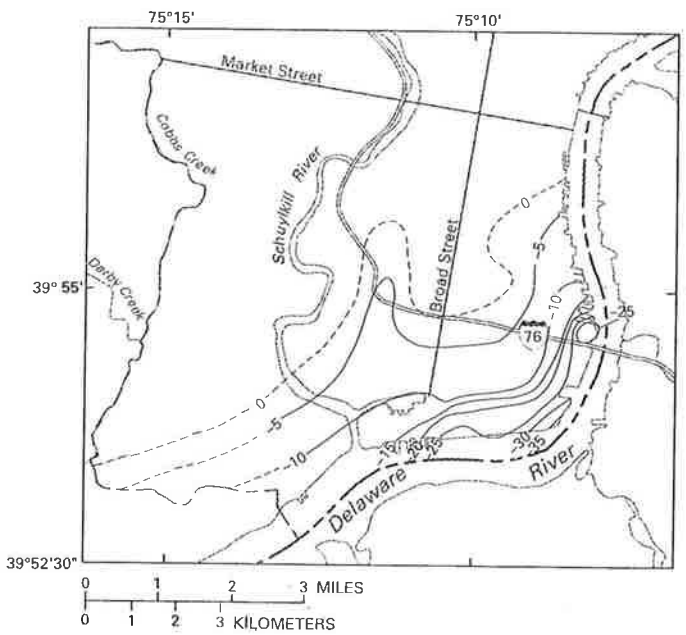


Figure 44. Potentiometric surface of the lower sand unit of the Potomac-Raritan-Magothy aquifer system, 1978–79.

surface of the lower sand unit in Philadelphia has been influenced more by withdrawals from the unit in nearby parts of New Jersey than by pumping in Philadelphia; consequently, water in the lower sand unit now flows chiefly toward pumping centers in New Jersey.

Unconfined Aquifer System

Prior to development by wells and drainage works, water in the unconfined aquifer system flowed from upland recharge areas toward lowland discharge areas, moving in the direction of decreasing head. In natural systems, the water-table profile generally resembles the land-surface profile. Hence, the altitude of the water table usually is highest under the highest areas of land surface, such as hilltops and ridges, and lowest in valleys, where it may intersect the land surface to form streams, ponds, and marshes. Available water-level data are inadequate to prepare a map representing the water table during the predevelopment period.

Human activities have greatly influenced the occurrence and movement of water in the unconfined aquifer system of Philadelphia. These activities include construction of large-scale water-distribution and sewer systems, pumping of wells, and use of dewatering systems. Other sections of this report describe the effects on ground-water levels of leakage from water pipes and seepage into and from sewers and present information on withdrawals by wells and dewatering systems.

The altitude and configuration of the water table in Philadelphia are influenced by human activities and by natural factors such as topography. Locally, the water table may be controlled chiefly by leakage, seepage, or ground-water pumping. Short-term, seasonal, and long-term water-table fluctuations may be dampened to a narrow range because of these processes and activities. Also, the water-table configuration may change when leaky brick sewers are replaced by relatively watertight sewers constructed of other materials or when the location or rate of ground-water pumping changes significantly.

The effects of human activities on the movement of water in the unconfined aquifer system are shown by the map of the water table in 1944–45 (fig. 45). The area along the Delaware and lower Schuylkill Rivers where the water table was below sea level is chiefly a result of pumping from the unconfined aquifers and from the lower sand unit of the Potomac-Raritan-Magothy aquifer system in Philadelphia and nearby parts of New Jersey. These withdrawals

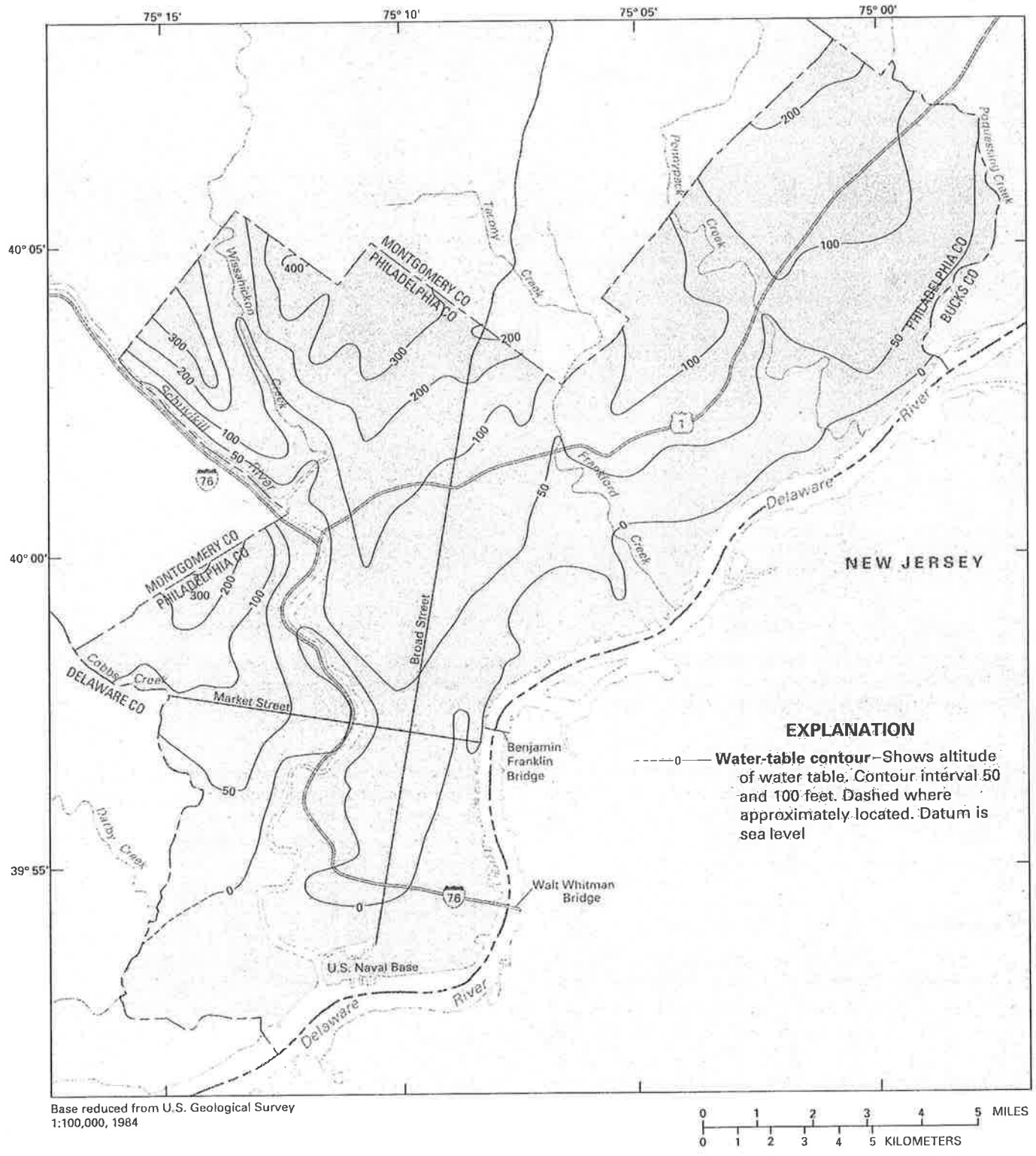


Figure 45. Water table, about 1944–45. (Modified from Graham, 1946.)

produced significant vertical differences in head between aquifers. Because of the head differences, water flowed downward from the unconfined aquifer system through the intervening confining units to the lower sand unit, causing head to decline locally below sea level in the unconfined aquifers. The effects on the water table of decreased pumpage from unconsolidated aquifers in Philadelphia are shown by the map of the water table from 1976 to 1980 (fig.

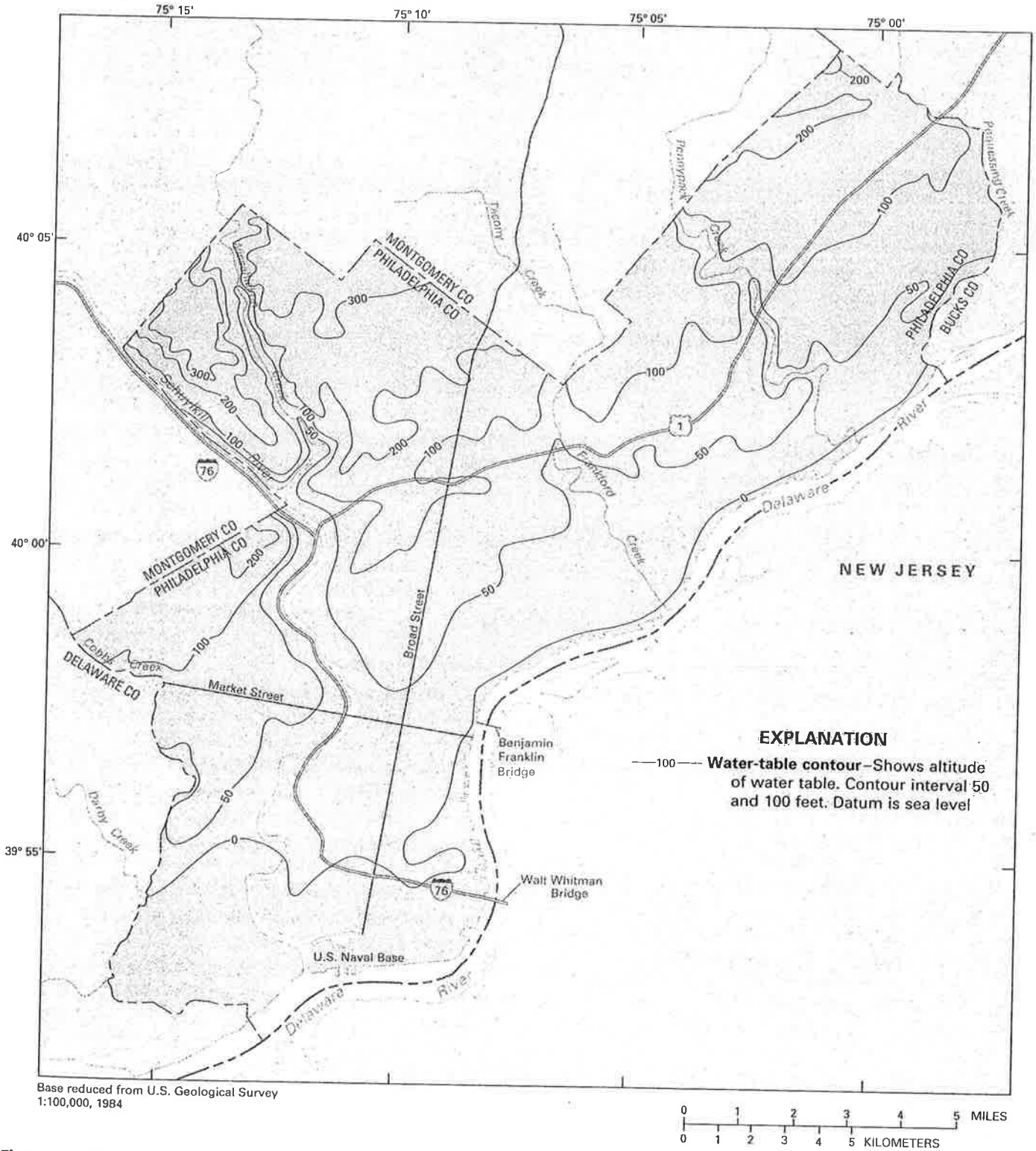


Figure 46. Water table, 1976–80. (Modified from Paulachok and Wood, 1984.)

46). Comparison of this map with that for the earlier period (fig. 45) shows that by 1980, the area where head was below sea level diminished because of the reduction in pumpage from the lower sand unit beginning in the mid-1960's. However, in areas where head was greater than 50 ft, differences in position of the water table were slight.

Because water moves in the direction of decreasing head, figures 45 and 46 can be used to determine the general

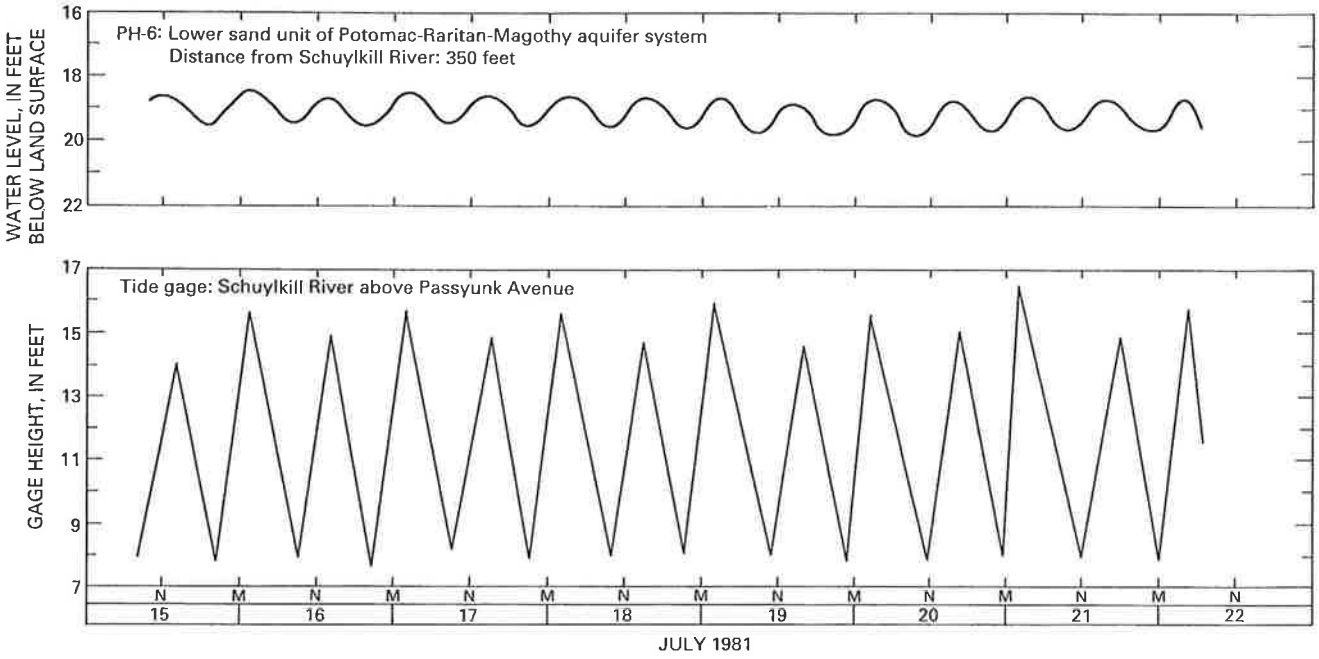


Figure 51. Continued.

Table 7. Summary of effect of river tides on water-level fluctuations in wells

[BK means well located in Bucks County; PH means well located in Philadelphia. A dash indicates lag time not determined]

Local well number[1/]	Distance from shoreline (feet)	Average ground-water level fluctuation divided by average tidal fluctuation	Lag time (hours)
		Confined Aquifers	
BK-548	120	0.77	0.65
BK-628	1,700	.02	-
PH-6	350	.14	-
PH-13	1,200	.04	-
PH-19	150	.31	-
PH-20	400	.32	-
PH-30	4,400	.00	-
PH-32	1,000	.05	2.74
PH-77	1,100	.03	-
PH-83	1,500	.13	3.04
PH-143	1,700	.13	-
PH-190	3,000	.01	2.35
PH-242	1,400	.22	-
PH-249	1,500	.20	-
PH-374	350	.38	.47
PH-400	200	.29	1.90
PH-747	400	.26	1.30
		Unconfined Aquifers	
BK-500	30	0.09	0.62
BK-647	120	.03	-
BK-671	300	.03	-
BK-672	200	.04	2.79

[1/] Locations of selected wells in Philadelphia are shown in figure 47. For locations of remaining wells, see Greenman and others (1961).

Iron and Manganese

Iron and manganese, which chemically are similar elements, are abundant constituents of the unconsolidated sediments and crystalline rocks of the Philadelphia area. Most of the iron and manganese in ground water is derived from the solution of minerals in the aquifer matrix. Lesser amounts may come from industrial chemical wastes or other manmade sources. Elevated concentration of iron and manganese is a major ground-water-quality problem in Philadelphia, and many wells have been abandoned because of excessive concentrations of these elements.

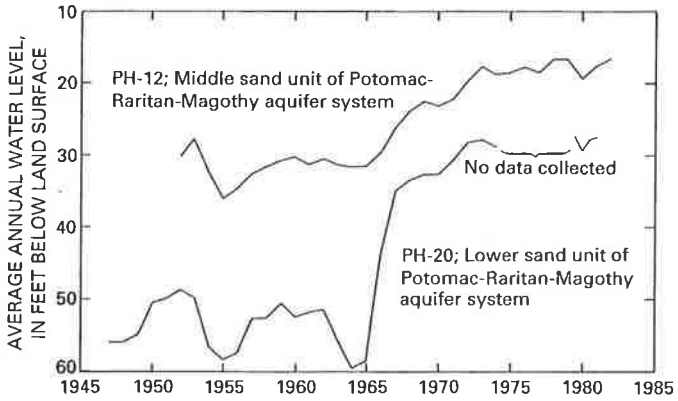


Figure 52. Long-term fluctuations of water levels in observation wells PH-12 and PH-20.

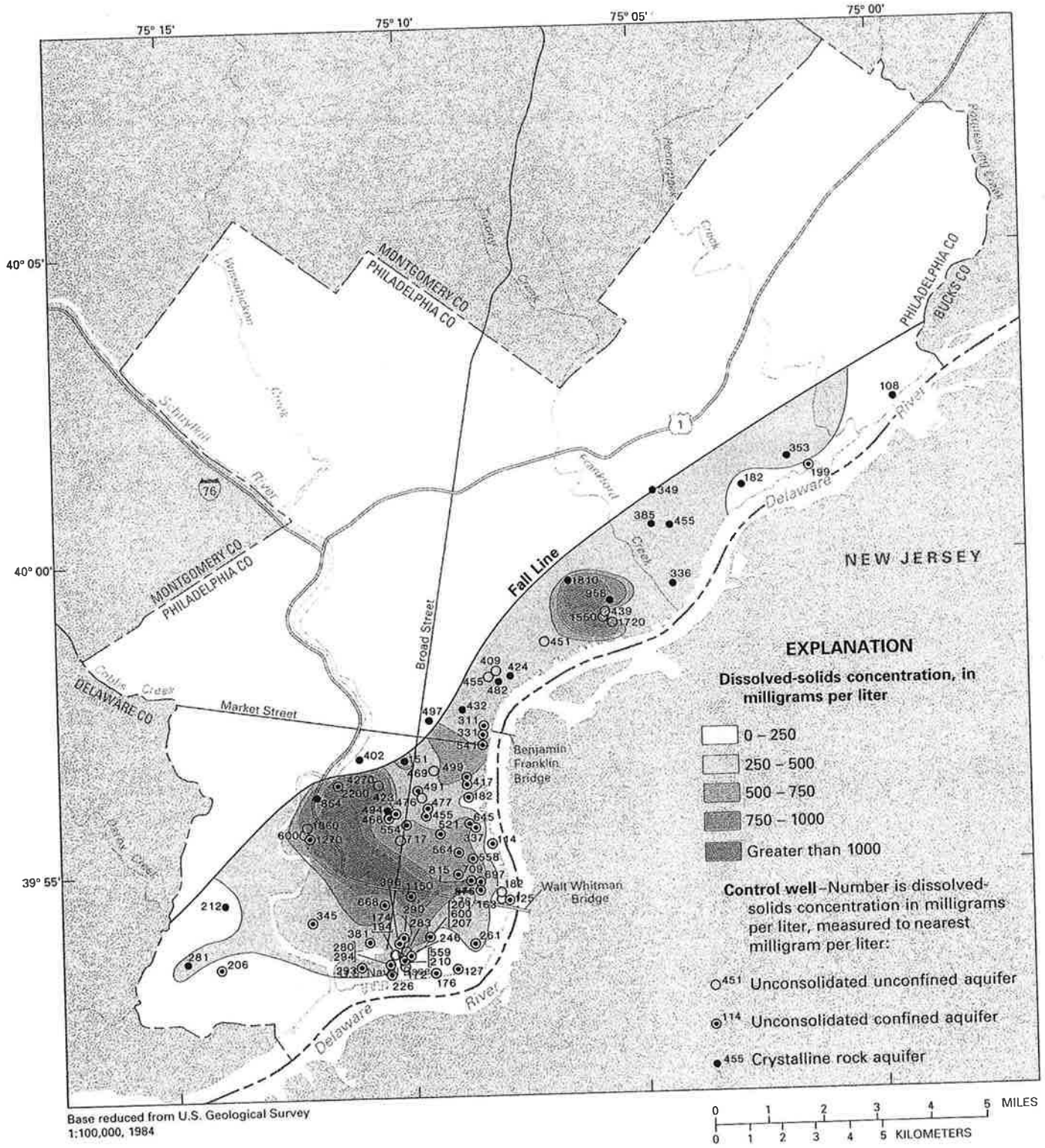


Figure 53. Dissolved-solids concentration, 1945–58.

Even small concentrations of iron and manganese in domestic water supplies are undesirable because they may cause turbidity, stains on plumbing fixtures and laundry, and objectionable taste and color. For these reasons, the U.S. Environmental Protection Agency (1977) recommends maximum drinking water concentrations of 300 μg/L (micrograms per liter) for iron and 50 μg/L for manganese. In industrial water supplies, high concentrations can result

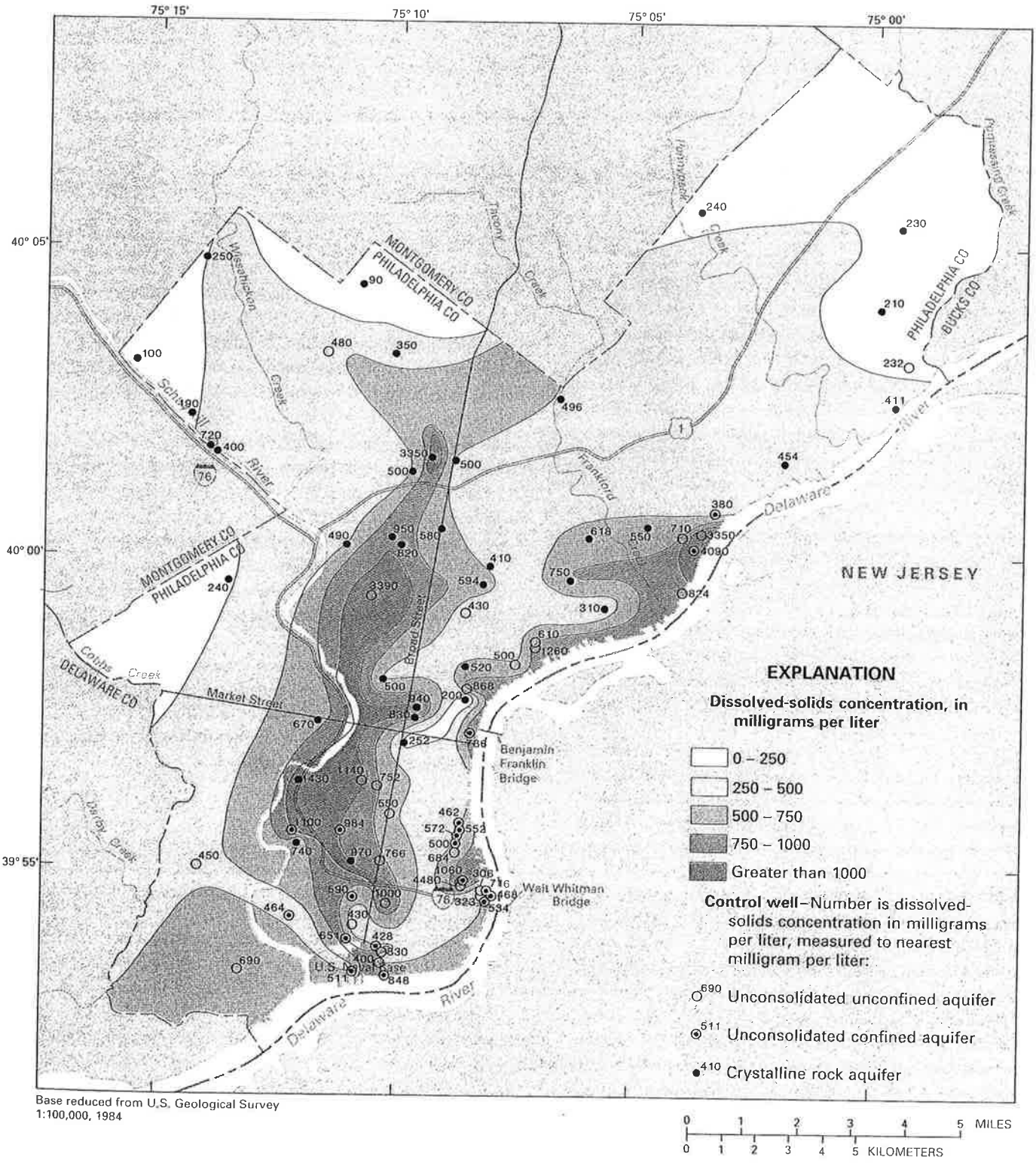


Figure 54. Dissolved-solids concentration, 1979–80.

in insoluble deposits accumulating in pipes and boiler tubes, which restrict flow and decrease the efficiency of heat exchange.

In Philadelphia, ground water commonly contains moderate to high concentrations of iron and manganese; in most places, iron is present in greater amounts than

manganese. Typically, the water is clear when first discharged from a well, but soon it becomes cloudy when exposed to the atmosphere. This turbidity is caused by chemical precipitation of iron-bearing compounds. Excessive concentrations of iron and manganese in water can be reduced by oxidation and filtration and ion exchange. These methods are described in table 8. Such treatment generally is expensive and often is incomplete.

Iron

Figure 55 shows the increase in dissolved-iron concentration from 1943 through 1982 in representative water samples from the lower sand unit of the Potomac-Raritan-Magothy aquifer system at the U.S. Naval Base. Although values are not available for several intervening years, figure 55 shows a progressive increase in iron concentration from 0.20 mg/L in 1943 to 30 mg/L in 1979. Chemical reactions involving oxygen and organic substances may have contributed to the significant increase. According to Langmuir (1969a, p. 21), these high concentrations of iron probably result under reducing conditions from leaching of iron-bearing minerals from the aquifer matrix. Microbiological decomposition of organic substances in ground water promotes these reactions by consuming oxygen and lowering the pH of the water. The median concentration of iron in 29 samples of ground water containing no detectable dissolved oxygen was 22 mg/L. The median concentration of iron in 55 samples of ground water containing at least 0.3 mg/L of oxygen was 0.68 mg/L.

In parts of Philadelphia, ground water is isolated from oxygen-enriched recharge water by impervious surfaces and low-permeability clay layers. This situation promotes the development of reducing conditions and the presence of ferrous iron in ground water. Where oxygenated recharge reaches the ground-water reservoir, it reacts with aqueous ferrous iron to produce insoluble ferric hydroxide; however, microbiological activity may deplete the oxygen before it reaches that reservoir. Similarly, when ground water containing ferrous iron is exposed directly to the atmosphere, ferric hydroxide precipitates from solution. Many wells in Philadelphia, including those at the U.S. Naval Base, were abandoned primarily because of problems associated with ferric hydroxide precipitation. Common problems include clogging of well screens, accumulation of deposits in water-distribution systems, and objectionable taste and color of water.

Dissolved-iron concentrations in 127 water samples collected during 1945–58 ranged from 0.02 to 429 mg/L; the average concentration was 13 mg/L. Iron concentrations in 75 percent of the samples exceeded the 0.30-mg/L drinking water standard recommended by the U.S. Environmental Protection Agency (1977). Figure 56 shows that the iron concentration in ground water was 5 mg/L or less, except in a few areas, particularly along the Delaware and lower Schuylkill Rivers. Water in the unconfined aquifers of southern Philadelphia had the highest concentrations; these concentrations are shown separately on the inset map of figure 56. Elsewhere, concentrations did not vary appreciably from aquifer to aquifer. By 1958, many wells were abandoned because of problems caused by excessive concentrations of iron.

Dissolved-iron concentrations in 79 water samples collected during 1979–80 ranged from 0 to 220 mg/L. The average concentration was 17 mg/L, an increase of nearly 30 percent over the average concentration during 1945–58. Iron concentrations in 71 percent of the samples exceeded 0.30 mg/L. Figure 57 shows that except for higher concentrations in areas along the Delaware and lower Schuylkill Rivers, iron concentrations in ground water generally were less than 5 mg/L. Comparison of this map with the map of dissolved-iron concentrations during 1945–58 (fig. 56) shows the expansion over time of areas affected by high concentrations. Differences in head caused by withdrawals from the confined aquifers in Philadelphia and nearby parts of New Jersey caused water containing high concentrations of iron to flow downward from the unconfined aquifer system into the confined aquifers. Consequently, iron concentrations in ground water in Philadelphia, particularly in the unconsolidated sediments, now differ little with depth.

Concentrations of iron are elevated in water from wells in parts of New Jersey adjacent to southern Philadelphia. This suggests that water from the lower sand unit in the vicinity of the U.S. Naval Base is migrating beneath the Delaware River into New Jersey.

Manganese

Figure 58 shows the change in dissolved-manganese concentration from 1945 through 1982 in representative water samples from the lower sand unit of the Potomac-Raritan-Magothy aquifer system at the U.S. Naval Base. The graph shows relatively stable concentrations of about 500 µg/L from 1945 through 1973, followed by an increase to a maximum concentration of greater than 4,000 µg/L in 1980. Manganese concentrations increased over time much the same as iron concentrations (fig. 55), although somewhat more slowly.

Dissolved-manganese concentrations in 58 water samples collected during 1945–58 ranged from 0 to 2,900 µg/L; the average concentration was 190 µg/L. Of these samples, 21 percent had manganese concentrations exceeding the 50-µg/L drinking water standard recommended by the U.S. Environmental Protection Agency (1977). Concentrations did not differ significantly from aquifer to aquifer. Figure 59 shows that, except for higher concentrations in a few parts of southern Philadelphia, manganese concentrations in ground water generally were less than 50 µg/L.

Table 8. Selected methods of removing and reducing concentrations of chemical constituents in water

[Modified from Hobba, 1976]

Constituent	Symptoms	Treatment processes
Iron (Fe)	Forms reddish-brown stains on plumbing fixtures and laundry. May impart objectionable taste to food and beverages. A slimy deposit indicates the presence of iron bacteria.	1. Oxidation and filtration--aeration of water or treatment with chloride or potassium permanganate converts most Fe and Mn to insoluble precipitates which can then be removed by sedimentation and filtration. Aeration commonly is used when the water contains little organic matter; chemical agents are utilized when large amounts of organic material are present, as in ground water containing iron bacteria. The water to be treated should be made alkaline before Fe or Mn removal is attempted.
Manganese (Mn)	Same objectionable symptoms as iron, but generally forms brown or black stains. Removal is more difficult and commonly is less complete than for iron.	2. Oxidation and filtration through manganese greensand--the greensand liberates oxygen which in contact with the water produces insoluble iron hydroxide and manganese oxide. When the available oxygen supply has been exhausted, the greensand is regenerated by backflushing a potassium permanganate solution through it. 3. Ion exchange--zeolite minerals or synthetic resin beads exchange sodium (Na) ions in their structure for Ca, Mg, Fe, and Mn ions in the water. When their exchange capacity has been exhausted, they are regenerated by backflushing with a strong sodium chloride solution. The resin beads have a greater exchange capacity than the zeolite minerals.
Hardness, Calcium (Ca), and Magnesium (Mg)	Forms scale in cooking utensils, pipes, and plumbing fixtures; consumes soap.	1. Lime-soda treatment--chemical reactions convert most Ca and Mg to insoluble calcium carbonate and magnesium hydroxide. The resulting precipitate can then be removed by sedimentation and filtration. 2. Ion exchange - see above.
Sulfate (SO_4) Chloride (Cl)	Has bitter taste, may have laxative effect, and usually is corrosive. Has salty taste and usually is corrosive.	Demineralization by ion exchange--resin beads remove nearly all dissolved chemical species by ion exchange. Treatment cost is relatively high for water containing more than 2,500 mg/L dissolved solids.
Volatile Organic Compounds (VOCs)	At low concentrations in water, the chlorinated aliphatic compounds essentially are odorless whereas the aromatic compounds may have a detectable odor. At very high concentrations, the VOCs may form a phase visibly distinguishable from the water.	1. Aeration--water and air are brought into contact with each other to transfer volatile substances from the water. The rate at which a volatile organic compound is removed from water by aeration depends on the air/water ratio, contact time, air and water temperature, contact area, and the chemical properties of the compound. 2. Adsorption by granular activated carbon (GAC)--water and GAC are brought into contact with each other to transfer VOCs to the GAC. However, the effectiveness of GAC for removing the volatiles depends on the types of organic compounds in the water. For example, unsaturated organic compounds such as ethylenes may be adsorbed on GAC more readily than saturated compounds such as ethanes.

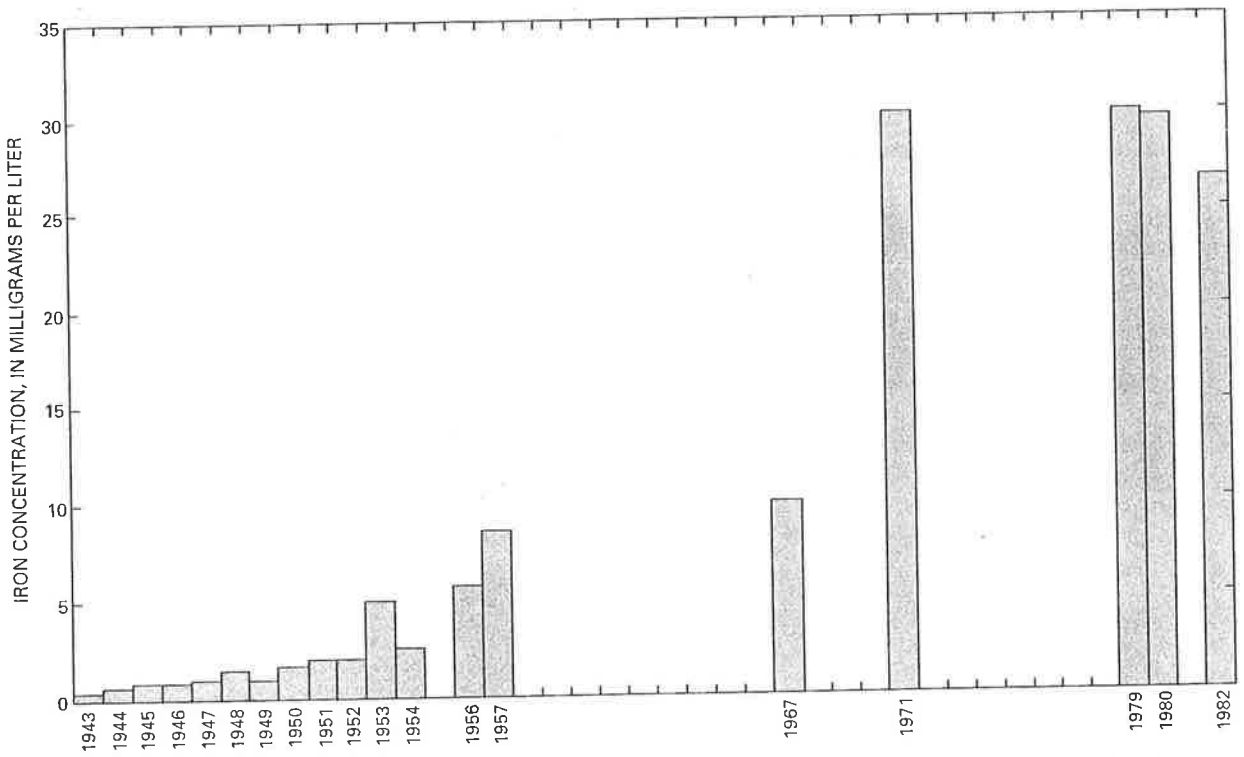


Figure 55. Concentration of dissolved iron in water from the lower sand unit of the Potomac-Raritan-Magothy aquifer system at the U.S. Naval Base, 1943–82.

Dissolved-manganese concentrations in 79 water samples collected during 1979–80 ranged from 0 to 31,000 µg/L. The average concentration was 1,700 µg/L, which is about nine times greater than the average for 1945–58. Of these samples, 78 percent had manganese concentrations greater than 50 µg/L. Figure 60 shows the prevalence of ground water having manganese concentrations in excess of 50 µg/L, particularly in eastern, central, and southern Philadelphia. Comparison of this map with the map of dissolved-manganese concentrations during 1945–58 (fig. 59) shows the expansion of the area affected by elevated concentrations of manganese. Chemical reactions involving oxygen and organic substances in ground water may leach manganese from the aquifer matrix, thereby increasing its concentration. In the Coastal Plain, hydraulic gradients between the unconfined and confined aquifers resulted in the downward flow of water containing elevated concentrations of manganese. Consequently, manganese concentrations in ground water in that part of Philadelphia vary little with depth.

Sulfate

Sulfide minerals, chiefly pyrite and marcasite, are relatively common in the unconsolidated sediments of the Philadelphia area (Langmuir, 1969b, p. 225). Where oxygenated recharge water comes in contact with these minerals, sulfide ions are oxidized to sulfate ions that can dissolve in ground water. Smaller amounts of sulfate in ground water may be products of weathering of crystalline rocks. In addition, some of the sulfate probably originates from sewage and industrial chemical wastes.

Elevated sulfate concentrations in drinking water are undesirable because they cause a bitter taste and may have a laxative effect. For these reasons, the U.S. Environmental Protection Agency (1977) recommends a maximum concentration in drinking water of 250 mg/L. Elevated concentrations in industrial water supplies are undesirable because the sulfate may cause corrosion or may react with calcium to form insoluble scale in boilers. Ground water in Philadelphia commonly contains moderate concentrations of sulfate; however, concentrations may be elevated locally. Excessive concentrations of sulfate can be reduced by ion exchange (table 8).

Figure 61 shows the change in dissolved-sulfate concentration from 1942 through 1982 in representative water samples from the lower sand unit of the Potomac-Raritan-Magothy aquifer system at the U.S. Naval Base. Although data on sulfate concentrations are not available for several intervening years, figure 61 shows a progressive increase in sulfate concentration from 2.8 mg/L in 1942 to 82 mg/L in 1956, fairly stable concentrations of about 100 mg/L during 1967–73, and a peak concentration of 185 mg/L in 1979.

Dissolved-sulfate concentrations in 138 water samples collected during 1945–58 ranged from 2 to 1,340

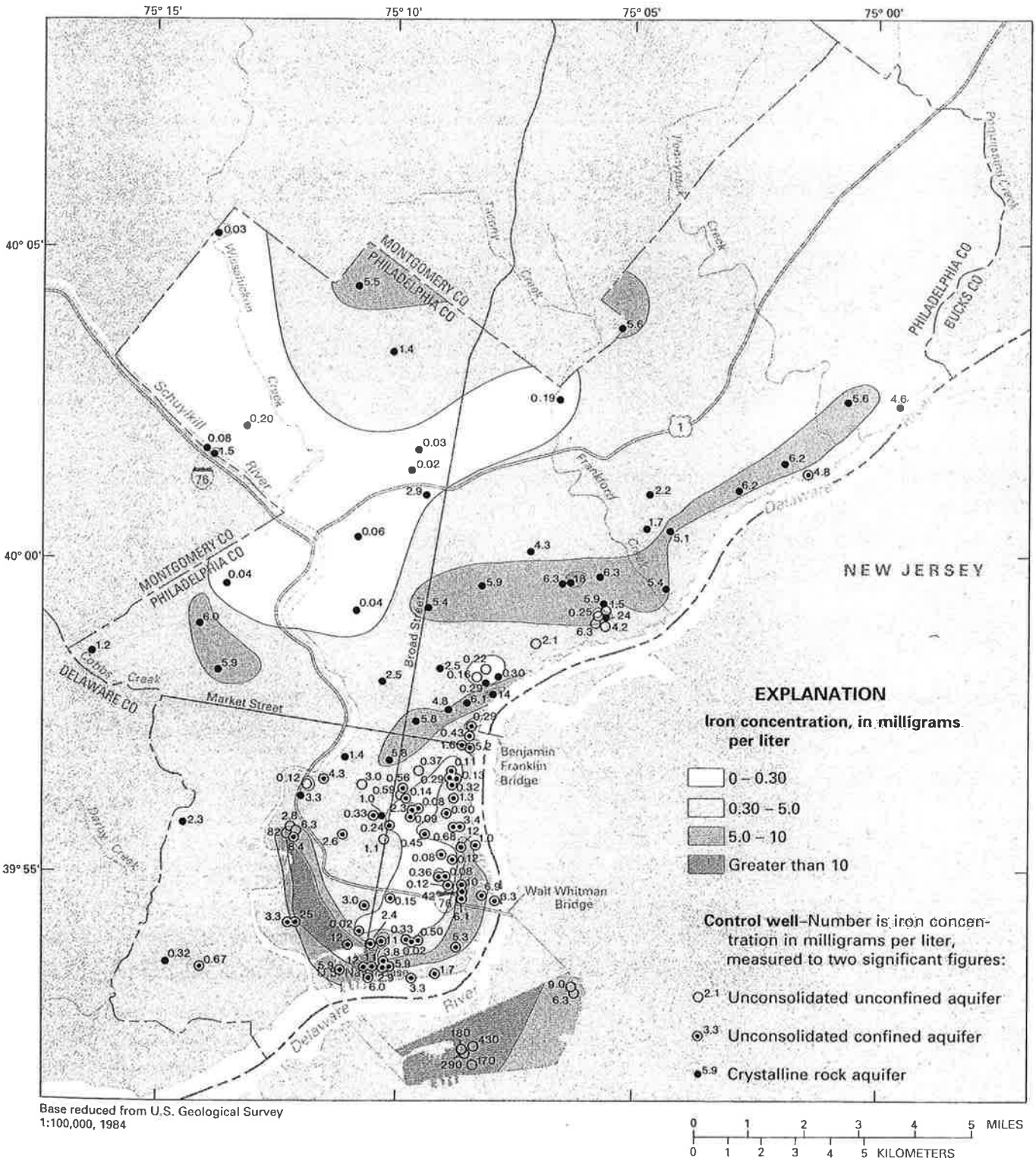


Figure 56. Dissolved-iron concentration, 1945–58.

mg/L; the average concentration was 148 mg/L. More than 12 percent of these samples had sulfate concentrations exceeding 250 mg/L. Average concentrations in all the aquifers were similar. Figure 62 shows that most ground water had a sulfate concentration of less than 250 mg/L except in relatively small parts of southern and north-central Philadelphia. Water in the affected part of southern Philadelphia (fig. 62) was contaminated by chemical wastes

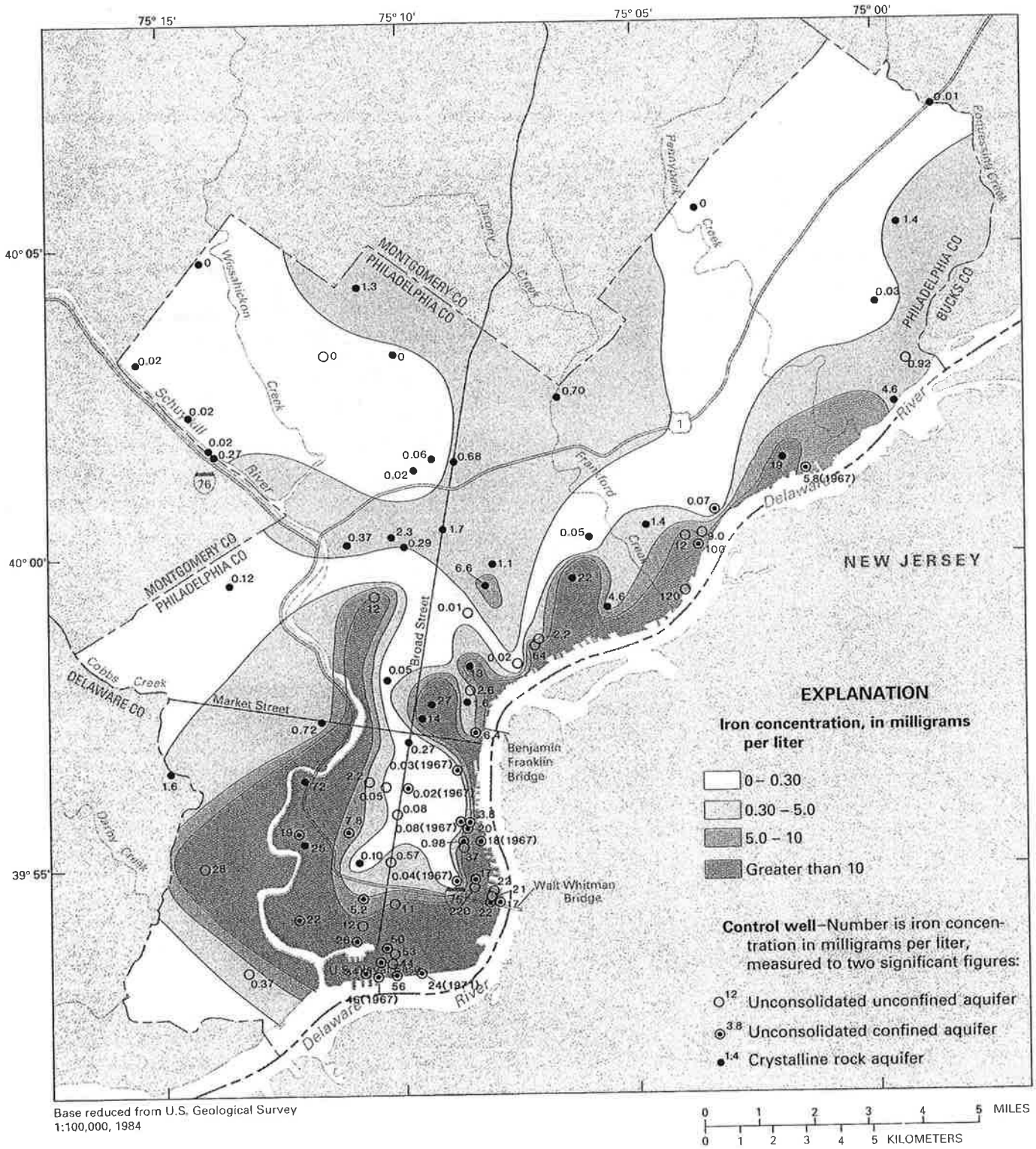


Figure 57. Dissolved-iron concentration, 1979–80.

originating from industrial sources near the Schuylkill River (Greenman and others, 1961, p. 70–74). After the wastes reached the ground-water system, they migrated toward the southeast, resulting in an elongated plume of contaminated water. This migration can explain the increase in sulfate concentration over time at the U.S. Naval Base (fig. 61), which is downgradient from these sources. Elevated concentrations in the affected part of north-central Philadelphia

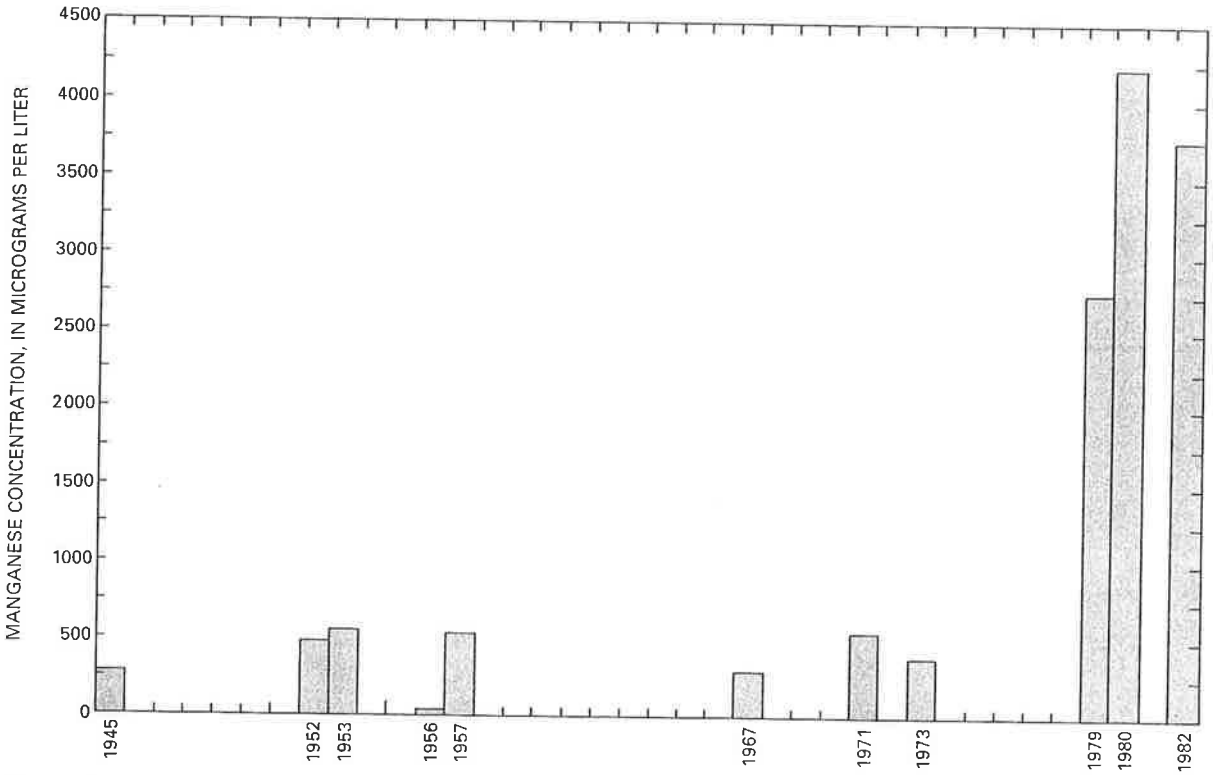


Figure 58. Concentration of dissolved manganese in water from the lower sand unit of the Potomac-Raritan-Magothy aquifer system at the U.S. Naval Base, 1945–82.

(fig. 62) probably were caused by industrial chemical wastes and sewage.

Dissolved-sulfate concentrations in 79 water samples collected during 1979–80 ranged from 0.9 to 2,200 mg/L. The average concentration was 161 mg/L, an increase of about 9 percent over the average for 1945–58. Figure 63 shows that during the later period, sulfate concentrations commonly were less than 250 mg/L. About 11 percent of these samples had sulfate concentrations greater than 250 mg/L. Comparison of this map with the map of dissolved-sulfate concentrations during 1945–58 (fig. 62) shows a significant reduction in the size of the contaminated area in southern Philadelphia. Flushing of sulfate-contaminated water from the aquifers, dilution, and decrease of source concentration likely have contributed to the reduction.

Nutrients

Phosphorus and nitrogen are elements necessary for plant growth. Phosphorus is not prevalent in most ground water. Water from only 4 of 91 wells had more than 1 mg/L of either total phosphorus or dissolved orthophosphorus. The median concentration of total phosphorus was 0.032 mg/L.

The principal nitrogen species present in ground water are nitrite, organic nitrogen, ammonium, and nitrate. Nitrite is present in very low concentrations—the median concentration in water from 81 wells and drainage sumps was 0.01 mg/L, and only one sample had a concentration greater than 0.12 mg/L. Organic nitrogen also is present in relatively small amounts; the median concentration in water from 78 wells and sumps was 0.91 mg/L, and water from only 10 percent of the sites contained more than 3 mg/L.

Ammonium and nitrate have similar median concentrations. Ammonium (as nitrogen) concentrations exceeded 10 mg/L in water from 5 of 80 wells and sumps. These five sites are in the upper and lower sand units of the Potomac-Raritan-Magothy aquifer system and the Trenton gravel. The median concentration of ammonium was 0.35 mg/L for 39 sites in the Wissahickon Formation, 2.1 mg/L for 18 sites in the lower sand unit, and 1.6 mg/L for 19 sites in the Trenton gravel.

Nitrate (as nitrogen) concentrations exceeded 10 mg/L in water from 17 of 195 wells and sumps. One of these sites was in hornblende gneiss, 12 were in the lower sand unit, and 4 were in the Trenton gravel. The median concentration of nitrate was 0.37 mg/L for water from 78 sites in the Wissahickon Formation, 3.2 mg/L for 71 sites in the lower sand unit, and 1.1 mg/L for 36 sites in the Trenton gravel.

Generally, ground water containing no detectable dissolved oxygen has very high ratios of ammonium to

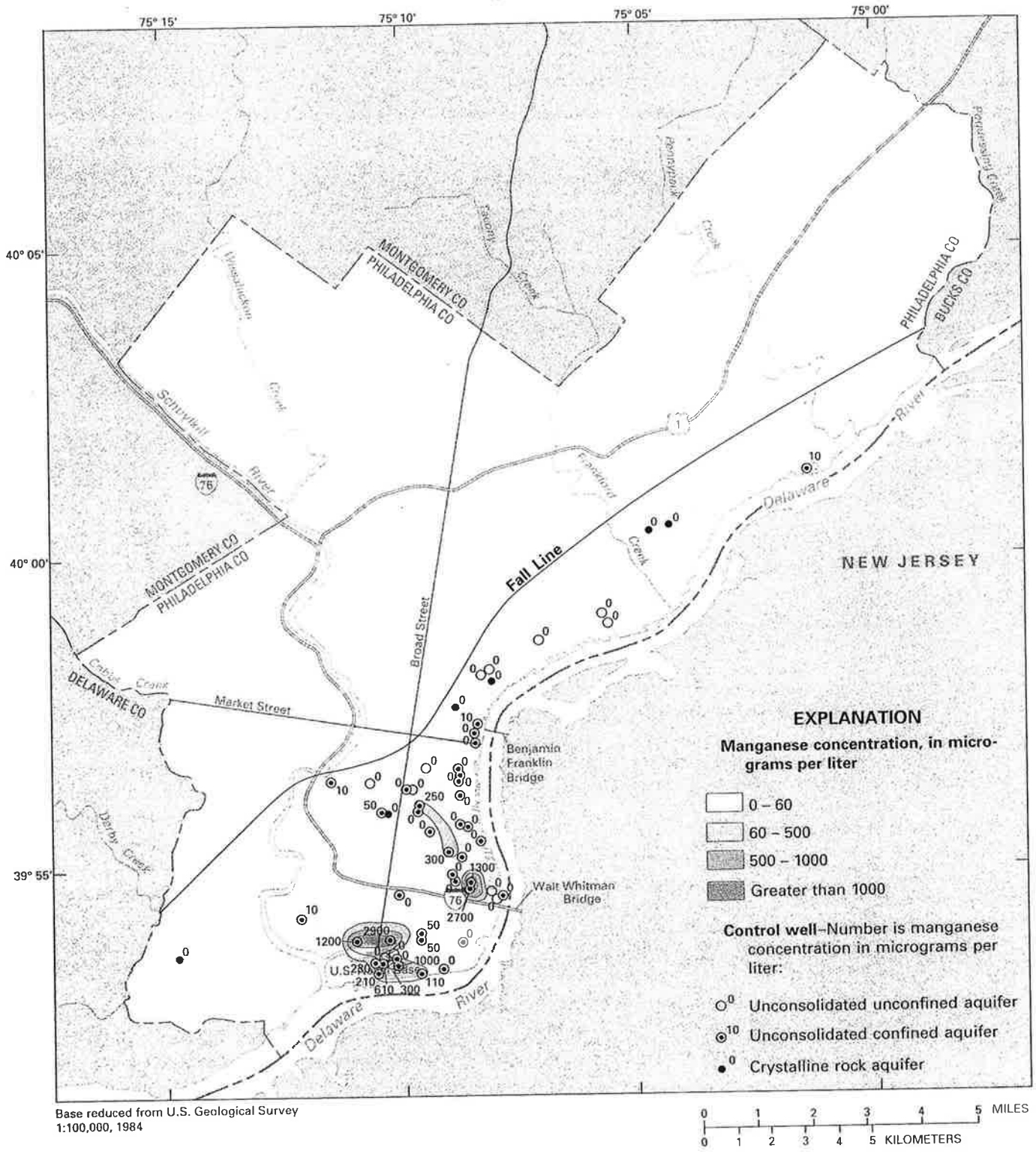


Figure 59. Dissolved-manganese concentration, 1945-58.

nitrate—the median ratio for 19 samples containing more than 1 mg/L of ammonium plus nitrate was 165 parts of ammonium (as nitrogen) to 1 part of nitrate (as nitrogen). A strong reducing environment in the aquifer is indicated where most of the nitrogen is present as ammonium. Conversely, ground water containing any measurable amount of oxygen (more than about 0.3 mg/L) has low ratios of ammonium to nitrate—the median ratio for 40

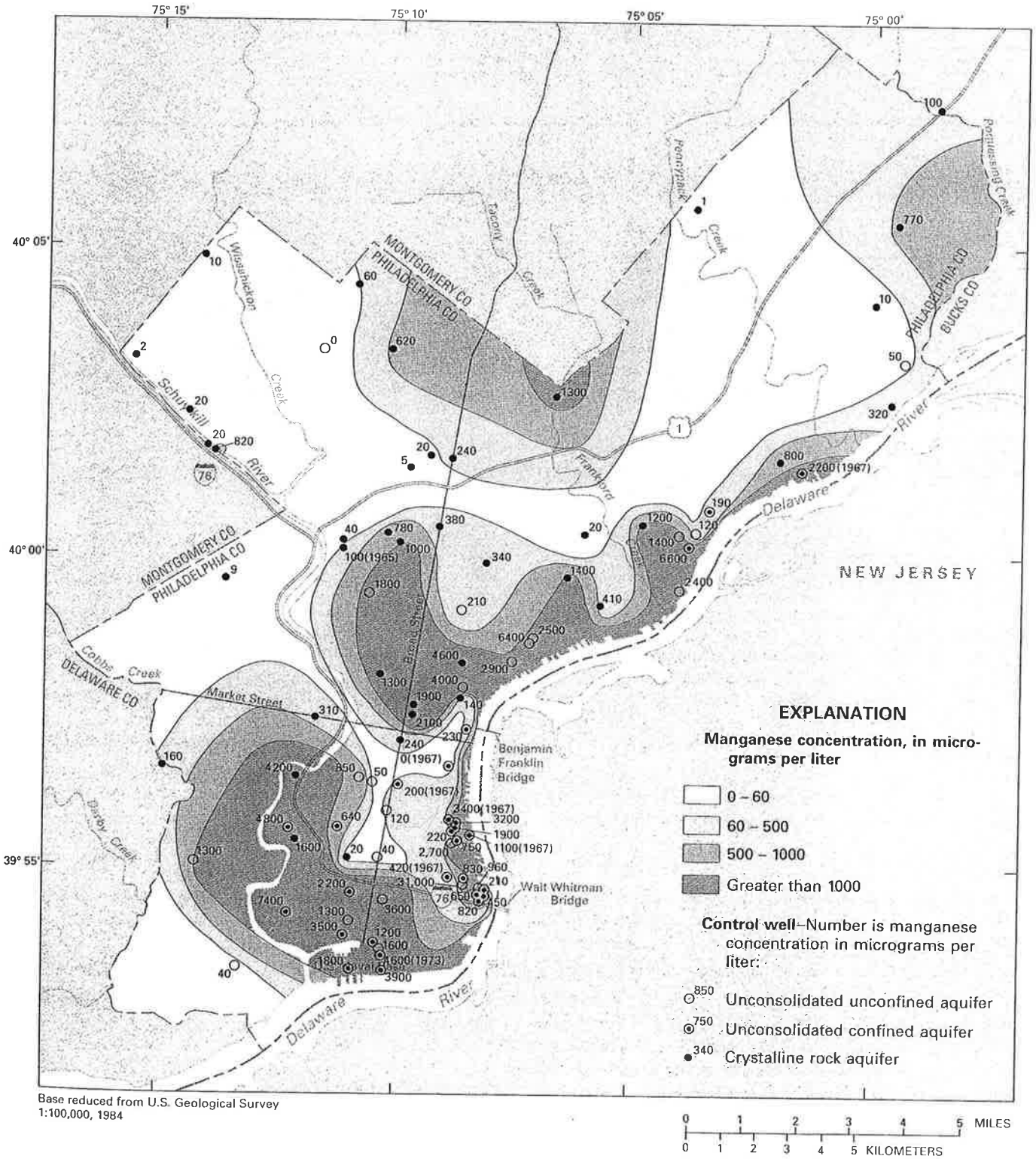


Figure 60. Dissolved-manganese concentration, 1979-80.

samples containing more than 1 mg/L of ammonium plus nitrate was 0.28 part of ammonium to 1 part of nitrate. Because some types of water treatment can convert ammonium to nitrate, concentrations of nitrate in treated water may be much higher than in raw water in which ammonium is the dominant nitrogen species.

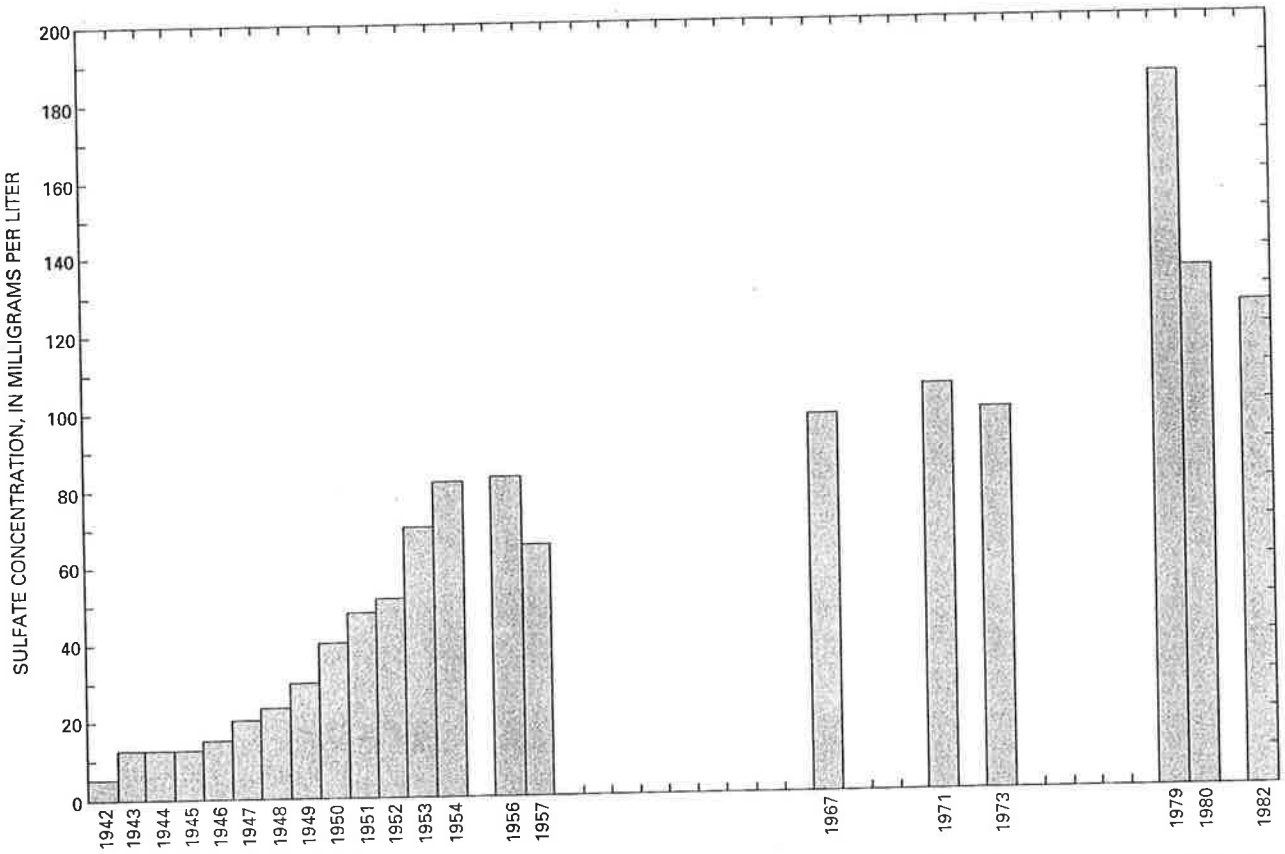


Figure 61. Concentration of dissolved sulfate in water from the lower sand unit of the Potomac-Raritan-Magothy aquifer system at the U.S. Naval Base, 1942–82.

Trace Elements

Trace elements are those chemical species that commonly are present at low concentrations in natural environments. Usually, concentrations in ground water are low because of adsorption of trace elements, particularly by clay minerals and organic matter in the aquifer matrix. Because some trace elements are known to be detrimental to human health, even at low concentrations, limits on concentration have been established by various public health agencies.

Except in localized areas, ground water in Philadelphia contains undetectable or low concentrations of trace elements. During 1979–80, 103 water samples were analyzed for one or more of the following dissolved trace elements: arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, strontium, and zinc (Paulachok and others, 1984, table 5). Except for those shown in table 9, trace-element concentrations did not exceed the water-quality criteria established by the U.S. Environmental Protection Agency (1977).

Figure 64 shows concentrations of cadmium, chromium, and mercury in ground water at sites where the concentrations exceeded drinking water standards. In general, these sites are in industrialized areas. The relatively high concentrations of trace elements probably have been caused by leaks or spills of industrial chemicals and waste products.

Table 9. Summary of trace-element concentrations that exceeded U.S. Environmental Protection Agency drinking water standards

[µg/L, micrograms per liter]

Trace element	Drinking water standard, in µg/L	Number of analyses	Number that exceeded standard	Percentage that exceeded standard
Cadmium	10	103	1	0.97
Chromium	50	91	2	2.2
Mercury	2	76	13	17

Volatile Organic Compounds

Volatile organic compounds are a group of manmade chemical substances used extensively for synthesizing other chemicals and as industrial solvents. Examples of such compounds are benzene, carbon tetrachloride, chloroform, and trichloroethylene. These substances do not occur naturally in ground water; rather, they enter the ground-water system as a result of disposal practices, leaks, and spills. At the land surface, many of these compounds volatilize (vaporize) and diffuse into the atmosphere. If volatile

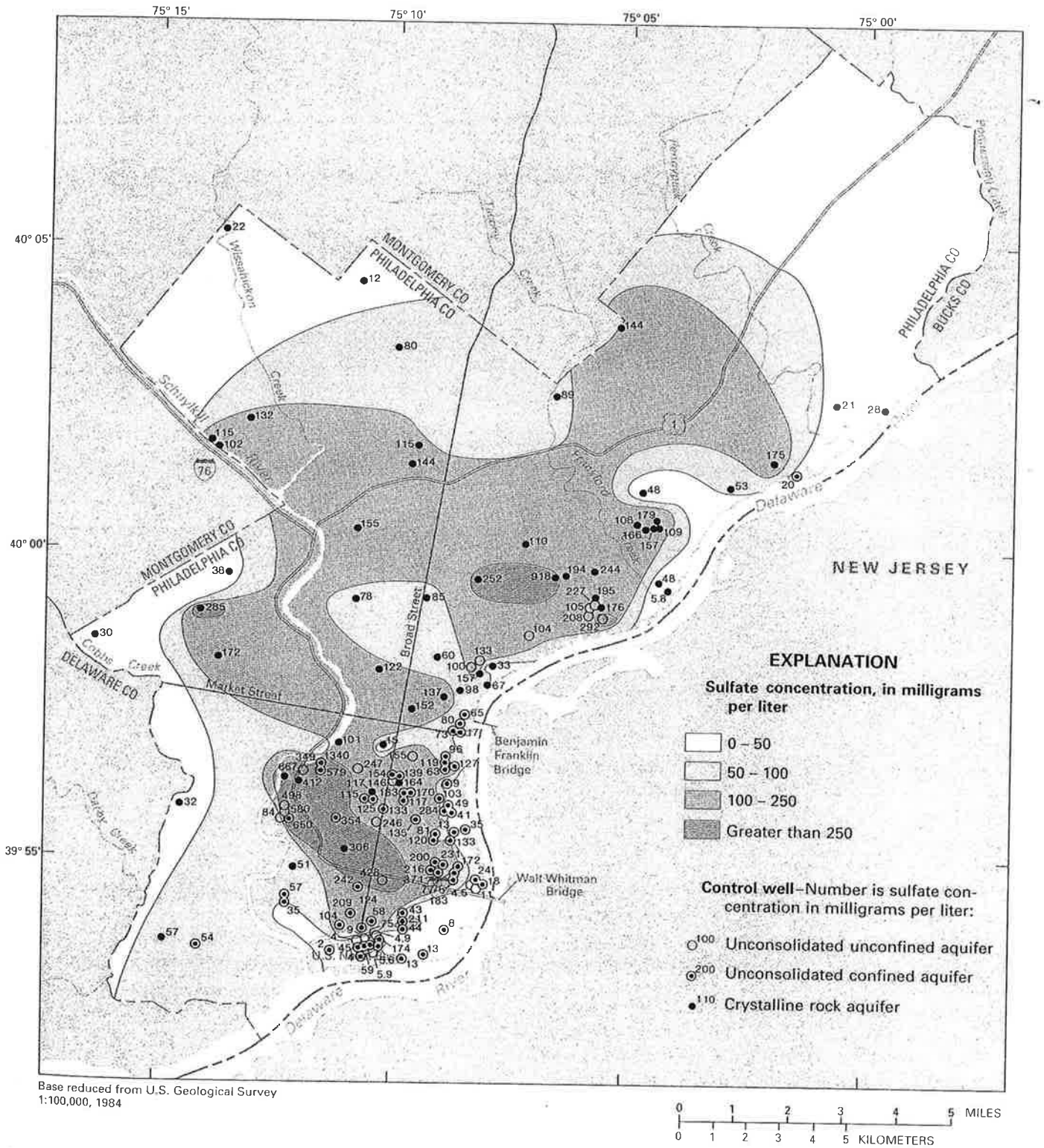


Figure 62. Dissolved-sulfate concentration, 1945–58.

organic compounds make their way into the unsaturated zone, the processes of adsorption, biological and chemical degradation, and biological uptake may inhibit their downward migration. The most effective of these attenuation processes is adsorption of compounds on the mineral surfaces of the sediment or rock matrix. However, none of these processes reduces concentrations rapidly in the saturated zone.

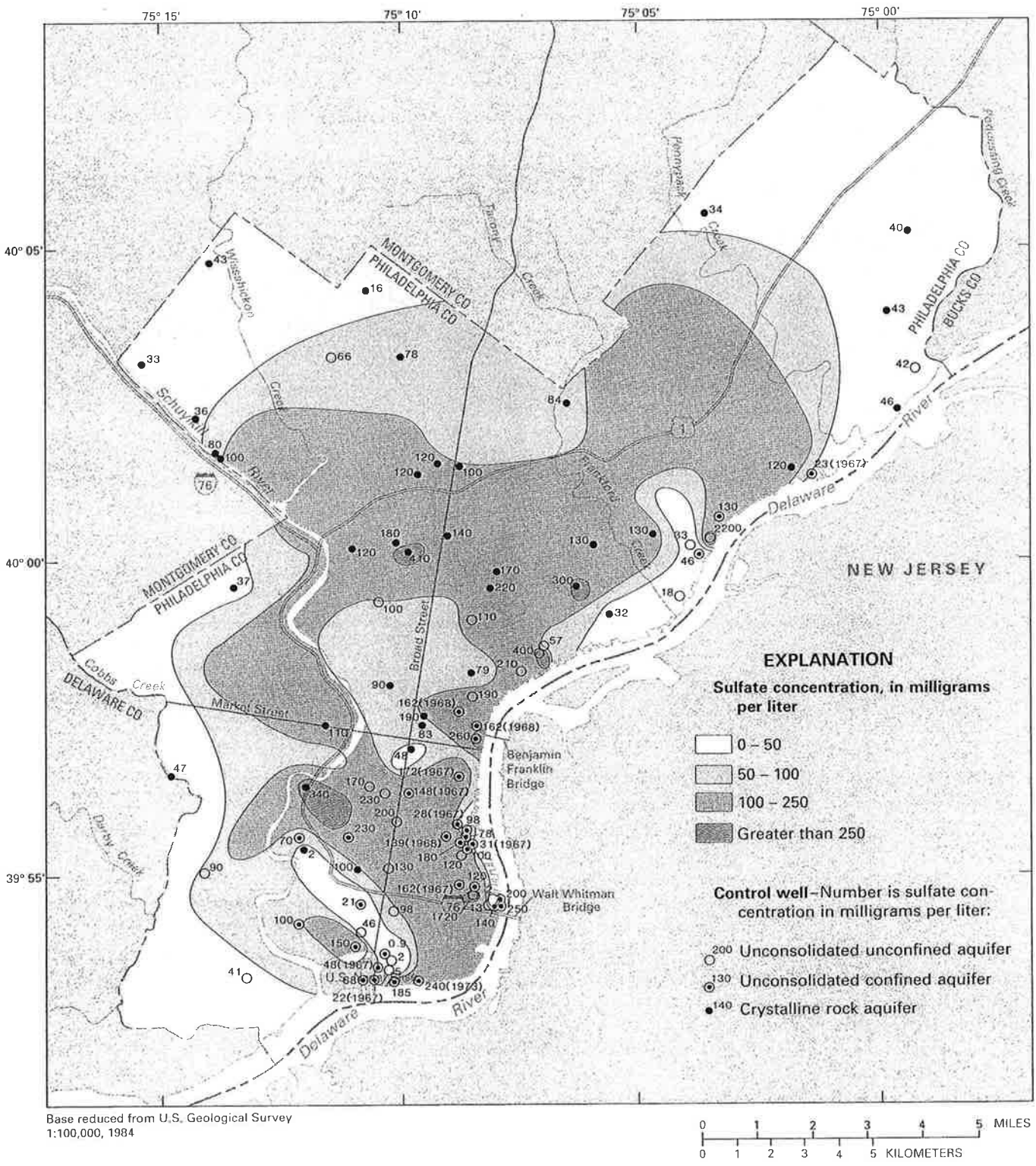


Figure 63. Dissolved-sulfate concentration, 1979-80.

During 1979–80, 68 water samples were analyzed for several or all of 14 selected volatile organic compounds noted in a companion report (Paulachok and others, 1984, table 6). The analytical data are summarized in table 10. The analyses show that ground water in Philadelphia commonly contains low concentrations of these substances except in localized areas of contamination. Chloroform, 1,2-dichloroethane, 1,1,2-tetrachloroethylene, 1,1,1-tri-

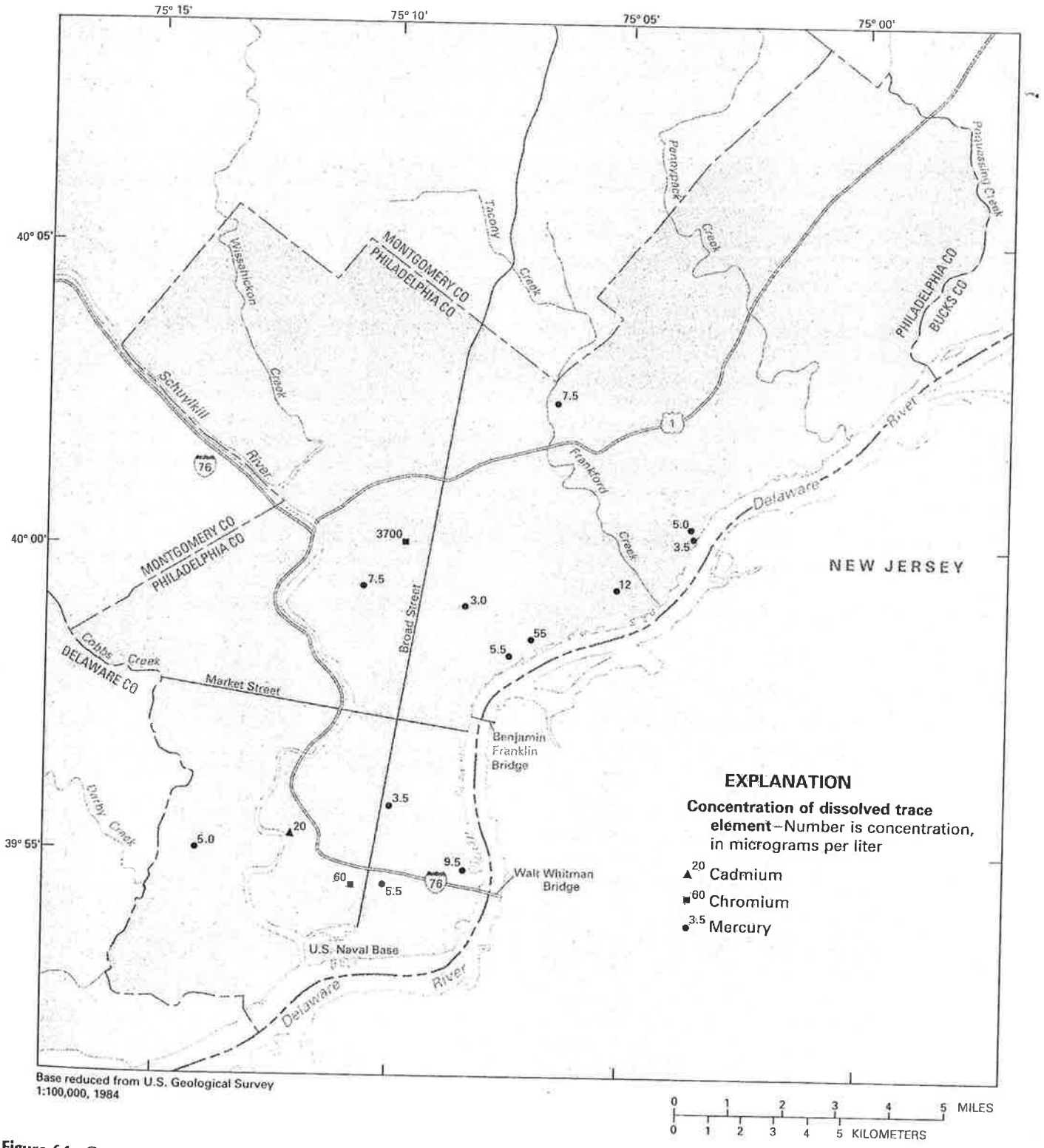


Figure 64. Concentration of selected trace elements, 1979–80.

chloroethane, and trichloroethylene were the most commonly detected volatile organic compounds.

Because many volatile organic compounds are toxic at low concentrations and are known or suspected carcinogens, their complete absence in drinking water is desirable. A limit of 0.10 mg/L has been established for total trihalomethanes (the sum of concentrations of the volatile organic compounds bromoform, chlorodibromomethane,

chloroform, and dichlorobromomethane) in a drinking water supply (U.S. Environmental Protection Agency, 1986). Total trihalomethanes did not exceed this limit in any of the water samples analyzed for this study.

Excessive concentrations of volatile organic compounds in water can be reduced by aeration and adsorption on granular activated carbon (table 8). The effectiveness of the latter method depends on the types of organic compounds present, however. Conventional water-treatment processes such as flocculation, clarification, and filtration do not remove volatile organic compounds to any appreciable degree (Dyksen, 1982).

Figure 65 shows the concentration of phenols and selected volatile organic compounds in ground water during 1979–80. Affected sites are citywide, with highest concentrations in industrialized parts of north-central Philadelphia. The elevated concentrations probably result from leaks or spills of chemical products; however, the extent of the areas affected is not known.

Temperature

Table 11 summarizes statistical data on ground-water temperatures. Water temperatures in the shallow aquifers vary more than those in the deep aquifers. Temperatures in the shallow aquifers are less uniform because the shallow ground water is affected more by seasonal climatic variations and local heat production than is water in the deep aquifers.

Heat production by human activities has raised ground-water temperatures in many parts of Philadelphia, as shown by temperatures of 98 water samples and logs of 40 wells measured during 1979–80. Most sample temperatures were higher than the local mean annual air temperature of 12.6 °C, and many logs show cooling trends with depth, or anomalous gradients. Heating of surface and shallow subsurface materials likely has caused the elevated temperatures and anomalous gradients. Solar radiation on concrete and asphalt surfaces, fossil-fuel combustion, and thermal losses from buried pipelines containing steam and process chemicals are the chief sources of heat.

The contours in figure 66 are based on 81 temperature measurements, 2 of which were made in adjoining parts of Bucks and Delaware Counties. Mean temperature is shown if more than one measurement was made at a particular site. The map shows that the lowest temperatures are in the wooded and less urbanized northern and western localities, whereas the highest are in the densely urbanized north-central and south-central areas. Cells of anomalously warm water (20 to 25 °C) are present in several industrialized areas. Although the median depth of wells in the crystalline rocks is considerably greater than that in the unconsolidated

Table 10. Summary of data on concentration of volatile organic compounds

[µg/L, microgram per liter; <, less than]

Volatile organic compound	Range of concentration, in µg/L. Smaller value is detection limit	Number of analyses	Number that exceeded detection limit	Percentage that exceeded detection limit
Benzene	<1.0-18	12	2	17
Bis 2-chloroethylether	<.10-2.1	48	1	2
Bromoform	<.10-.30	57	4	7
Carbon tetrachloride	<.10-35	67	7	10
Chlorobenzene	<.10-320	57	17	30
Chlorodibromomethane	<.10-2.1	67	6	9
Chloroform	<.10-36	68	49	72
Dichlorobromomethane	<.10-2.7	67	26	39
1,2-dichloroethane	<.10-50	67	40	60
1,2-dichloropropane	<.10-30	57	29	51
Methylene chloride	<.10-2.7	59	24	41
1,1,2-tetrachloroethylene	<.10-650	68	46	68
1,1,1-trichloroethane	<.10-570	57	42	74
Trichloroethylene	<.10-3,700	68	43	63

Initial Conditions

In order to simulate pre-development conditions, a steady-state simulation was run with initial water levels for all layers placed at the land surface. The resulting steady-state potentiometric surface of the lower sand unit (layer 7) is shown in figure 28. The potentiometric surface agrees with pre-development conditions theorized by Barksdale and others (1958) that describe the pre-pumping, regional ground-water-flow system having upward vertical gradients with local recharge in upland areas and discharging to nearby rivers.

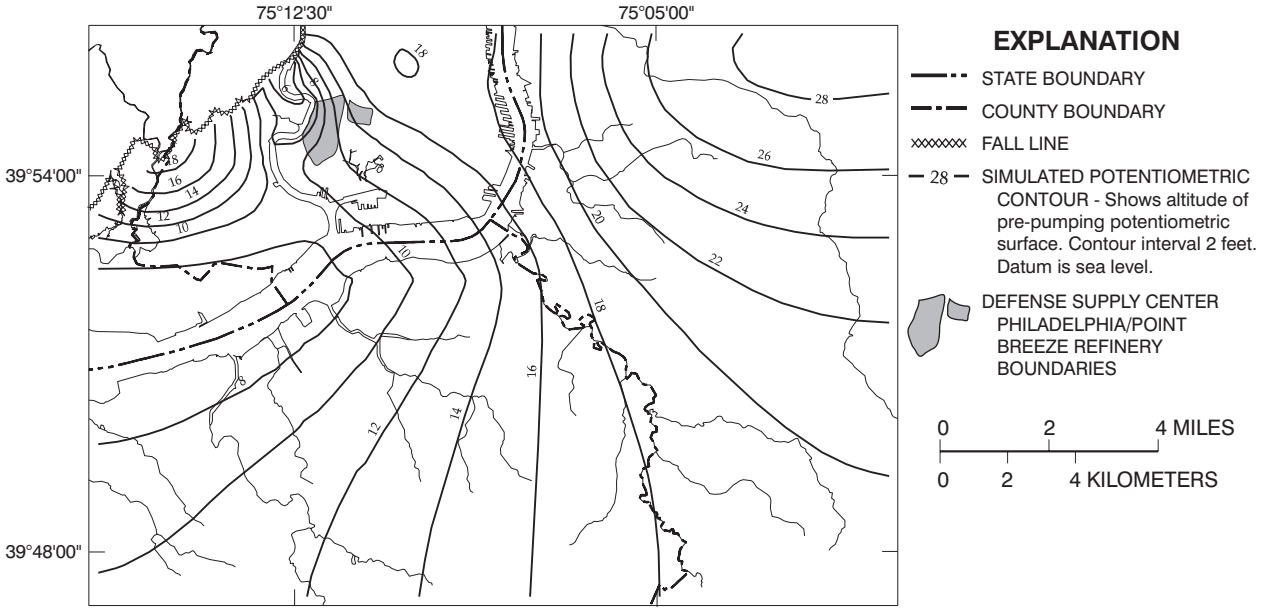


Figure 28. Simulated pre-development potentiometric surface of lower sand unit (model layer 7) of the Potomac-Raritan-Magothy aquifer system.

Comparison of Simulated Heads to Potentiometric Surface Maps

The simulated potentiometric surface of the south Philadelphia area for August 1945 is shown in figure 29. The August 1945 potentiometric-surface map of Greenman and others (1961) is shown in figure 30. The potentiometric-surface configurations are in agreement, but maximum drawdowns at the pumping centers are not. This could be the result of water-level data collected in pumping wells in which well-loss effects increase drawdown. Well-loss effects are negligible in non-pumping wells. Also, the grid-cell size may be too large to adequately represent drawdowns in the aquifer, especially in areas near large withdrawals.

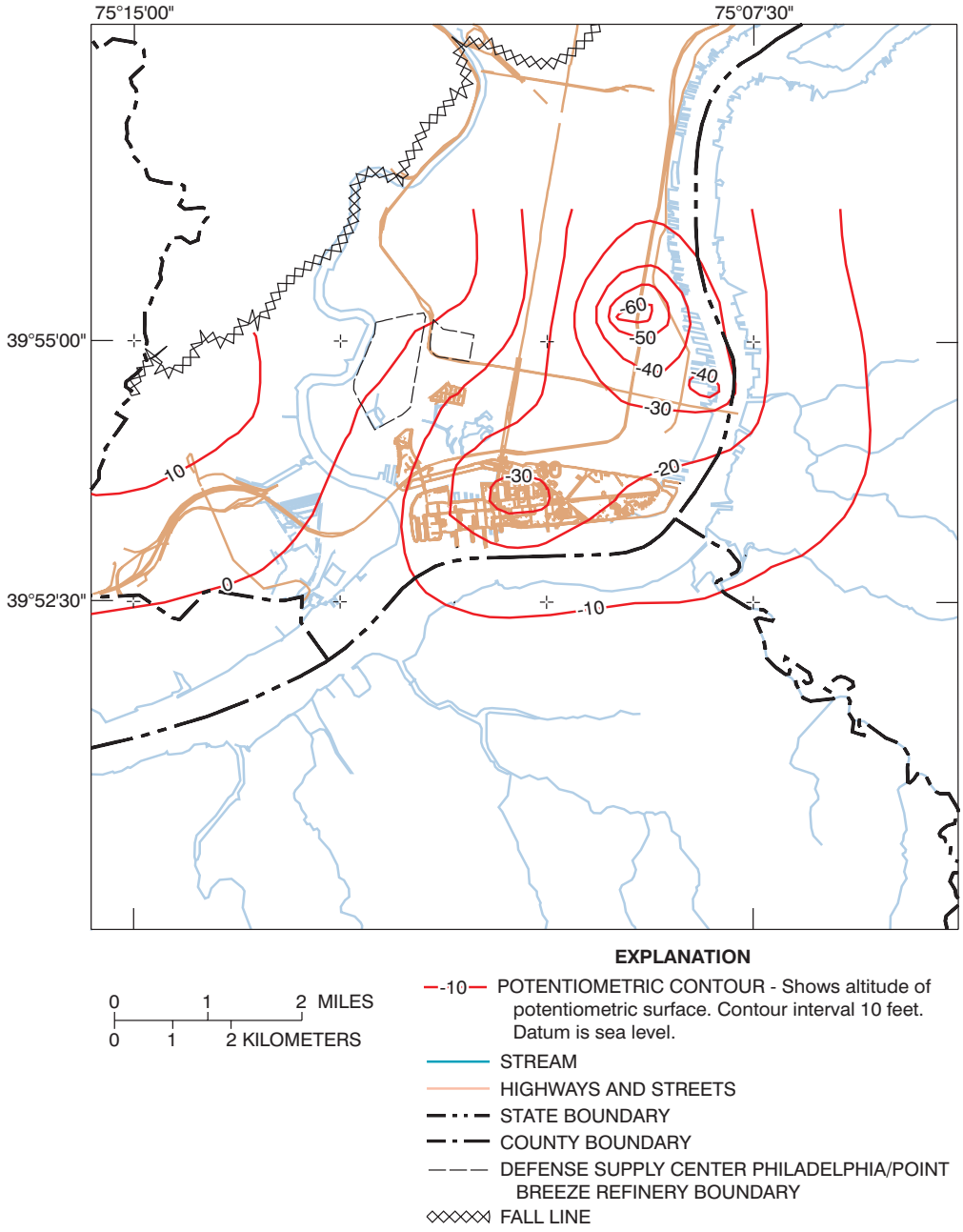


Figure 29. Simulated potentiometric surface for the lower sand unit of the Potomac-Raritan-Magothy aquifer system, August 1945.

For August 1945, simulated horizontal ground-water-flow direction in the lower sand unit (layer 7) near the area of concern was to the southeast towards areas with large cones of depression along the Delaware River. Simulated water-level altitudes in the lower sand unit (layer 7) ranged from 0 to -10 ft sea level, which caused downward vertical flow gradients in the upper units.

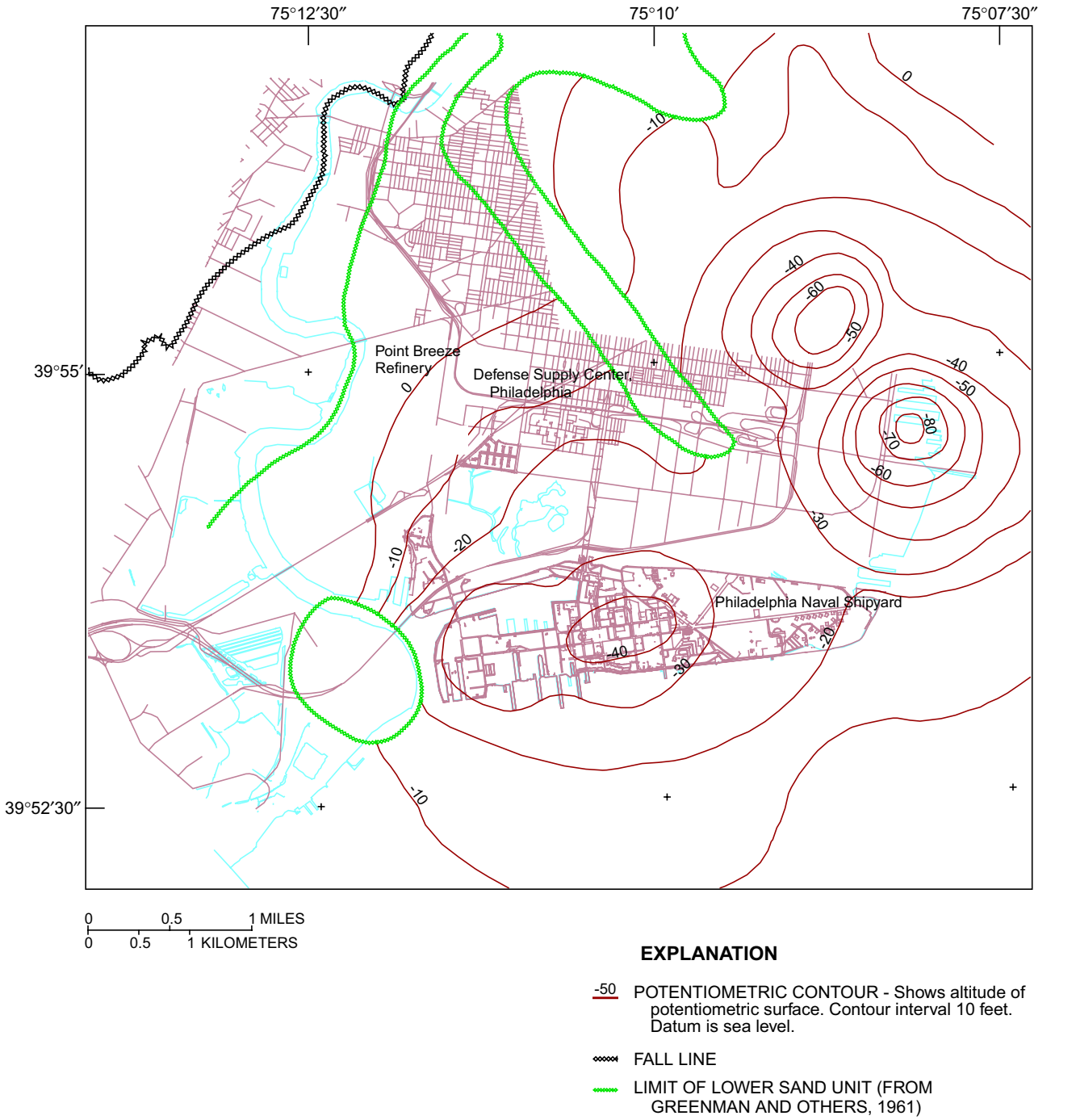


Figure 30. Potentiometric surface of the lower sand unit, August 1945 (modified from Greenman and others, 1961).

The simulated potentiometric surface of the south Philadelphia area for March 1954 is shown in figure 31. The March 1954 potentiometric-surface map of Greenman and others (1961) is shown in figure 32. The potentiometric-surface configurations are in agreement, but maximum drawdowns at the pumping centers once again are not. As described earlier, this could result from well-loss effects in pumping wells, and the large grid-cell size in areas of large withdrawals.

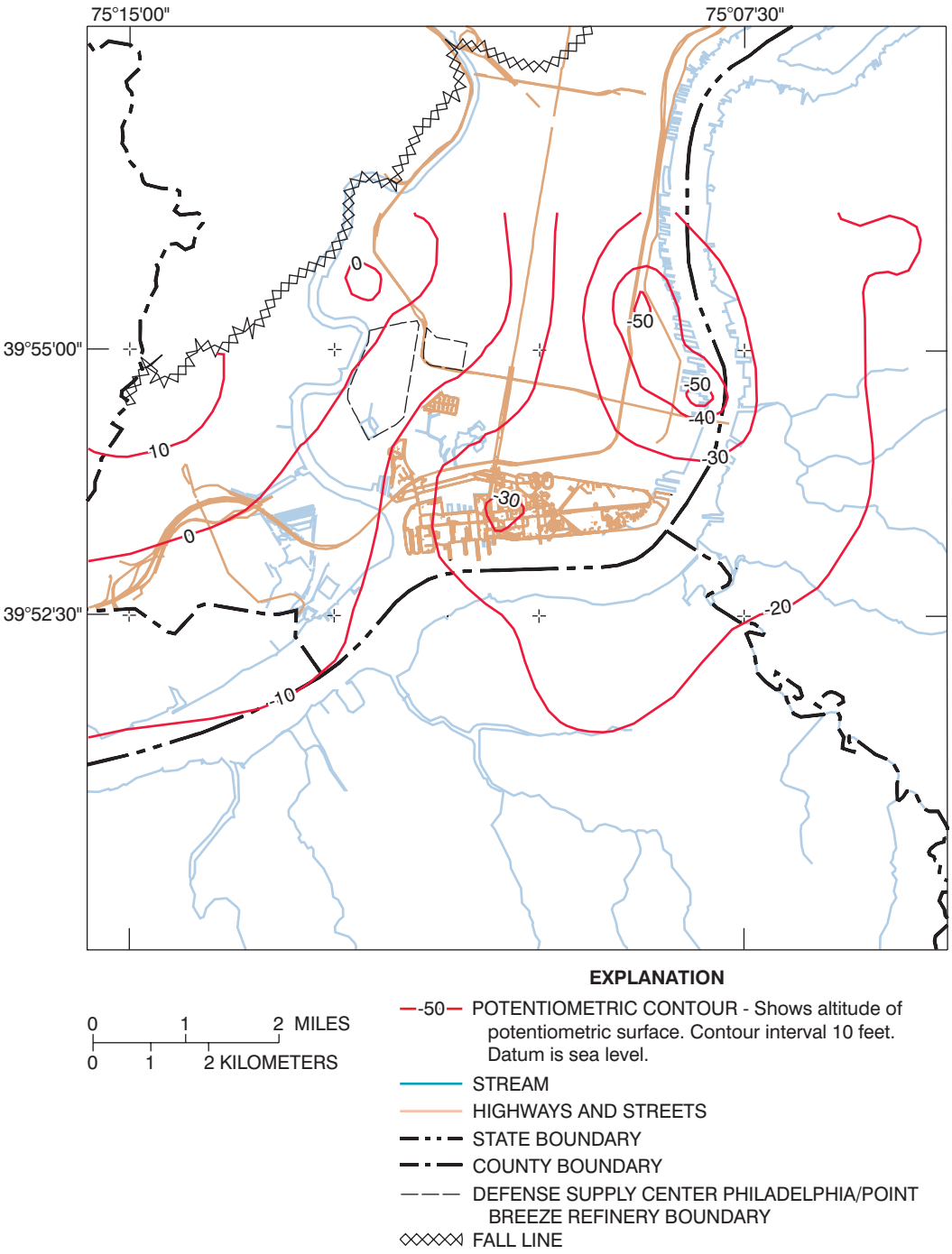


Figure 31. Simulated potentiometric surface for the lower sand unit of the Potomac-Raritan-Magothy aquifer system, March 1954.

For March 1954, simulated horizontal ground-water-flow direction in the lower sand unit (layer 7) near the area of concern was to the southeast towards areas with large cones of depression along the Delaware River. Simulated water-level altitudes in the lower sand unit (layer 7) ranged from 0 to -10 ft sea level, which caused downward vertical flow gradients in the upper units.

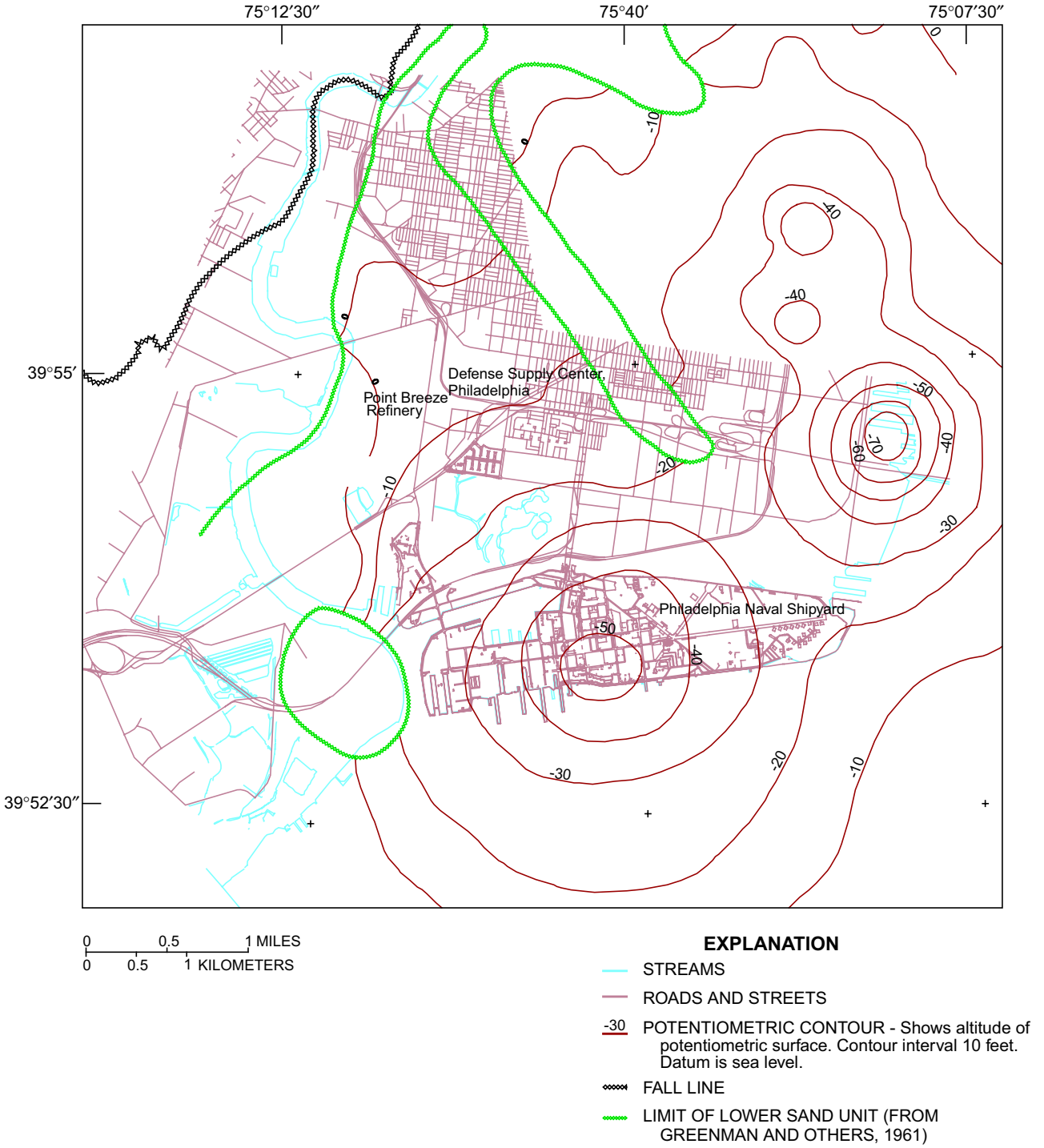


Figure 32. Potentiometric surface of the lower sand unit, March 24, 1954 (modified from Greenman and others, (1961).

The simulated potentiometric-surface map of the south Philadelphia area for 1968 is shown in figure 33. The 1968 potentiometric-surface map of Gill and Farlekas (1976) is shown in figure 34. The directions of ground-water flow are in agreement. However, maximum drawdowns of the simulated water surface near pumping centers are not in agreement. This could be the result of inaccurate water-withdrawal data; perhaps the withdrawals at these pumping centers were substantially less than reported.

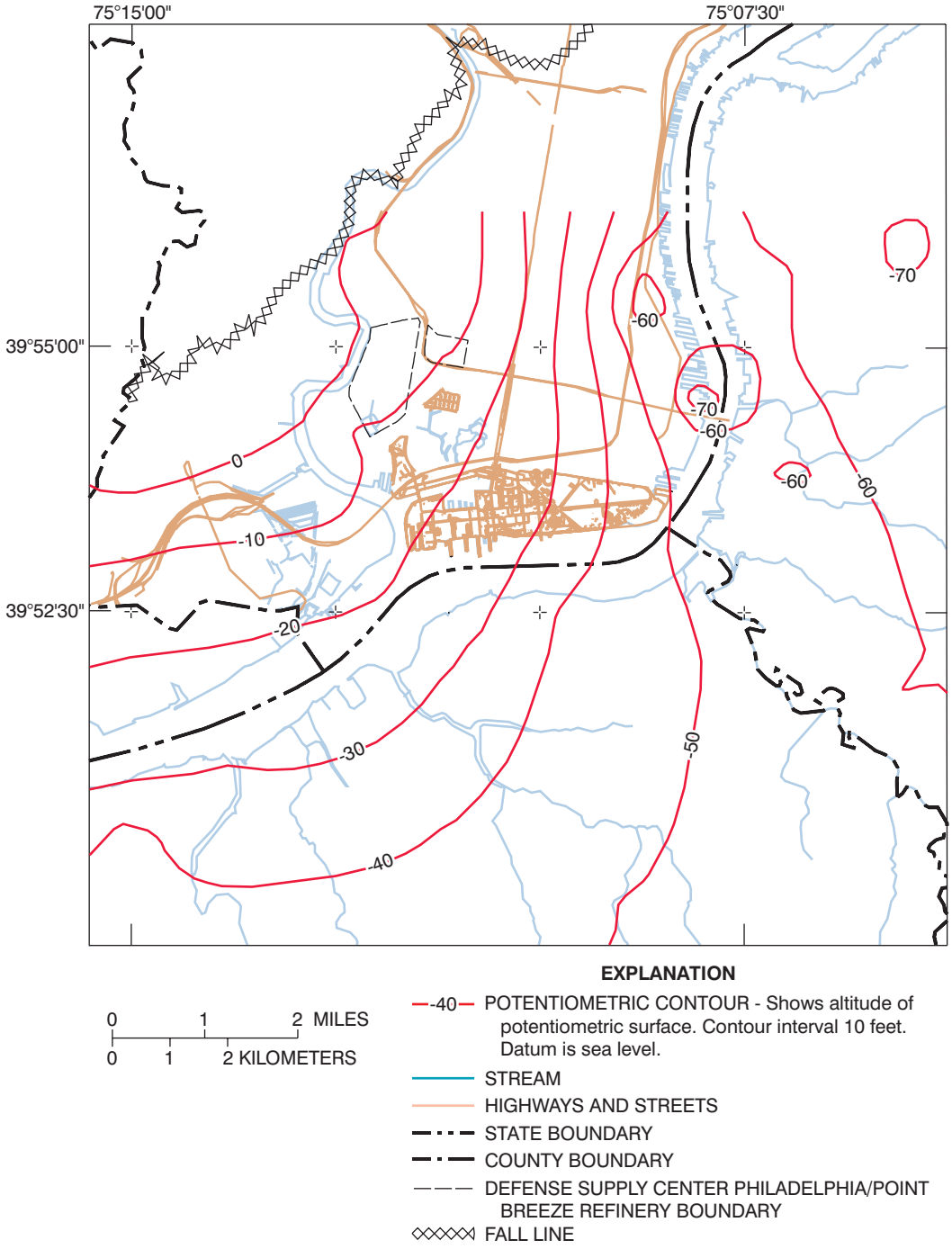


Figure 33. Simulated potentiometric surface for the lower sand unit of the Potomac-Raritan-Magothy aquifer system, December 1968.

For 1968, simulated horizontal ground-water-flow direction in the lower sand unit (layer 7) near the area of concern was to the east towards areas with large cones of depression in New Jersey and along the Delaware River. Simulated water-level altitudes in the lower sand unit (layer 7) ranged from -10 to -20 ft sea level, which caused a downward vertical flow gradients in the upper units.

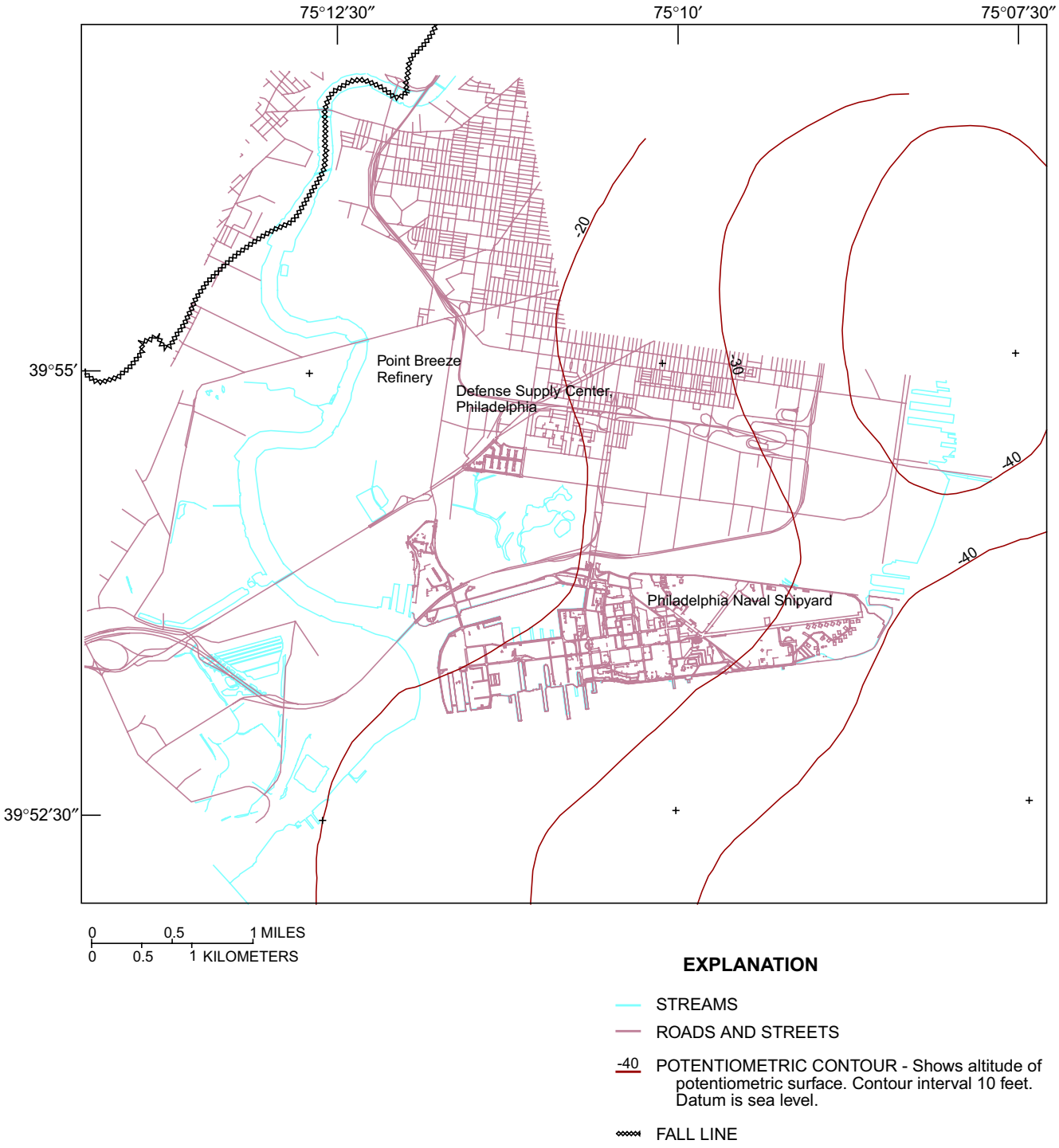


Figure 34. Potentiometric surface of the lower sand unit, 1968 (modified from Gill and Farlekas, 1976).

The simulated potentiometric-surface map of the south Philadelphia area for 1978 is shown in figure 35. The 1978 potentiometric-surface map of Sloto (1981) is shown in figure 36. The directions of ground-water flow indicated by the contour lines on the two maps are similar but not in agreement, and the water-level altitude contours are not in agreement. This could be the result of a small number of data points used to construct the original map, particularly on the Pennsylvania side of the river. Walker (1983) did not measure wells on the Pennsylvania side of the river to construct the map, and Paulachok (1991) measured only a few wells in the northwest corner of the study area.

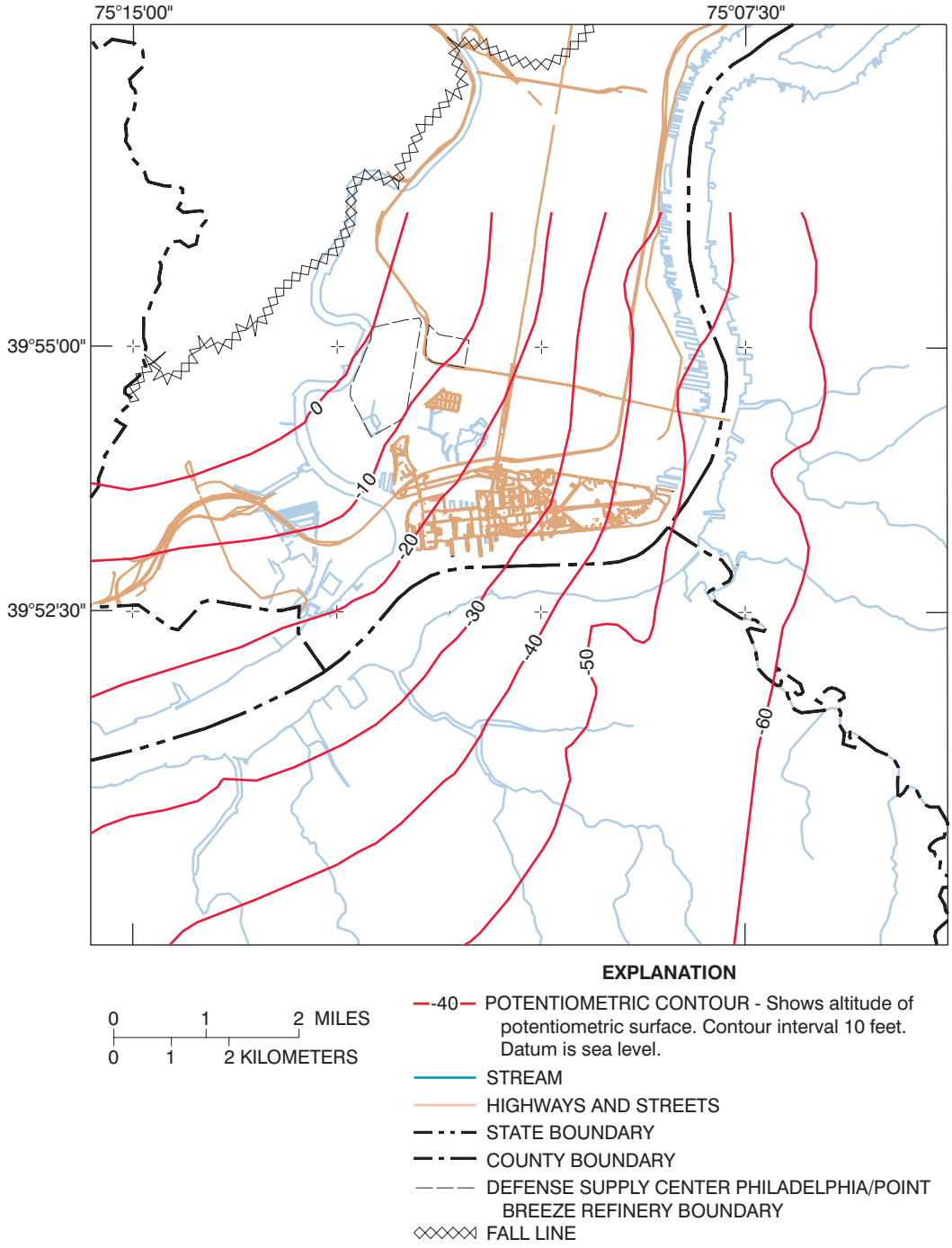


Figure 35. Simulated potentiometric surface for the lower sand unit of the Potomac-Raritan-Magothy aquifer system, December 1978.

For 1978, simulated horizontal ground-water-flow direction in the lower sand unit (layer 7) near the area of concern was to the east towards areas in New Jersey. Simulated water-level altitudes in the lower sand unit (layer 7) ranged from -10 to -20 ft sea level, which caused downward vertical flow gradients in the upper units.

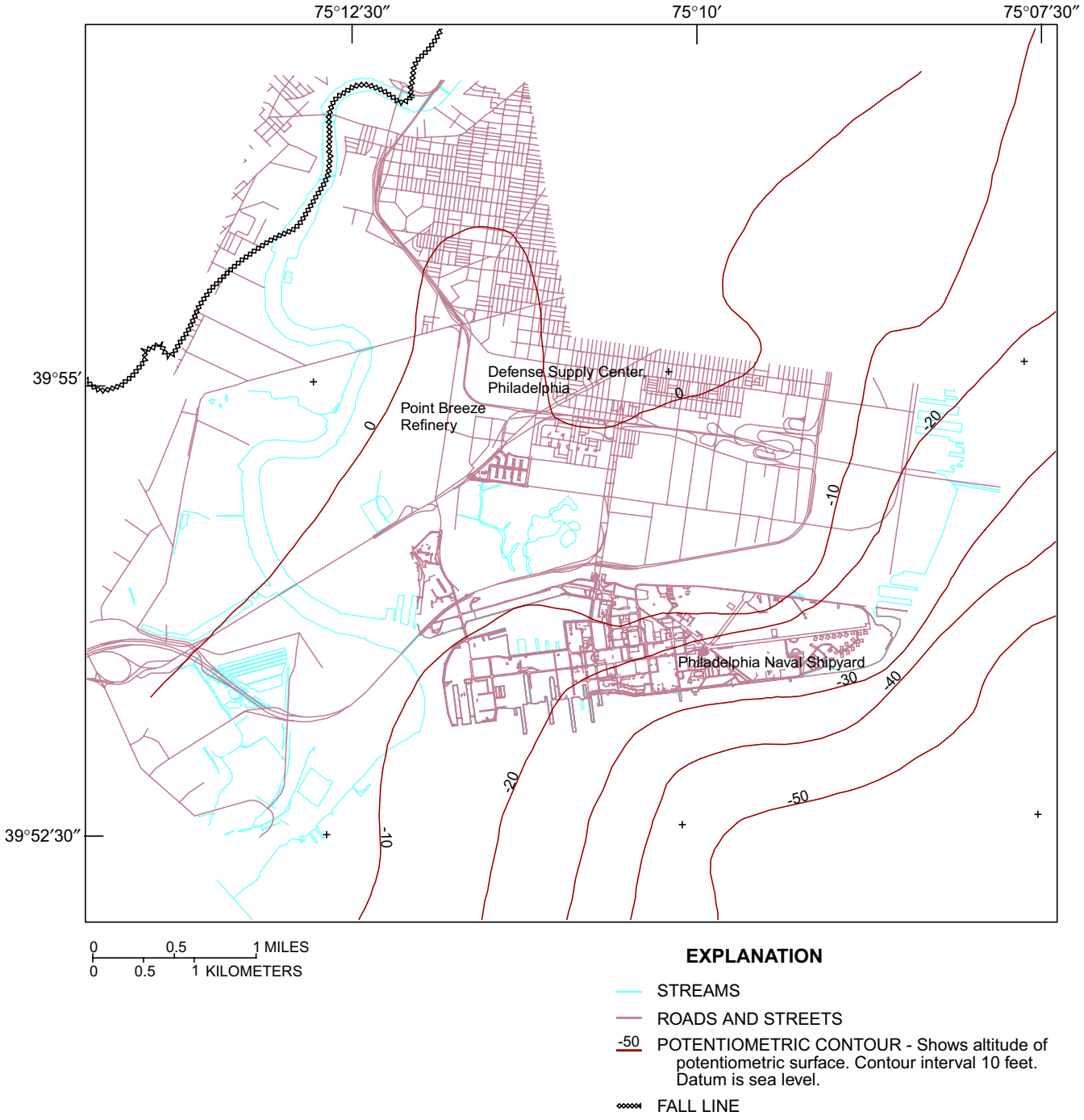


Figure 36. Potentiometric surface of the lower sand unit, 1978 (modified from Sloto, 1988).

The simulated potentiometric-surface map of the south Philadelphia area for 1995 is shown in figure 37. The potentiometric-surface map for 1996 of Rosman (1997) is shown in figure 38. The potentiometric-surface map configurations and the directions of ground-water flow indicated by the contour lines are in agreement. The simulated potentiometric contours are slightly west of the contour lines constructed from measured water levels.

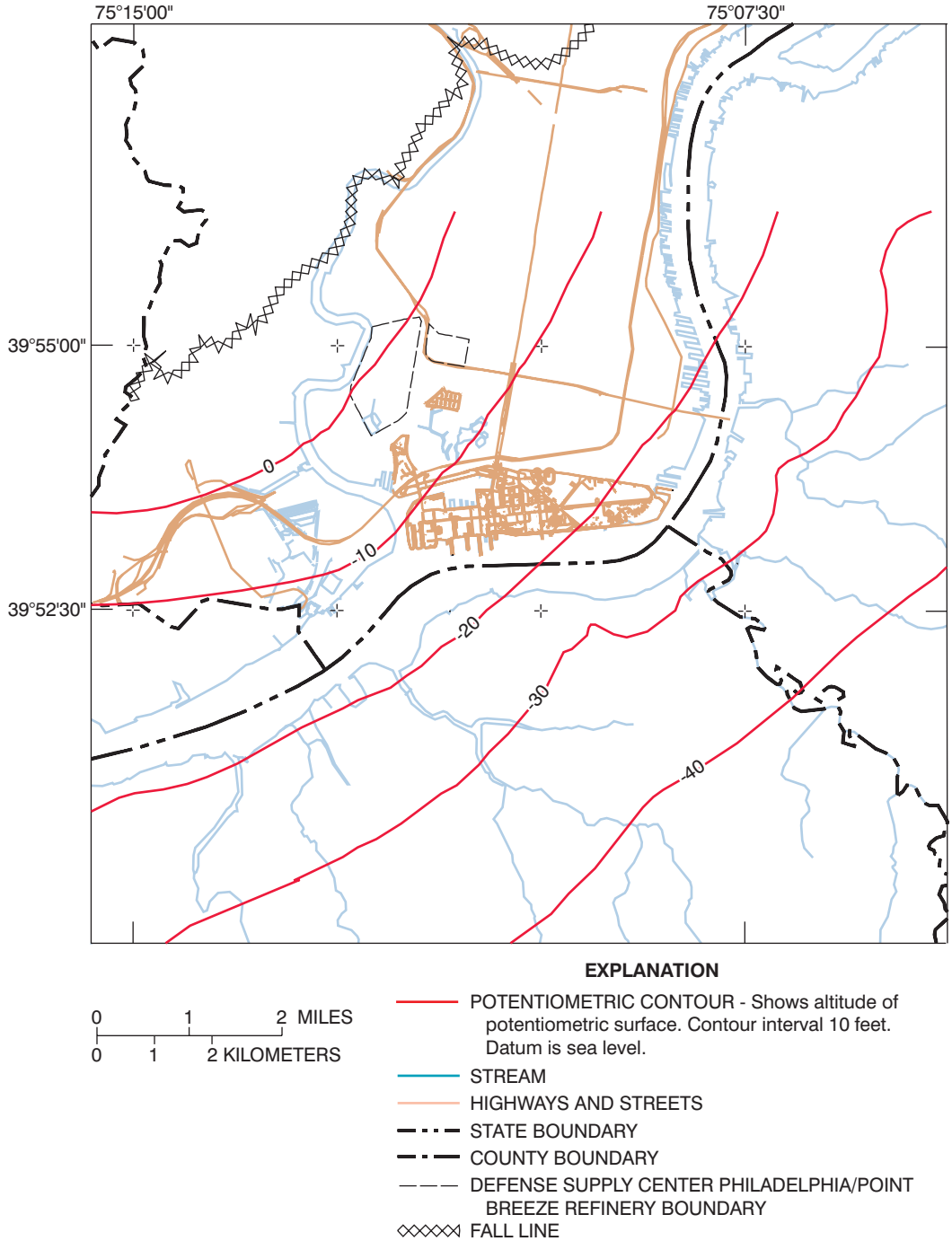


Figure 37. Simulated potentiometric surface for the lower sand unit of the Potomac-Raritan-Magothy aquifer system, December 1995.

For 1996, simulated horizontal ground-water-flow direction in the lower sand unit (layer 7) near the area of concern was to the southeast towards areas in New Jersey. Simulated water-level altitudes in the lower sand unit (layer 7) ranged from 0 to -10 ft sea level, which caused downward vertical flow gradients in the upper units.

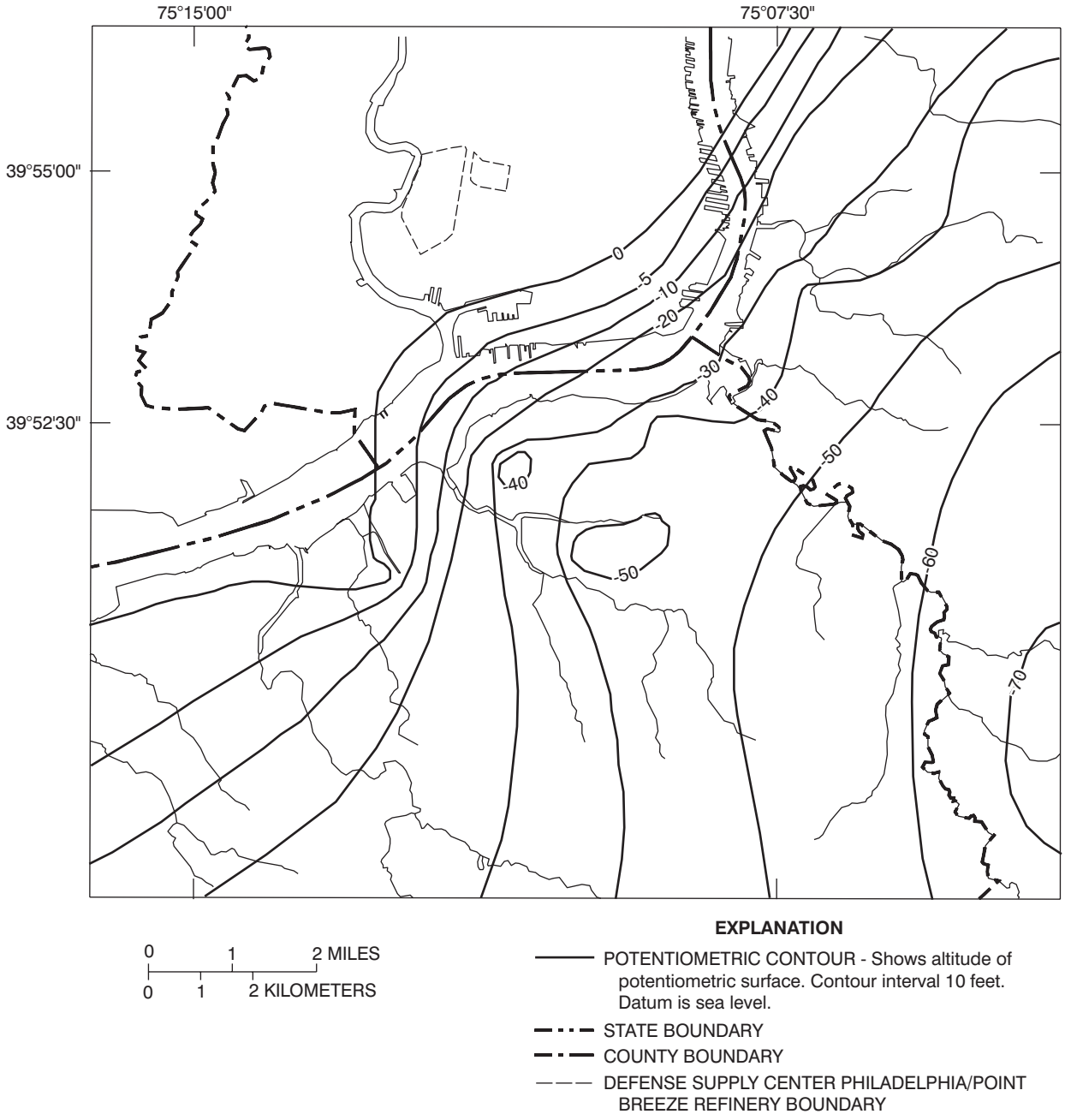


Figure 38. Potentiometric surface map of the lower sand unit, 1996 (from Rosman, 1997)

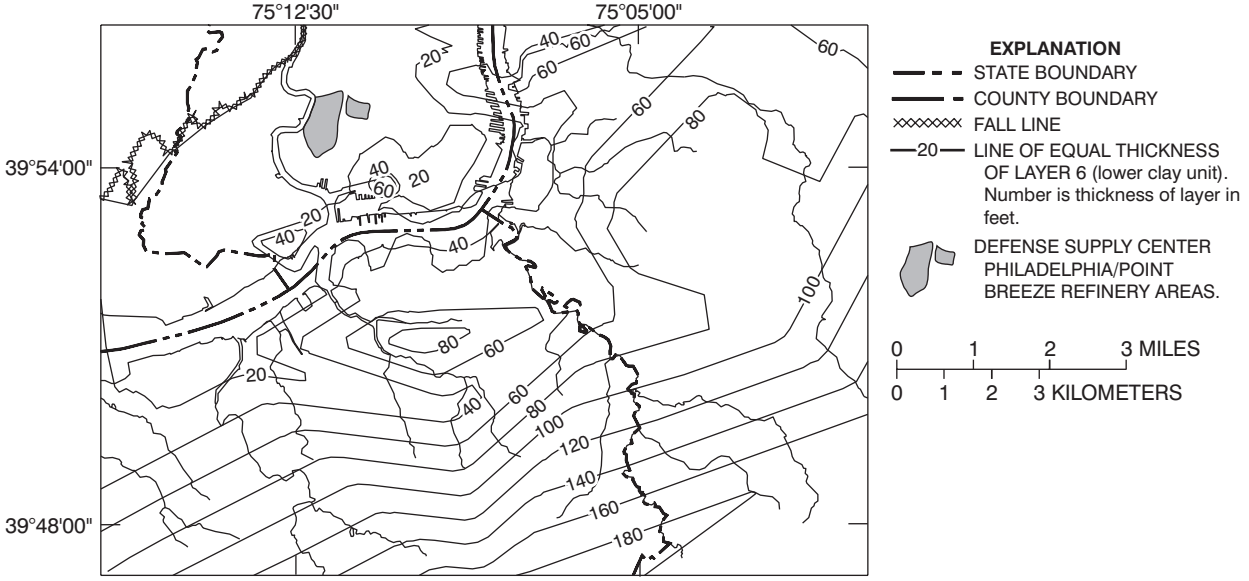


Figure 11. Thickness of the lower clay unit (model layer 6) of the Potomac-Raritan-Magothy aquifer system in the south Philadelphia area.

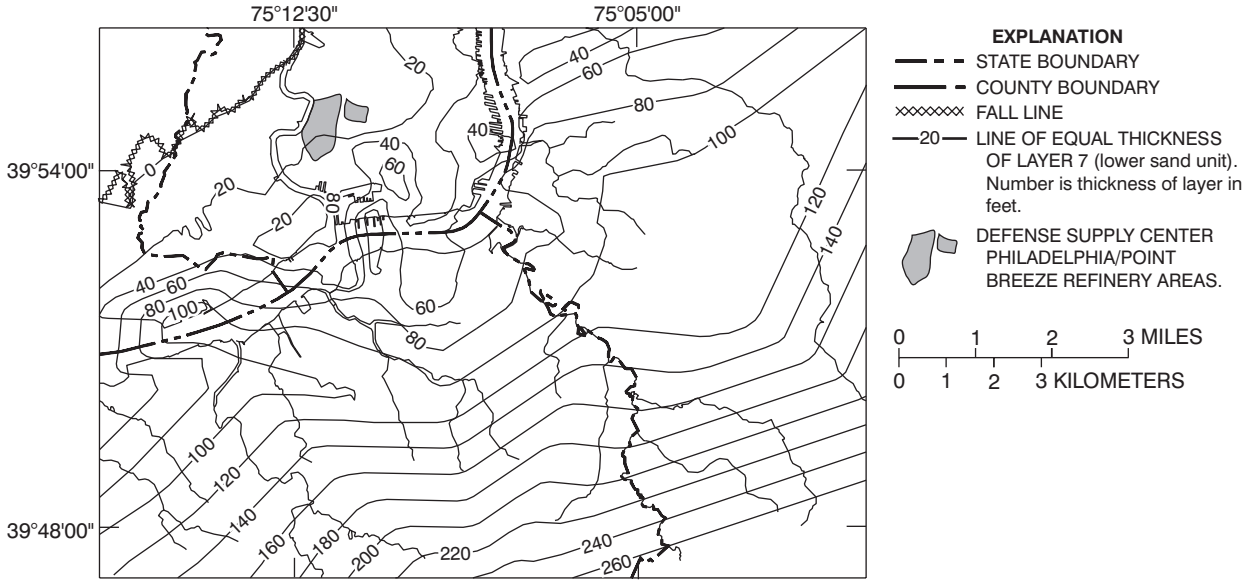


Figure 12. Thickness of the lower sand unit (model layer 7) of the Potomac-Raritan-Magothy aquifer system in the south Philadelphia area.

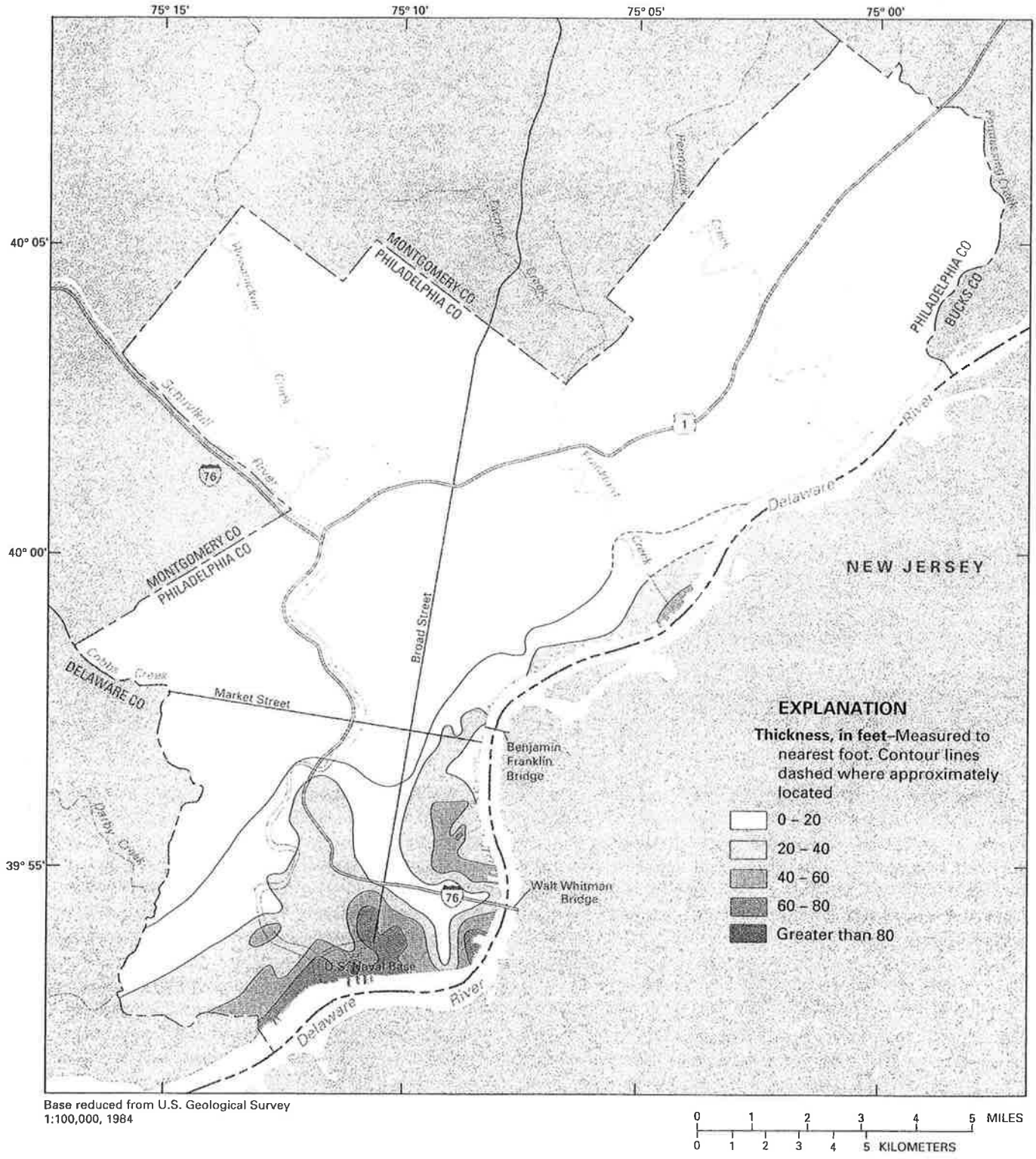


Figure 23. Thickness of the lower sand unit of the Potomac-Raritan-Magothy aquifer system.

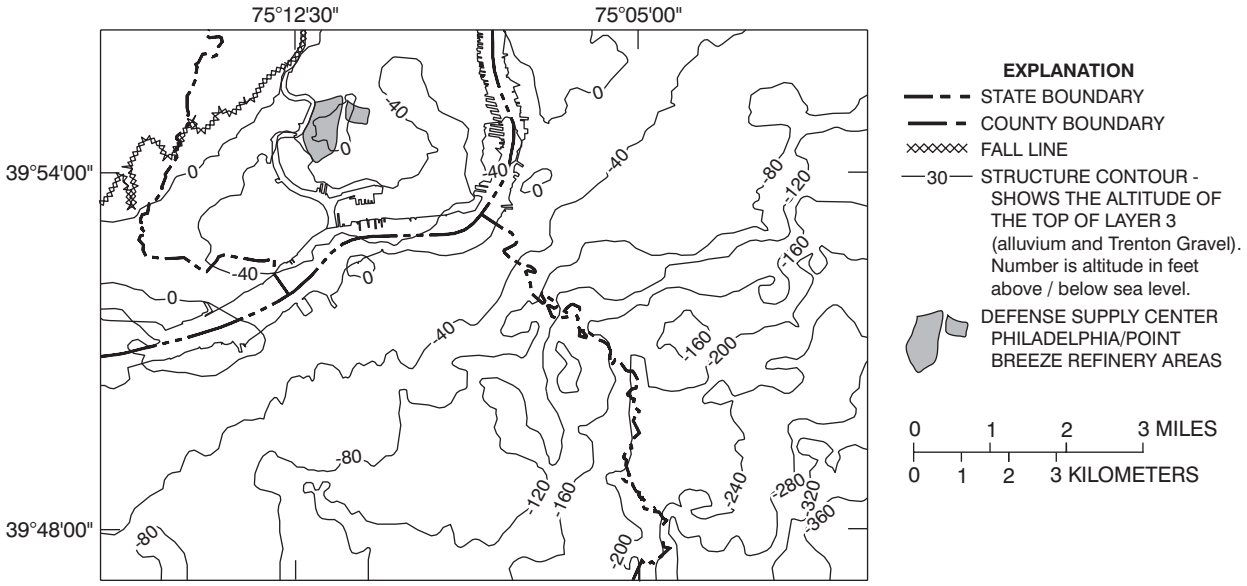


Figure 7. Altitude of the top of the upper sand unit (model layer 3) of the Potomac-Raritan-Magothy aquifer system in the south Philadelphia area.

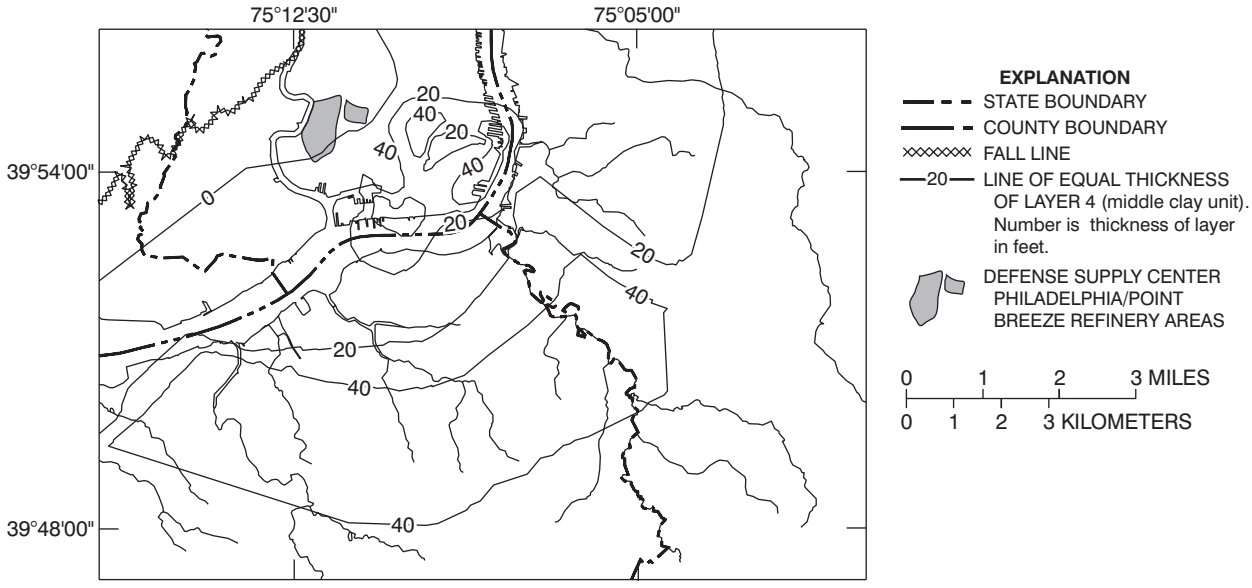


Figure 8. Thickness of the middle clay unit (model layer 4) of the Potomac-Raritan-Magothy aquifer system in the south Philadelphia area.

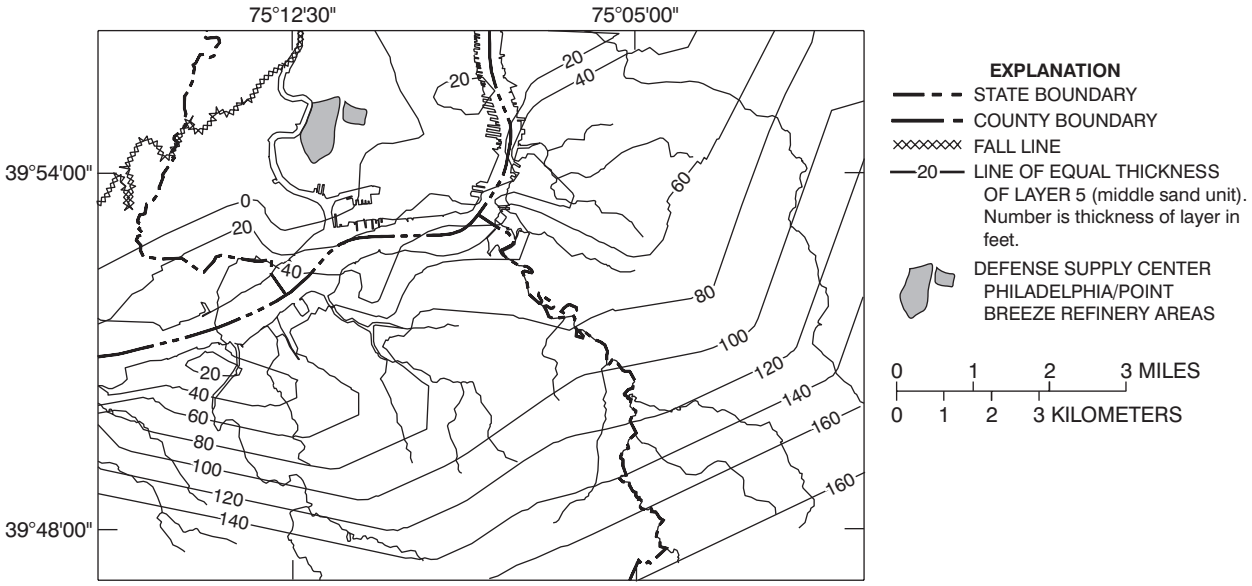


Figure 9. Thickness of the middle sand unit (model layer 5) of the Potomac-Raritan-Magothy aquifer system in the south Philadelphia area.

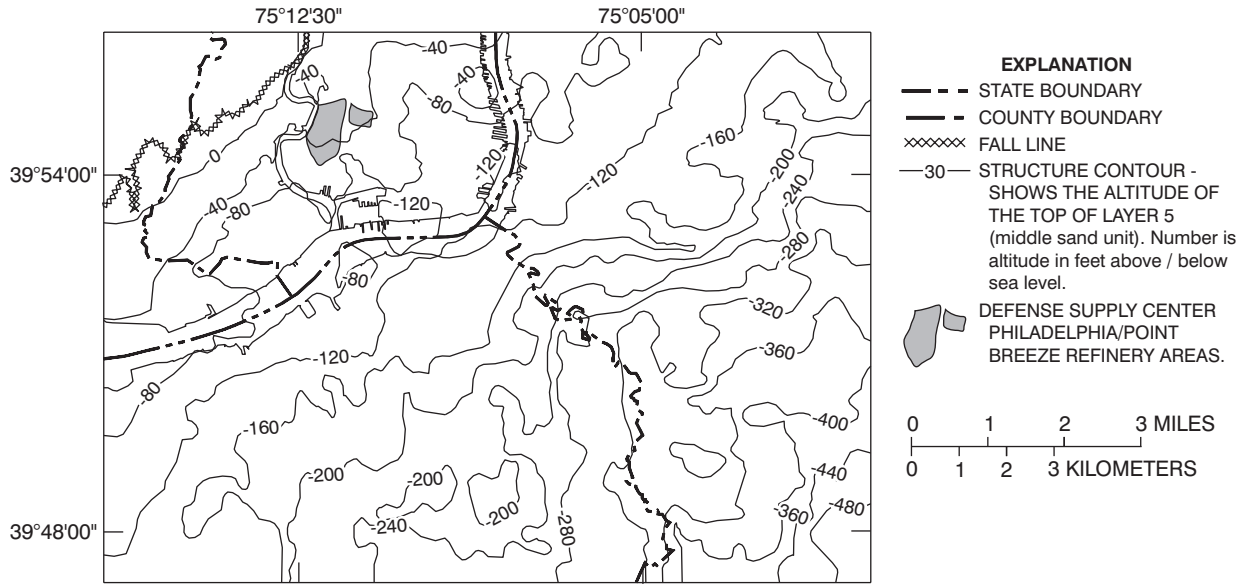


Figure 10. Altitude of the top of the middle sand unit (model layer 5) of the Potomac-Raritan-Magothy aquifer system in the south Philadelphia area.

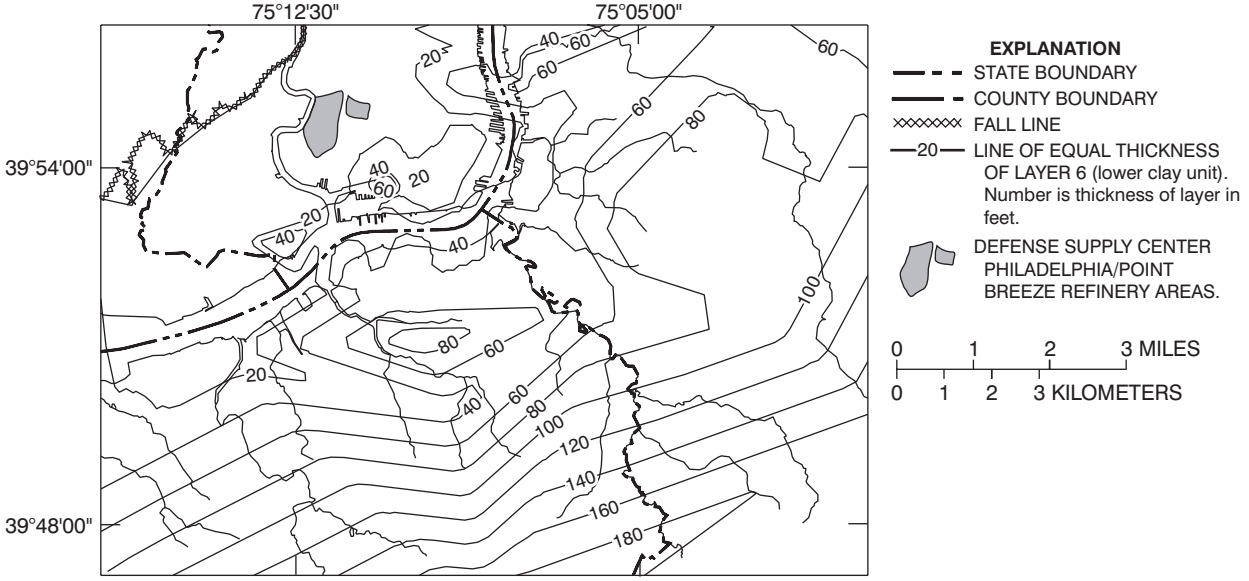


Figure 11. Thickness of the lower clay unit (model layer 6) of the Potomac–Raritan–Magothy aquifer system in the south Philadelphia area.

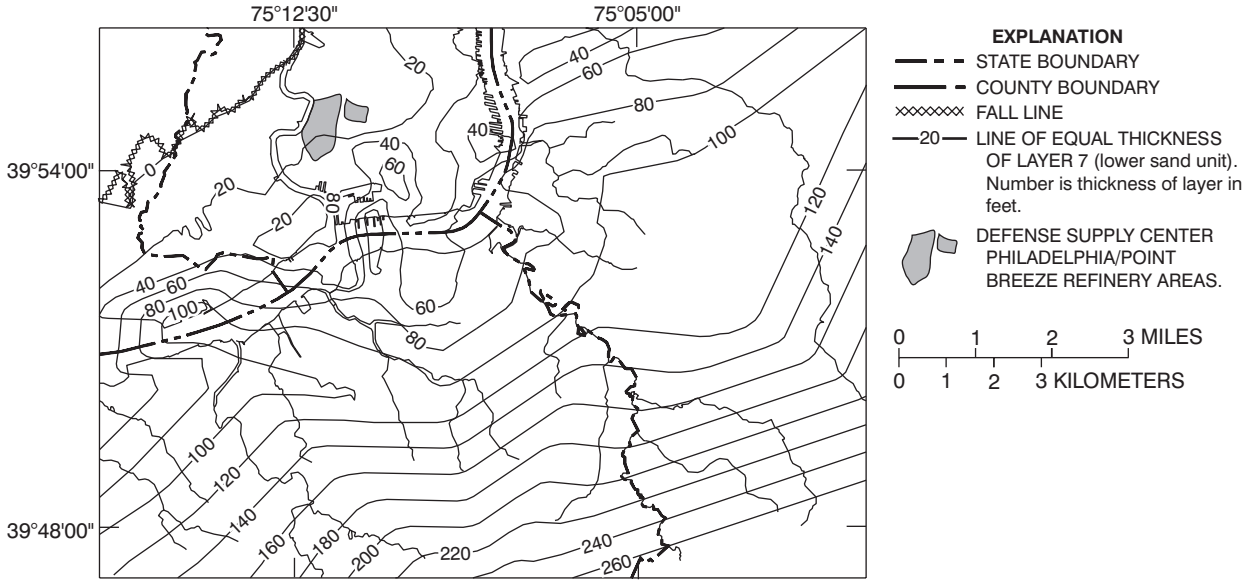


Figure 12. Thickness of the lower sand unit (model layer 7) of the Potomac–Raritan–Magothy aquifer system in the south Philadelphia area.

APPENDIX C

Deep Soil Boring Logs and

Monitoring Well Construction Summaries

AOI-1

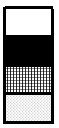
Aquaterra Technologies, Inc.
Subsurface Log: S-46D

Project Name: Sunoco Philadelphia Refinery AOI - 1 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-46D **Log By:** M.B. Spancake **Date:** 3/17-18/05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 2" **Length:** 15' **Slot Size:** **Water Level (Init):** 58'
Casing Diameter: 2" **Length:** 56' **Type:** PVC
Drilling Method: Hollow Stem Auger/ Mud Rotary **Sample Method:** Split Spoon **Rig Type:** HAS/Mud rotary

Construction Details

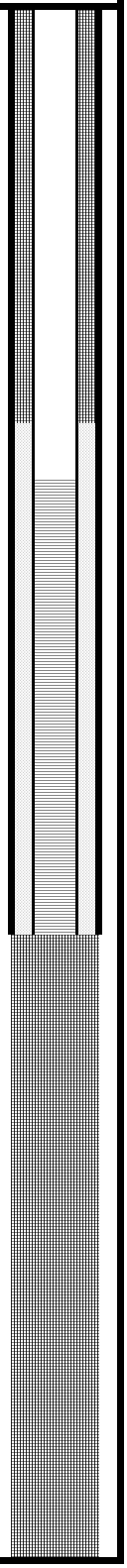
Total Well Depth: 69' BGS **Outer Steel Casing Interval:** 0'-48'
Screen Interval: 54'-69' **Bentonite Interval:** 0'-52'
Sand Pack Interval: 52'-69' **Cement/Grout Interval:**
Completion Details: Completed with 2' Steel stick-up **Sand Pack Type:** # 2



Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Vacuum Utility Clearance to 9' below ground surface (bgs).	
5					
10	10-12	45	1	Brown coarse sandy gravel, moist, poorly sorted.	
	12-14	28	0.75	Same as above. Rock fragment in bottom of spoon. Slightly more moisture.	
15	14-16	823	1	Wet, poorly sorted, coarse sandy gravel. Brownish-red in color.	
	16-18	829	1	Same as above.	
	18-20	817	1.5	Same as above.	
20	20-22	267	0.75	Same as above, gravel is slightly larger.	
	22-24	744	1.75	Same as above, gravel is smaller and less abundant, more coarse sandy gravel matrix.	
25	24-26	760	1	Brownish red, coarse, sandy gravel, wet.	
	26-28	20	2	Same as above, more gravel and pebbles.	
	28-30	0	2	Same as above, changing to a wet, gray, fine sand at 28.5'. Slight clay content from 28.5'-29' bgs.	
30	30-32	13	NM	Same as above, changing to a coarse sand and very small gravel.	
	32-34	9	2	Coarse sandy gravel turning to a fine sandy gray clay towards bottom.	
35	34-36	122	1	Fine brown silty sand, wet.	
	36-38	11	1.25	Gray clayey silt, slight moisture to dry.	

Aquaterra Technologies, Inc.
Subsurface Log: S-46D (Continued)

Depth (ft)					Well Schematic
	38-40	2	0.75	Same as above, more clay content.	
40	40-42	0	1.5	Same as above.	
	42-44	0	2	Gray clayey silt.	
45	44-46	0	1.5	Gray fine sandy silt, slight clay.	
	46-48	0	1.5	Same as above.	
	48-50	0	1.25	Same as above.	
50	50-52	0	1.75	Same as above.	
	52-54	NM	1.5	Same as above. Changing to a green coarse sand. Large quartz fragment sand and in bottom and serpentine fragment.	
55	54-56	0	0.5	Note: The spoon advanced only 0.75 feet. Coarse brown orange coarse pebble matrix. Moist.	
	56-58	0	1	Same as above. No gravel or pebble present in bottom of spoon.	
	58-60	0	1	Same as above. Changed to medium sand at bottom of shoe. Moist to wet.	
60	60-62				
65	65-67	0	1.5	Medium brown orange sand and pebble. Wet. Changing to a medium greenish gray wet sand.	
70	70-72	0	1	White medium and fine sand matrix with large pebble fragments. Wet End augers. Remove augers from borehole and fill with grout. Will move well location 15' east. Advanced augers to 48' BGS and set 4"-steel casing. Begin with mud rotary drilling on 4/5/05. Advance mud rotary to 75' BGS and collect spoon.	
75	75-77	0	1.75	White and light gray saprolitic mica schist. Some dark gray banding is present. Blow count = 5-23-36-46	
80	80-82	0	1.25	Light gray highly weathered mica schist with darker banding. Slight green coloration. Blow count = 14-27-42-46	
85	85-87	0	2	Greenish gray saprolitic mica shist in top 1.5'. Changing to a dark grayish green weathered mica schist. Blow count = 27-43-50-50.	
90	90-92	0		Greenish gray and tan weathered mica schist, very dense and compact. Blow count = 47-52-50/0.3	



Aquaterra Technologies, Inc.
Subsurface Log: S-80D

Project Name: Sunoco Philadelphia Refinery AOI - 1
Location: Philadelphia, PA
Owner: Sunoco, Inc. (R&M)
Permit No.:

Boring Number: S-80D
Casing Elevation: N/A
Screen Diameter: 2" **Length:** 15'
Casing Diameter: 2" **Length:** 66'
Drilling Method: Hollow Stem Auger/ Mud Rotary
Log By: M.B. Spancake
Driller: Parrat Wolff
Slot Size: 0.02
Type: PVC
Sample Method: Split Spoon
Date: 3/15-31/05
Borehole Dia: 8.25'
Water Level (Init): 70'
Rig Type: HSA Rig/Mud Rotary

Construction Details

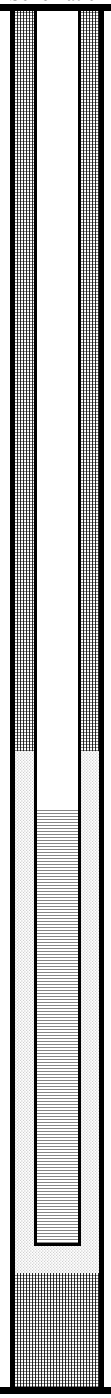
Total Well Depth: 79' BGS
Screen Interval: 64'-79'
Sand Pack Interval: 62'-79'
Completion Details: Completed with 2' Steel stick-up
Outer Steel Casing Interval: 0'-58'
Bentonite Interval: 0-62'
Cement/Grout Interval:
Sand Pack Type: 62'-79'

= Backfill
= Cement/Grout
= Bentonite
= Sand

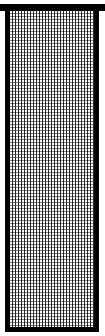
Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Vacuum Utility Clearance to 9' below ground surface (bgs). Advance augers to 10' BGS and begin split spoons	
5					
10	10-12	21	2	Wet gray sandy clay changing to a wet gray medium sand	
	12-14	43	2	Wet gray and brown fine to medium sand, some small gravel	
	14-16	NM	0	No recovery	
15					
	16-18	102	1.5	Coarse sand and gravel, some gray clayey silt	
	18-20	48	1	Coarse sand and pebble fragments, reddish brown in color, slight moisture	
20	20-22	660	1	Poorly sorted coarse sandy gravel, quartz fragments and small pebble Moist	
	22-24	1485	1.75	Sams as above, changing to a reddish gray medium sand and smaller gravel toward bottom	
	24-26	959	1.5	Same as above, changing to a brownish gray clayey silt	
25					
	26-28	1435	1.75	Reddish brown clayey silt and fine sand, moist to wet	
	28-30	1511	2	Wet brown poorly sorted sandy gravel and silt, black staining present towards bottom of spoon.	
30	30-32	967	1.25	Wet poorly sorted coarse sandy gravel, gray in color.	
	32-34	697	1.25	Coarse sandy gravel, poorly sorted and wet. Gravel is small. Rock fragment in bottom of spoon.	
	34-36	44	2	Wet poorly sorted gravel with fine and medium sand. Some brown silt	
35					
	36-38	87	2	Same as above, changing to a gray and brown moist silt in bottom 3"	

Aquaterra Technologies, Inc.
Subsurface Log: S-80D (Continued)

Depth (ft)					Well Schematic
	38-40	11	1	Fine gray and brown sand, slight moisture	
40	40-42	4.5	1.5	Moist brownish gray silty clay changing to a moist light brown clay	
	42-44	19	2	Wet gray medium sandy gravel - Note: could be cave-in from above	
	44-46	9	2	Wet gray medium sand and silt, slight clay content towards bottom	
45	46-48	5	2	Same as above, changing to a reddish brown silty clay at 47' BGS	
	48-50	NM	0	No recovery	
50	50-52	0	1	Reddish brown clay, moist	
	52-54	0	1.25	Same as above.	
	54-56	0	1.5	Same as above.	
55	56-58	0	1	Same as above.	
	58-60	NM	NS	Set 4" steel casing at 58' BGS. Continue drilling with mud rotary on 3/29/2005	
60	60-62	NM	NS	Advanced Mud rotary to 62' BGS	
	62-64	0	NM	Reddish brown moist clay becoming sandy towards bottom Blow Count: 4-4-4-4	
	64-66	0	NM	Moist reddish brown coarse sand, slight clay content Blow Count: 9-11-10-11	
65	66-68	0	NM	Moist to wet coarse sand reddish brown in color. Some small gravel Blow Count: 10-10-9-10	
	68-70	0	NM	Moist reddish brown coarse sand Blow Count: 11-9-18-18	
70	70-72	0	0.5	Reddish brown coarse sand and some small gravel, wet Blowcount: 17-21-18-19	
75	75-77	0	0.5	Same as above, gravel lense at 76' BGS with very coarse sand. Blowcount: 20-20-16-20	
80	80-82	0	0.5	Brown coarse sand and some small gravel, wet. Blowcount: 38-15-22-16	



Aquaterra Technologies, Inc.
Subsurface Log: S-80D (Continued)

Depth (ft)					Well Schematic
85	85-87	0	2"	Dark greenish gray silt, some pebble. Silt had some dark brown layering Blowcount: 27-25-40-31 Rollerbit starting slight refusal at 87' BGS. Slow advancement	
90	90-92	0	2'	Small gravel (white, tan, red, green and gray) with very coarse sand. Blowcount: 19-17-15-50/4"	
	92-94	0	0.75	Dark greenish gray tight silt, slight clay content, some medium sand Blowcount: 21-30-28-20	
95				Rollerbit started "jumping" at 95' BGS, only advance 1" in 45 minutes End boring	

AOI-2

MONITORING WELL LOG: S-294 D

PROJECT:	**Sunoco-Philadelphia Refinery**	DRILLING CO.:	**ECDI**
SITE LOCATION:	**AOI-2**	DRILLING METHOD:	**Hollow Stem Auger & Mud Rotary**
JOB NO.:		SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Tiffani Doerr/Shaun Sikes**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**6/7/10-6/10/10**	WELLBORE DIAMETER:	**6.25"**
TOTAL DEPTH:	**99'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Cleared to 8' - Fill Material - asphalt over ~2.5' of black gravel and cinders. 2.5-8' dark gray clay with sand and gravel.	Hand cleared to 8'		
-5						
-10	8.3		(BC=5-4-5-7)16" Recovery - Sl moist brn and gray mottled sl plastic SILT.		Grout/bentonite slurry (0'-80')	
	7.9					
	31.4		(BC=6-9-9-12)16" Recovery - same as above in top 3", then sl moist gray fine SAND, with strong petroleum odor.			
	153					
	1.2		(BC=7-9-13-11)10" Recovery - same in top 4" - then pinky-gray fine-coarse SAND w/few fine gravels. Dry-loose, slight odor.			
-15	11.2					
	18.4		(BC=6-9-9-8)10 Recovery - Sl moist gray silty SAND grading to fine gray sand.			
	1.2					

MONITORING WELL LOG: S-294 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.2		(BC=6-6-7-6)Fine SAND grading from gray to orange-brn, sl moist.			
	0.1					
-20	3.4		(BC=5-7-13-13)Gray & orange layered fine-coarse sand then red-brn silty very fine sand.			
	1.2		@ 21' (Trenton) Fine-coarse multicolored SAND w/ fine multicolored GRAVEL. Sub-angular to sub-round.			
	0.0		(BC=11-18-23-28)2" Recovery - lt brn sandstone gravel and fine sand.			
	241		(BC=7-12-13-16)Top 5" gray (stained?) silty clay layer, rest is type Trenton - mostly fine-coarse sand w/fine gravel ~1".			
-25	8.3					
	23.7		(BC=7-12-11-8)Same as above			
	26.2					
	18.7		(BC=12-14-17-17)Same, but less gravel, mostly orange-brn, 3" fine sand layer at 28'.			
	21.6					
-30	255		(BC=12-17-20-16)Same as above, saturated,			
	159					
	355		(BC=12-11-15-14)Coarse SAND with few gravels, loose, oilly.			
	374					
	95.8		(BC=12-15-17-15)Same to 35'. At 35' becomes more dense w/more gravel (up to 1/2"), black-red color.			
-35	206					
	395		(BC=10-4-4-3)10" Recovery - Orange-gray layered very fine sand.			
	21.8		(BC=5-3-2-2)14" Recovery - Same as above with increased clay content near bottom (38').			
	25.9					
-40						

MONITORING WELL LOG: S-294 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	18.6		(BC=3-2-4-6)Top 2" same. Rest is dark gray CLAYEY SILT w/some fine sand, sl micaceous.			
	12.2		(BC=6-3-4-4)No recovery.			
	2.5		(BC=1-2-2-4)Dark gray SILTY CLAY.			
-45	1.7		(BC=1-3-2-2)No recovery.			
	1.8		(BC=2-4-5-6)6" Recovery - same as above			
-50	0.0		(BC=2-3-5-6)Red-brn very fine sand in top 4", grades to red-brn CLAY w/trace organics.			
	0.0					
	0.0		(BC=2-3-4-4)Same as above - Clay with trace organics, sl micaceous			
	0.0					
	0.0		(BC=5-10-12-11)Same grades into sandy clay. At 55.5' transition into med-coarse sand with trace fine gravel, same red-brn color. (red-brn from fines - washed sands are multi-colored).			
-55	0.0					
	0.0		(BC=8-6-5-5)Same as above - red-brn med-coarse SAND w/ few gravels, clayey from 57'-58'.			
	0.0					
	0.0		(BC=6-7-7-12)Same as above with less gravel, clayey sand.			
	0.0					
-60						

MONITORING WELL LOG: S-294 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-65			Cuttings: same as above.			
-70			Cuttings: Med-coarse sand w/ few fine gravels.			
-75			Cuttings: Med-coarse sand w/ few fine gravels.		#1 Sand (82'-99')	
-80			Cuttings: Med-coarse sand with few gravels and some mica flakes.		#00 Sand (80'-82') Screen (84'-99')	

MONITORING WELL LOG: S-294 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-85			Cuttings: Med-coarse sand w/ few fine gravels.			
-90			Cuttings: Greenish gray Clayey Sand.	Mud rotary terminal depth = 105'		
			According to driller, tough drilling gravel layer from 92' to 95'.			
-95			Cuttings: Sand and gravel.			
-100			Cuttings: Med-coarse sand with few gravels and some mica flakes			
			Encountered weathered bedrock.			
105						

MONITORING WELL LOG: S-302 D

PROJECT:	**Sunoco-Philadelphia Refinery**	DRILLING CO.:	**ECDI**
SITE LOCATION:	**AOI-2**	DRILLING METHOD:	**Hollow Stem Auger & Mud Rotary**
JOB NO.:		SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Tiffani Doerr**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**5/6/10-5/7/10**	WELLBORE DIAMETER:	**6.25"**
TOTAL DEPTH:	**92'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Cleared to 8' - fill material: gray clay and gravel, no debris.	Hand cleared to 8'		
-5						
-10	400		(BC=2-3-3-5) Medium brown, moist silty sand grades into sand at bottom. Odors at 10'.		Grout/bentonite slurry (0'-75')	
	0.0					
	-		(BC=5-7-4-4) No recovery			
	-					
	0.0		(BC=12-21-26-26) Trenton gravel, medium, dense, moist.			
-15	0.0		Subangular/subrounded gravels and coase sand, poorly graded		#1 Sand (75'-92')	
	0.0		(BC=7-22-17-19) Same as above, coarser sand. Quartz and quartzite, siltstone gravels,			
	0.0		wet.			
	367		(BC=20-17-19-19) Saturated sand and gravels, strong odor			
	-					
-20	466		(BC=12-17-20-21) Larger gravels up to 2 inch. Medium sand at 22.5'. Black petrol staining		Screen (77'-92')	
	622					

MONITORING WELL LOG: S-302 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	-		(BC=19-15-12-14) No recovery			
	-					
	-		(BC=10-12-21-25) No recovery			
-25						
	0.0		(BC=31-20-19-17) Same gravel and sand. Little clay and silt where very degraded mudstone/siltstone, cobbles.			
	0.0					
	0.0		(BC=12-28-31-30) Silty sand, medium grained with some gravels. Micaceous gray/black fine sands, decomposed schist from 28'-29.5'.			
-30	0.0		(BC=9-8-26-26) Mostly gray-yellow brown, coarse sand with few rounded fine gravel. Sand in bottom 2 inches of spoon.			
	0.0		(BC=10-4-2-5) Gray-orange finely laminated clay, medium stiffness, few areas of fine sand, wet			
	0.0					
	0.0		(BC=4-6-8-5) Dark gray stiff clay, very little organics			
-35	0.0					
	0.0		(BC=2-2-2-3) Same as above			
	0.0					
	0.0		(BC=4-4-4-5) Gray, loose fine sand with little silt			
-40	0.0		(BC=7-7-8-8) Grayish, red-brown silty fine sand, no gravel, with little clay, slightly micaceous.			
	0.0		(BC=5-8-7-7) Same as above			
	0.0		(BC=4-5-7-9) Same as above, grading into fine sandy clay with silt			
-45	0.0					

MONITORING WELL LOG: S-302 D

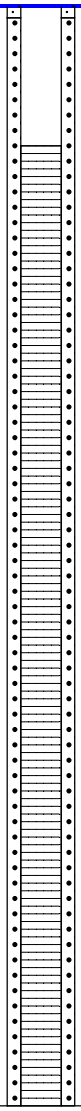
Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-50	0.0		(BC=2-4-6-4) Silty fine sand with little clay			
	0.0					
-55	0.0		(BC=4-5-5-7) Red-brown alternating layers of slightly plastic, very fine sandy silt and very fine sandy clay, slightly micaceous, moist, few thin layers of fine sand			
	0.0					
-60	0.0		(BC=4-5-5-5) Reddish brown clay, slightly micaceous, no sand			
	0.0					
-65	0.0		(BC=10-12-12-9) Medium sand with trace of medium gravel			
	0.0					
-70	0.0		(BC=27-24-16-13) Medium to coarse fine sands with coarse gravel, poorly sorted, large gravels are rounded quartzite			
	0.0					
					#00 Sand (73'-75')	

MONITORING WELL LOG: S-302 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-75	0.0		(BC=21-18-18-20) Broken gravel, Light gray and purple quartzite, white quartz gravel, few red-brown fines.			
	0.0					
-80			(BC=17-21-18-19) Gray, medium coarse sands and fine-medium gravels, few red-brown fines.			
-85			(BC=5-6-6-7) Dark gray silty clay with thin gray fine sand layers approx 2 inches apart.			
-90			(BC=70/6',200/2") Weathered wissahickon schist	Mud rotary terminal depth = 92'		



MONITORING WELL LOG: S-305 D

PROJECT:	**Sunoco-Philadelphia Refinery**	DRILLING CO.:	**ECDI**
SITE LOCATION:	**AOI-2**	DRILLING METHOD:	**Hollow Stem Auger & Mud Rotary**
JOB NO.:		SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Tiffani Doerr**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**5/25/10-6/4/10**	WELLBORE DIAMETER:	**6.25"**
TOTAL DEPTH:	**82'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Cleared to 8' - Fill material: dark gray, silt and sand with gravel and debris.	Hand cleared to 8'		
-5						
-10	3.1		(BC=14-7-7-5) 12" Recovery. Moist, fine SAND (gray then lt brown) with silt. Few sub-angular gravels. Very slight odor.	Full Recovery in spoons unless otherwise noted.	Grout/bentonite slurry (0'-63')	
	2.0					
	0.0		(BC=9-9-10-13) 18" Recovery. Top 3" clayey fine sand w/ few fine gravels. 12'3"-14' moist, lt brown, dense silty CLAY w/few sands and some orange mottling.			
	0.0					
	0.2		(BC=10-12-18-18) Light gray CLAY with little orange mottling.			
-15	0.2					
	0.0		(BC=9-10-17-17) 18" Recovery. Gray & orange mottled CLAY.			

MONITORING WELL LOG: S-305 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0		At 19'2" fine gravels are present (sub-round, multi-colored quartz).			
			(BC=5-8-11-11) 16" Recovery - same as above with more and larger gravel (up to 1/2") and sand. Last 2" medium gray sand.			
-20	30.1		(BC=11-16-16-15) 14" Recovery. Gray SAND & GRAVEL (clay remains in top 4"). Sand is med-coarse w/ fine-med gravels - gray and red-brn, poorly sorted, slight odors.			
	102		(BC=8-7-8-9) 10" Recovery. Reddish-gray reddish gray-brown medium-coarse SAND with few fine gravels. Strong petroleum odor.			
	175		(BC=6-12-15-16) Same as above.			
	221					
-25			(BC=11-24-83-20) 1" Recovery - fragments of larger quartzite gravel in spoon.			
			(BC=10-36-24-17) 2" Recovery - Red-brown sand & lg gravel w/ little clay.			
	157					
-30	5.2		(BC=19-24-26-21) 10" Recovery - top 2" red-brown poorly sorted sand and gravel; rest red-brown fine-med SAND with some fine gravel.			
	4.5		(BC=10-16-17-13) No Recovery - lg quartzite frag in tip of spoon.			
	0.0		(BC=4-6-9-6) Moist, dark gray silty CLAY w/ 2 ~3" layers of light gray very fine sand, trace organics.			
-35	0.0					
	0.0		(BC=1-1-2-2) Dark gray silty CLAY with light gray very fine sand layers <1" thick every few			

MONITORING WELL LOG: S-305 D

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0		inches.			
	0.0		(BC=4-3-3-3) Same with trace fine sands.			
	0.0					
-40	0.0		(BC=3-4-3-3) Same - few laminations of fine light gray sands.			
	0.0					
	0.0		(BC=3-4-3-5) Same as above			
	0.0					
	0.0		(BC=2-3-3-4) Same as above			
-45	0.0					
	0.0		(BC=3-4-4-5) Same as above			
	0.0					
	0.0		(BC=5-5-5-8) Same with more fine sand - sandy clay.			
	0.0					
-50	0.0		(BC=4-3-3-7) Same as above			
	0.0					
	0.0		(BC=6-7-7-9) Transition to dark gray fine SAND w/ few clay lenses.			
	0.0					
			(BC=6-10-14-18) No recovery - quartzite gravel in tip of spoon.			
-55						
	0.0		(BC=35-24-29-34) 6" Recovery. Orange-brn med SAND with gravel in top 2".			

MONITORING WELL LOG: S-305 D

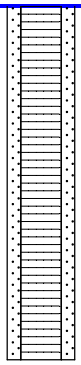
Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0		(BC=31-30-32-29) Orange-brn med-coarse SAND with fine GRAVEL.			
	0.0					
-60			(BC=19-18-20-17) 10" Recovery - same as above.			
	0.0					
					#00 Sand (63'-65')	
-65			Cuttings: coarse SAND and fine GRAVEL (yellow, gray, white qtz sand grains - note that orange-brn color from undisturbed samples is from the clay/silt fines). Gravels: yellow, white, red, black, pink.		#1 Sand (65'-82')	
					Screen (67'-82')	
-70			Same as above			
-75			Same as above			

MONITORING WELL LOG: S-305 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-80			Same as above Bedrock encountered at 83' - spoon attempted, but no recovery, but cuttings returning lg mica flakes and black crystals (tourmaline?)			



AOI-3

S-6

ENSR

Sheet 1 of 3

Project No. 6445-017 Date - Start 2/27/92 Finish 3/2/92 Boring B-10

Project Name Sun Oil Drilling Co. Empire

Location Guard Basin (SWMU-3) Drilling Method Mud Rotary

Total Depth 90.3' Inspector BEM Reviewer Charles E Martin

Remarks

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log Sample	Lithologic Description	Equipment Installed
0						Asphalt Road	
	A		~~1-3~~			Drilled Through fill material (Ash, Silt, Gravel, Sand)	
5	B		~~4-5~~				
					FI	FILL	
10	A	1-8 0-8	10-12	24"	310AA	Silt, Trace Clay, Brown Grey, Soft Oil. odor, wet	Sample chemical
	B	2-8 12-17	12-14	6"	ML	As Above Trace Med Gravel	+ Geotech
15							
20	C	8-9 12-29	20-22	10"	310BA	Gravel, Fine, and Silt and F. Sand Loose, Brown, moist, Poorly Sorted Trace Cobbles	Chemical + Geotech
25	D	12-28 32-38	25-27	0"	GP	Large Gravel, Possibly Cobbles rough Drilling	
30	E	7-4 4-10	30-32	9"	310CA CL	Clay, Soft, med Plastic, Yellow WET. NOT ~~enough for sample size~~	Chemical ~~VOC~~
	—	—	33-35	18"	Tube		Shelby Tube
35	F	5-5 10-20	35-37	8"	310CA CL	As Above. Damp, Thin Colored stratographic layers	Chemical ~~TPHC~~

M890278

BORING LOG (continued)

ENSR Project 6445-017 Boring B-10 Sheet 2 of 3

Depth Feet	Sample Type & No.	Sample Blows per 6 in.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
						B-10 continued	
40	G	18-24 98/6"	41-43	14"	CL	Clay, STIFF, low Plastic, Grey-Brown moist	
45	H	24-27 24/6"	45-47	10"		As Above	
50	I	24-28 27/3"	50-52	10"	CL	Clay, STIFF, mod Plastic, Grey, moist	
55	J	56/6"	55-57	8"	CL	Clay, hard, Trace Coal Fragments, Dark Grey, damp.	
60	K	50/6	60-62	1"	SW	Sand, Fine To Coarse, Some F. Gravel and Clay, loose, wet, Brown	
65	L	50/6"	65-67	6"	310DA	Sand, Fine To Coarse, Some F.-M. Gravel Trace Clay, Dense, Brown To Yellow, wet	Chemical + GeoTech
70	M	50/8"	70-72	6"	SW	As Above	
75	N	50/8"	75/76	5"	SW	As Above	
80	O	50/6"	80-82	1"	GP	Gravel, med To Crse, Some F. Sand Dense, Brown, wet	

M890248

ENSR Project Sun Oil BORING LOG (continued) Boring B-10 Sheet 3 of 3

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
85	P	50/8"	85-87	8"	SW	Sand, Fine, Well Sorted, Brown Loose, WET	
90	Q	50/4"	90-92	4"	90'	Sand, Fine and Rock Fragments Trace Clay, Damp-Dry (Bedrock)	
						BOH = ~~92.0'~~ 90.3'	

MB90248

ENSR

BORING LOG S-B

Sheet 1 of 3

Project No. 6445-017 Date - Start 2/12/92 Finish 2/19/92 Boring B-2

Project Name SUN-OIL

Location Guard Basin - SWMU No. 3 Drilling Co. EMPIRE Co.

Total Depth 91' Inspector C. Martin Drilling Method MUD ROTARY

Reviewer

Remarks S 13:30 cl

Depth Feet	Sample Type & No.	Blows per 6 in.	Depth Range	Rec.	Graphic Log	Lithologic Description	Equipment Installed MWD
	NS		0-2			2" asphalt — FILL —	
	S-1	11-14-9-12	2-4'	12"	FI/SW	Brown F-M SAND, some C Sand and C Gravel (to 1" ø)	
5	S-2	5-10-8-10	4-6'	3"	ML	Gray SILT w/some Clay and C Sand	
	S-3	5-7-4-4	6-8'	0		(No rec.; C Gravel, wash only)	0 in mud tub
	S-4	1-1-1-1	8-10	0		(No rec; mud too thin, will be thickened)	
10	S-5	WOR/1/0	10-12	3"	CL	Gray CLAY, some Silt (very soft)	3
	S-6	WOH/5/6	12-14	8"	13' ML/CL 14'	Gray/brown SILT w/Clay, C gravel, little organics	3
15	S-7	NRec	14-16	10"	SW	Brown F-C SAND w/Gravel (to 1" ø), some Silt (mod. HC. odor)	25
	S-8	14-42-45-42	16-18'	12"	SW	brown F-M SAND w/some Silt and C Gravel (1/2" - 1"), HC odor (Sheen in tub)	18
	S-9	16-26-27-[illegible]	18-20	12"		- same -	4
20	S-10	22-28-[illegible]	20-22	14"		- same -	4.5
	S-11	22-32-42-[illegible]	22-24	2"	SW/SP 29	very M SAND w/some C Sand, little F Sand red/br M-C SAND - same - (dense, tr. clay in spoon tip)	
25	S-12	17-20-32-[illegible]	24-26	12"			
	S-13	17-34-40-[illegible]	26-28'	0		No rec. (only wash gravel)	
	S-14	35-27-21-22	28-30	3"	SW	Red/br F-M SAND, & some C Sand, gravel, silt, tr. Clay	
30	S-15	4-6-9-9	30-32	4"	30 CH	Yellow CLAY, tr. C sand (very plastic)	
	S-16	WOR/WOR/1-[illegible]	32-34	0		No recovery (clay smear in spoon)	
35	S-17	NR	34-36	0'			
	S-18	11/14/15/25	36-38	14"	CH	RED CLAY & Silt, (some yel clay)	
	ST-1	—	38-40			(Shelby tube - no rec)	

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ENSR Project 6445-017 BORING LOG (continued) Boring B-2 Sheet 2 of

Depth Feet	Sample Type & No.	Blows per 6 in.	Depth Range	Rec.	Graphic Log	Lithologic Description	Equipment Installed
40		6					
	ST-2	—	41-43'	~12"		CLAY	
	S-19	WOH-7-7	43-45	4"	CL	RED CLAY (V. Soft)	
45	S-20	20-28-28-34	45-47	16"	CH	brown/gray CLAY (M. Dense)	
	S-21	19-29-30-32	47-49	12"		- same -	
50	S-22	WOR	50-52	10"	CH	dk. Gray CLAY (Soft)	
	S-23	NR	52-54	12"	CH	dk Gray CLAY w/ some Silt, black wood frags (V. dense)	
55	S-24	WOR/50 6"	54-56	12"		- same -	
	S-25	NR	56-58	12"	ML 57	yel/light gray SILT w/ CLAY	
	S-26	50/6"	58-60	6"	GP	br Med SAND C GRAVEL w/ M-C Sand	
60	S-27	50/6"	60-62	2"		(Qtz cobble only)	
	S-28	50/6"	62-64	6"	GP	C GRAVEL (to 1.5" ø), some M-C Sand (Qtz)	Ge B-2 62-6
65	S-29	35/50/6"	64-66'	8"		M-C SAND w/ C Gravel (Qtz)	
	S-30	50/6"	66-68	6"	SP	C SAND w/ C Gravel	
	S-31	50/6"	68-70	6"		brown M-C SAND w/ some C Gravel	
70	S-32	50/6"	70-72	6"	GP	C GRAVEL (Qtz to 1.5" ø) (to 1" ø)	
	S-33	50/6"	72-74	6"		C GRAVEL (weath?)	
75	S-34	50/6"	74-76	6"	GP	C GRAVEL w/ C SAND	
	S-35	50/6"	76-78	2"		- same - (cobble in spoon)	
	S-36	35/50/6"	78-80	8"	SW	brown C SAND, some f-M Sand, tr Gravel, Silt	3020
80	S-37	18-35-50/2"	80-82	8"		lt br/tan M-SAND, some F/C Sand, tr C Gravel, some Silt	D
	S-38	50/6"	82-84	6"	SW	- same -	
85	S-39	—	84-86	2"		Gravel only (poor rec.)	
	S-40	50/6"	86-88	3"	SW	lt br M-C SAND w/ C Gravel, tr Silt	
	S-41	50/6"	88-90	2"	88 CL/BR	tan CLAY w/ Silt and some C Sand, micaceous (possibly wthrd rock)	

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ENSR Project 6445-007 Boring B-2 Sheet 3 of

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
	S-42	—	90-91	12"	BR	Wthrd mica schist (?)	
						Bottom of Boring @ 91'	
95							

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Sheet 1 of 2

Project No. 6445-017 Date - Start 2-25-92 Finish 2/26/92 Boring 3-9

Project Name Sun Oil - Philadelphia Drilling Co. Empire

Location Grand Basin (SWMU-3) Drilling Method Mud rotary

Total Depth 85.5' Inspector G. Anderson/Enviro Tech Reviewer Charles E. Martin

Remarks Water encountered at ~ 4 feet. Samples B & C were composited for laboratory analysis as single sample

Mud rotary, drilled on cased hole to feet

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
	A 2" SS	4 5 9 11	0-2	18"		Crushed stone to 1 foot Silty clay fill to 2 feet	
	B 2" SS	6 8 14 11	2-4	12"		Brown med-coarse sand to 4 feet, loose	Chemical Analyses (3 of AA)
5	C 2" SS	4 6 7 5	4-6	12"	FI	Cinder FILL; well graded sand with silt & gravel, saturated; medium dense	
		? ?					
10	D 2" SS	weight of rods	10-12	10"	ML	SILT with fine sand; trace clay; grey; saturated; loose (Driller notes rough drilling (cobbly).	Geotechnical
15	E 2" SS	50 50/5"	15-16'	6"	SW	Silty SAND with gravel; cobbly; extremely dense; saturated.	Geotechnical
20	F 2" SS	23 27 50/5"	20-21½	0"		no recovery; (Driller notes easier drilling from 23'-27', possible sand seam)	
25	G 2" SS	3 14 20 50	25-27	5"	SP	Poorly graded med-coarse SAND with gravel, light brown, saturated, very dense Rough drilling to 30 feet	
30	H 2" SS	10, 11 22 27	30-32	0"		no recovery Rods dropped to 25 feet so there is ~5 feet of slough at bottom of hole before drilling to 35 feet	
35	I 2" SS	14 30 28 30	35-37	8"	SP	Poorly graded med-coarse Sand and med Gravel (sand lo may be slough; hard to distinguish)	

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BORING LOG (continued) 5-13

Project 5525-017 Boring E-9 Sheet 2 of 2

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
						Driller noted seam of sand and gravel due to grout flow to bottom of hole (lost circulation)	
40	J 2" SS	9 11 18 18	40-42	0"	SW/SP	NO RECOVERY Cuttings coming up with mud is sand & gravel; no clay cuttings. Driller said cobbly zones seem to be interbedded with more sandy zones.	
45	K 2" SS	14 20 22 20	45-47	0"		no recovery	
						Driller indicates clay at 48-49 feet. Drilling mud is turning a reddish color	
50	L 3" SS	15 24 40 50/6"	50-52	0"	CL	CLAY no recovery - spoon was filled with stones that had accumulated on bottom of hole because they weren't being carried up by mud.	
55	M 2" SS	12 22 39 55	55-57	6"	CL Sample 3098A	Clay, V. STIFF, med Plastic. Grey moist, Trace M. Gravel	chemical ~~VOA~~ All
60	—	—	60-62	20"	CH	Clay, hard, Damp, Yellow.	Shelby Spoon
	N	50/8"	62-64	8"		Sand, Well Sorted. Fine Grain, moist Yellow. Dense	Geotechnical
65							
70	O	50/8"	70-72	8"	SW	Sand and Gravel, Fine to med. Some Clay, Yellow/Brown, Dense, WET	
75	P	50/8"	75-77	8"	SW	As Above. NO clay	
						Clay	
80	Q	50/6"	80-82	6"	CH	Clay. hard, Brown. Yellow, Damp	
85	R	50/1"		1"			

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Sheet 1 of 2

Project No. 6445-017 Date - Start 3-4-92 Finish 3-9-92 Boring B-11

Project Name SUN OIL Drilling Co. EMPIRE

Location GUARD BASIN (SUMU-3) Drilling Method Mud Rotary

Total Depth 881 Inspector BEM Reviewer Charles E. Hunter

Remarks

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
0					FI	Drilling Through Fill Material	
5	1	2-3 6-7	5-7	20"	—	SILT, SOFT, Brown, moist Petro. Odor	
10	2	25-18 18-23	10-12	15"	311AA SW	Sand, Fine, well sorted, Brown Loose, moist, Petro Odor	Chemical
15	3	21-27 31-38	15-17	9"	GP	Gravel, med. To Crse. Some Sand F. Dense, Brown, moist	
					SW	Sand As Above, odor; Natural?	
20	4	8-19 19-20	20-22	10"	Geo.	Sand, As Above, Odor med. Dense	Geotech.
25	5	24-34 31-18	25-27	12"	311BA	Sand. Fine. Well sorted, Loose. Grey, WET. No odor	Chemical
30	6	19-42 50/3"	30-32	0"	—	NO Recovery Cobble in Tip	
35	7	34 24 80-26	35-37	10"	SP	Sand. Fine To Med. Loose. White/Grey Trace F. Gravel. WET	
40							

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ENSR Project 6445-017 Boring B-11 Sheet 2 of 2

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
	8	50-30 40	40-42	10"	—	Sand, Fine, Loose, White/Grey Well Sorted, wet	
					SP		
45	9	41-24 27-39	45-47	12"	—	Sand, med To Crse, Loose Grey, well Sorted wet, Petro. Odor,	
50	10	19-30 31/5"	50-52	1"	CL	Clay, V. STIFF, Yellow To Red, mottled med-Plastic, moist,	
55						Drilled Through To 56.0'	55.0' Bottom of Casing
					CL		
	—	—	57-59	18"	Shelby Tube	Clay, Hard, Red+White, med-Plastic Damp-DRY at TIP	Shelby Tube
60	11	50-50/4"	60-62	20"	311CA	Clay, V. Hard, Red+White mottled Brittle, Dry.	Chemical MS+MSD
					CL		
65	12	50 50/2"	65-67	4"	—	Sand, V. Fine to Powder, White Dense, Damp,	
					SP	very hard	
70	13	50/4"	70-72	4"	—	Sand, Fine, meddense, moist. brown layers. weathered rock?	
75	14	50/8"	75-77	6"	311DA	Sand, med-corse, meddense, wet Brown, PeTro. odor	Chemical VOC's
					SP		
80	15	50/8"	80-82	8"	311DA	Sand, Med-Corse, Clay Binder hard, White, damp, Mica+Quartz	Chemical SVOC's
85	16	50/6"	85-82	6"	—	Sand, Med Corse, Trace Clay Red, hard, wet, slight odor	
						B.O.H. (Stopped - Very hard drilling)	

Project No: _____ Client: _____ Site: _____ Well No: MW-11

Well Location: Gaurd Basin Date Installed: 3/9/92

Contractor: _____ Method: _____ Inspector: BEM

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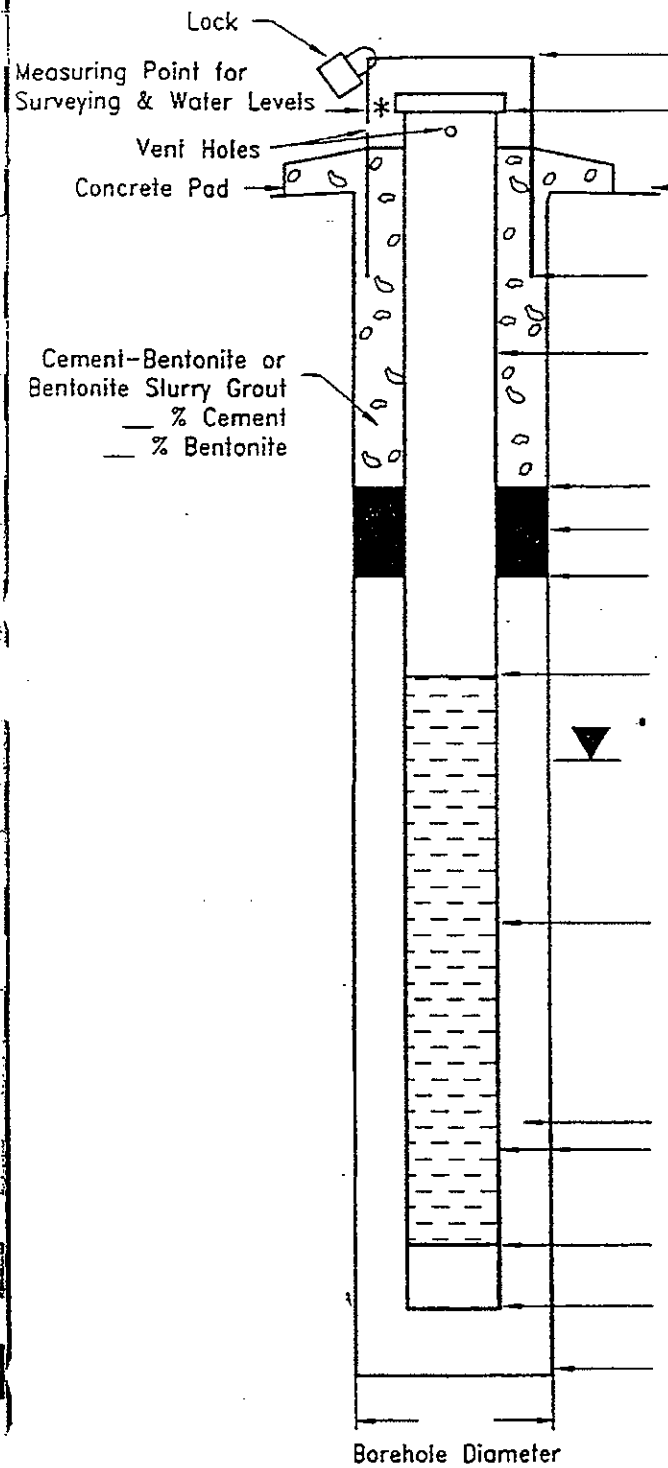
MONITORING WELL CONSTRUCTION DETAIL



		Depth from G.S. (feet)	Elevation (NGVD)
Top of Steel Guard Pipe		1.55	
Top of Riser Pipe	JH 5/27/93	1.35	
Ground Surface (G.S.)		0.00	
Bottom of Steel Guard Pipe			
Riser Pipe:			
Length	7.2'		
Inside Diameter (ID)	2"		
Type of Material	PVC		
Top of Bentonite Seal		59.0'	
Bentonite Seal Thickness	5'		
Top of Sand		64.0'	
Top of Screen		70.0	
Stabilized Water Level		[illegible]	
Screen:			
Length	10.0'		
Inside Diameter (ID)	2"		
Slot Size	.020		
Type of Material	PVC		
Type/Size of Sand	#0 Monie		
Sand Pack Thickness	3"		
Bottom of Screen		80.0	
Bottom of Tail Pipe:		80.0	
Length	.5'		
Bottom of Borehole	JH 5/27/93	98.5'	

Approved:

* Describe Measuring Point: _____

_____ Signature _____ Date

ENSR

MONITORING WELL LOG: S-280 D

PROJECT:	**Sunoco-Philadelphia Refinery**	DRILLING CO.:	**ECDI**
SITE LOCATION:	**AOI-3**	DRILLING METHOD:	**Hollow Stem Auger & Mud Rotary**
JOB NO.:		SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Tiffani Doerr/Shaun Sikes**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**5/11/10-5/14/10**	WELLBORE DIAMETER:	**6.25"**
TOTAL DEPTH:	**61'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Fill Material Surface to 1' - black/brown sandy gravel. Brick layer from 1.5' to 2.5'.	Hand cleared to 10'		
-5				PID malfunction, limited field sceening data		
			Rest of fill to 10' is large gravel w/ sandy and clay, brown, no odors.			
-10			(BC=6-8-9-6) Orange-brown and gray brown very fine sandy SILT, trace round gravels		Grout/bentonite slurry (0'-49')	
			(BC=8-10-12-15) Same as above, all orange-brown color from 12'-13', all gray-brown color 13'-14'.			
-15			(BC=8-12-12-15) Same as above, Orange brown SAND and GRAVEL, angular to subround, few fines.			
			(BC=8-12-16-15) Tight sand and gravel, overall orange brown color, gravels multicolored up to 0.5 inch.			

MONITORING WELL LOG: S-280 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
			(BC=10-13-10-14) Same as above			
-20			(BC=11-12-15-13) Same as above, less gravel and more sand, brown in color, moist			
			(BC=6-8-6-7) Orange brown fine SAND.			
			Light gray-brown, very fine sandy CLAY, wet.			
			(BC=6-9-15-15) Red-brown SAND and GRAVEL with fine to coarse sand and gravel up to 1 inch, some clays			
-25			(BC=7-10-12-13) Same as above			
			(BC=6-8-5-5) Light brown to orange-brown slightly plastic, fine SAND.			
-30	0.2		(BC=12-10-11-13) Medium brown, medium SAND and GRAVEL, slight odor (chemical). Gray fine CLAY lenses.			
	0.6					
	0.5		(BC=24-23-31-40) Same as above, same gray fine silt/clay lense holding odor. All else, red brown, medium-coarse sand with some gravel			
	0.5					
	0.2		(BC=24-23-31-40) Same as above, grades to brown-orange fine SAND, plastic silty fine sand			
-35	0.1					
	0.1		(BC=16-27-11-12) Orange-gray CLAY with some fine sand			
	0.3		(BC=5-4-4-6) Same as above			
			(BC=2-2-3-5) Dark gray clay with trace fine sand, trace organics			
-40						

MONITORING WELL LOG: S-280 D

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.1		(BC=3-2-3-4) Same as above, dark gray clay			
	0.3		Few fine sandy layers and trace organics, organic odor			
			(BC=2-2-1-4) Gray fine sandy clay, some silt, trace organics, grading into gray fine sand, some clay with trace silt			
-45			(BC=1-2-5-7) Gray fine sandy clay, some silt grading into light-dark brown fine sand with trace fine subrounded gravel			
			(BC=4-4-3-3) Gray fine clayey SAND, some silt with fine coarse subrounded gravel, trace amounts of course brown sand			
			(BC=2-3-2-3) Orange-gray alternating fine sands, slightly plastic, trace subrounded gravels			
-50			(BC=1-1-1-1) Gray, loose fine sand more plastic clays than above, no gravel		#00 Sand (47'-49')	
			(BC=7-7-12-12) Same as above, more clay content		#1 Sand (49'-61')	
			(BC=7-9-12-12) Dark gray loose sand with mica flakes throughout, trace clay and fine subrounded, subangular gravel, degrading into dark gray fine silty sand with trace clay, moist			
-55			(BC=7-12-21-30) Dark gray-brown fine SAND and GRAVEL, trace silt, moist to wet			
			(BC=25-23-18-25) Red-brown medium dense sand, some fine to coarse subrounded gravel, mica flakes throughout, trace rounded quartzite, wet	Rods broke during rheeming - lost roller bit and >20' rods down hole.	Screen (51'-61')	
-60			(BC=12-30-41-16) Red-brown medium dense fine to coarse sand, some fine to coarse subangular gravel	Grout hole up to 61' and install well.		
			Very stiff CLAY			

MONITORING WELL LOG: S-280 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-65			(BC=25-17-21-17) Reddish-brown to yellowish-brown medium dense fine to coarse SAND, some fine to coarse subrounded GRAVEL, wet			
-70			(BC=27-28-43-51) Same as above, roller bit past tough gravel layer, large quartzite in spoon.			
-75			(BC=5-15-14-10) Light brown-gray coarse sand with fine gravel, no odor			
-80			(BC=60-58-59-50/1) Green-gray large quartzite grading into coase sand with gravel, green and red silty fine sand lense, decomposed rock			

MONITORING WELL LOG: S-280 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-85			(BC=46-120/5) Large, pink-gray-yellow quartzite, coarse sand layer, overall gray appearance			
-90			(BC=58-66) @ 92' White clay and muscovite with white quartz fragments, top of weathered bedrock, wissahickon schist.	Mud rotary terminal depth = 93'		

MONITORING WELL LOG: S-284 D

PROJECT:	Sunoco-Philadelphia Refinery	DRILLING CO.:	ECDI
SITE LOCATION:	AOI-3	DRILLING METHOD:	Hollow Stem Auger & Mud Rotary
JOB NO.:		SAMPLING METHOD:	Split Spoon
LOGGED BY:	Tiffani Doerr/Shaun Sikes	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	5/17/10-5/24/10	WELLBORE DIAMETER:	6.25"
TOTAL DEPTH:	78'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Fill Material to 10' - Light brown sandy clay and gravel, some brick and larger concrete block fill.	Hand cleared to 8'		
-5						
-10			(BC=10-12-13-8) 6" Recovery - Loose, saturated, olive-brn, coarse SAND w/ GRAVEL up to 1/2". Various color and composition, sub-round, strong odor.		Grout/bentonite slurry (0'-59')	
	147		(BC=6-8-9-8) No Recovery - lg green qtzite gravel in tip of spoon.			
-15	33.7		(BC=4-5-7-9) 6" Recovery - same as above w/clay lense, slight odor.			
			(BC=7-7-8-9) No Recovery - loose sands and gravel?			

MONITORING WELL LOG: S-284 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.6		(BC=10-12-10-16) 12" Recovery - same in top 6". Bottom 6" yellow-brn med sand getting coarser w/few small gravles at bottom.			
	0.4					
-20	0.0		(BC=5-3-3-4) Top 2" orange very fine sandy CLAY, bottom 20" medium gray clay w/thin very fine lt gray sand layers.			
	0.1					
	0.0		(BC=4-3-6-6) Gray CLAY, some organics.			
	0.0					
	0.0		(BC=4-7-7-5) Same as above, slightly brown hue to CLAY, more organics.			
-25	0.0					
	7.1		(BC=5-7-12-10) 8" Recovery - top 1" gray sand w/few fine gravels, rest is orange medium SAND.			
	4.7		(BC=9-11-21-13) Same as above, but coarser SAND, dense, dark orange to red-brn w/ trace fine Gravels.			
	0.3					
-30	0.0		(BC=6-24-28-16) 3" Recovery - orange med-coarse SAND, one 2"+ gravel in tip of spoon.			
	0.0		(BC=4-5-8-12) Dark gray soft CLAY, trace red-brn fine sand, trace organics, moist.			
	0.0					
	0.0		(BC=10-12-12-12) 16" Recovery - reddish brn to orange medium dense fine-coarse SAND, trace sub-rounded qtz gravels, wet.			
-35	0.0					
	0.0		(BC=46-24-7-7) 4" Recovery - dark gray-brn, coarse subangular to subrounded			

MONITORING WELL LOG: S-284 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0		GRAVEL (possible fall-in).			
	0.0		(BC=6-16-21-19) 6" Recovery - same as above.			
	0.0					
-40	146		(BC=19-11-10-10) 12" Recovery - black stained fine-coarse SAND w/ trace sub-round gravel, petroleum odor. Lower half same composition, but orange, no staining or odors.			
	0.0					
	0.6		(BC=17-28-14-10) Same as above - fine-med sand, orange-lt brn.			
	1.4					
-45	60.5		(BC=19-16-14-13) 9" Recovery - Lt brn med-coarse SAND w/trace fine sub-round gravels, chemical odor.			
	2.2		(BC=12-13-13-14) 6" Recovery - Lg qtzite gravel in tip of spoon. Finer lt brn sand grading into coarse sand w/ some fine gravels.			
	9.0		(BC=12-15-15-17) 12" Recovery - Med-coarse SAND w/trace fine gravels, lt brn at top, orange at bottom - petroleum odors in top 6".			
	1.6					
-50	0.3		(BC=4-17-46-15) 8" Recovery - No odor, orange-brn med-coarse SAND and GRAVEL (up to 1/2"). Few red-brn clayey fine sand lenses.			
	0.5		(BC=14-29-34-39) 12" Recovery - coarse SAND and some GRAVEL (fine to 1"), very dense, orange. Fine red-brn clayey sand nodule - completely degraded gravel.			
	0.4					
-55	1.4		(BC=29-55-50-27) 6" Recovery - same as above, slight petroleum odor.			
	0.0		(BC=15-17-29-21) 6" Recvoery - same as above, no odor.			

MONITORING WELL LOG: S-284 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
			(BC=5-12-39-31) 6" Recovery - same as above, less gravel (trace round, <1/2"), more fines (silt & clay in sand matrix).			
	0.0				#00 Sand (59'-61')	
-60						
					#1 Sand (61'-78')	
			Drill to 65' - driller noted 2 tough drilling layers through gravels.			
					Screen (63'-78')	
-65	0.0		(BC=56-102-17-24) 10" Recovery - Fine orange-brn SAND, some gravel in top 3".			
	0.0					
-70			(BC=9-52-46-43) 4" Recovery - orange-brn SAND and GRAVEL (50/50), no odor.			
	0.1					
-75			Cuttings: orange sand and gravel (up to 1/2") quartz.			

MONITORING WELL LOG: S-284 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-80			Same as above. Top of weathered schist at 81.5' - collected spoon - 2" recovery - white clay and qtz grains with mica flakes (up to 1/4").	Mud Rotary terminal depth = 82'		

AOI-4

Aquaterra Technologies, Inc.
Subsurface Log: S-59D

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

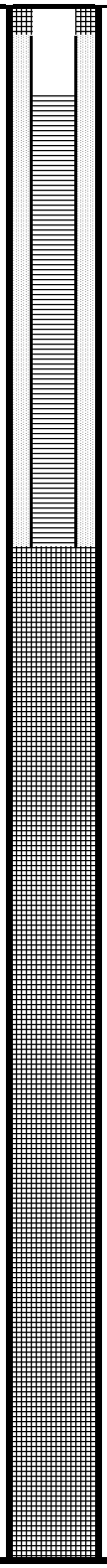
Boring Number: S-59D **Log By:** M.B. Spancake **Date:** 3/24 & 4/12 & 13/05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 2" **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 42'
Casing Diameter: 2" **Length:** 41' **Type:** PVC
Drilling Method: Hollow Stem Auger/ Mud Rotary **Sample Method:** Split Spoon **Rig Type:** HSA/Mud rotary

Construction Details

Total Well Depth: 56' BGS **Bentonite Interval:** 0'-39'
Screen Interval: 41'-56" **Cement/Grout Interval:**
Sand Pack Interval: 39'-56' **Sand Pack Type:** # 2
Completion Details: Completed with 2' Steel stick-up

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Recovery (ft) / Blowcount	Lithology	Well Schematic
0				Vacuum Utility Clearance to 9' below ground surface (bgs). Advance augers to 10' BGS and beging continuous split spoons.	
5					
10	10-12	0	1.75 4-5-5-7	Brown stiff clay becoming slightly sandy towards the bottom	
	12-14	0	2 7-7-9-12	Brown sandy clay, sand is coarse grained. Moist.	
	14-16	80	0.5 32-32-50 / 0.4	Wet brown sandy gravel.	
15					
	16-18		0 50 / 0.1	No recovery	
	18-20	100	1.25 7-9-18-8	Reddish gray coarse sandy gravel, wet.	
20	20-22	186	0.75 8-14-14-15	Same as above	
	22-24	92	1.5 48-24-20-20	Same as above. Rock fragment in shoe of spoon. Less moisture content towards bottom.	
	24-26	17	0.75 10-16-30-40	Wet fine sand and large rock fragments. Most of recovery is large rock fragments	
25					
	26-28	NA	2 23-27-28-31	Wet gray coarse sandy gravel. Bottom 3" changing to a gray clayey silt and fine sand.	
	28-30	214	2 4-5-5-6	Wet medium gray sand and small gravel	
30	30-32	0	2 3-3-4-5	Moist dark gray clayey silt and fine sand	
	32-34	44	2 5-7-8-13	Moist gray fine sandy clay, changing in color to a brownish gray in the bottom 2"	
	34-36	0	1 1-2-1-2	Grayish tan clayey silt, slightly moist	
35					
	36-38	0	1.25 3-4-4-5	Greenish gray stiff clayey silt with fine sand. Slightly moist.	

Depth (ft)					Well Schematic
	38-40	0	1 5-7-7-9	Same as above. Set 4" steel casing at 38' BGS on 3/24/05 and grouted in place. Continue with mud rotary on 4/12/05	
40	40-42	0	1 12-12-12-15	Brown fine sand, slightly moist to becoming wet at bottom.	
	42-44	0	1.5 14-12-12-16	Wet brown and gray fine sand Advance to 50' BGS and collect spoons every 5'.	
45					
50	50-52	NA	0 50/ 0.0	No recovery. Advance to 55' BGS.	
55	55-57	0	1.75 30-25-22-14	Coarse brown sand, large gravel and pebble present, wet.	
60	60-62			Borehole not staying open at this interval. Advance to 65' BGS.	
65	65-67	0	1 17-13-10-10	Gray and tan coarse sand and small poorly sorted gravel. Some large pebble fragments and a thin lense of reddish brown sandy silt at 61.5'	
70	70-72	0	1.25 11-11-12-15	Same as above.	
75	75-77	0	1 10-12-11-13	Coarse well sorted gravel, wet.	
80	80-82	0	1.5 22-14-24-21	Moist white saprolitic mica schist, dense and compact.	
85	85-87	0	1.25 17-19-14-15	Black and white saprolitic mica schist, dense and compact.	
90	90-92	0	1 21-16-17-19	Same as above. End boring and set well at 56' BGS. Backfilled anular space with bentonite chips.	

Aquaterra Technologies, Inc.
Subsurface Log: S-119D

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

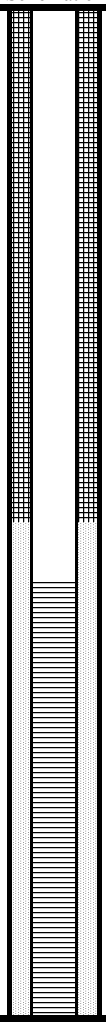
Boring Number: S-119D **Log By:** M.B. Spancake **Date:** 3/22/05 & 4/7/05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 2" **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 57
Casing Diameter: 2" **Length:** 57' **Type:** PVC
Drilling Method: Hollow Stem Auger/ Mud Rotary **Sample Method:** Split Spoon **Rig Type:** HSA Rig/Mud Rotary

Construction Details

Total Well Depth: 72' BGS **Bentonite Interval:** 0-55'
Screen Interval: 57'-72' **Cement/Grout Interval:**
Sand Pack Interval: 55'-72' **Sand Pack Type:** 62'-79'
Completion Details: Completed with 2' Steel stick-up

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Recovery (ft)/ Blow Count	Lithology	Well Schematic
0	**1'-1.5'**			Vacuum Utility Clearance to 9' below ground surface (bgs). Hand auger to 1.5' BGS to collect soil sample on 4/1/05. Advance augers to 10' BGS and begin split spoons	
5					
10	10-12	0	2 5-7-7-12	Moist gray silt, slight clay content with some brown silt banding	
	12-14	0	2 12-17-15-21	Same as above	
	14-16	0	1.25 4-4-8-10	Same as above in top 6", changing to a brown sandy silt for 4" Changing to a gray & brown medium to fine sandy silt.	
15	16-18	0	1.25 26-16-23-30	Brown medium sand and gravel, pebble fragments. Dry	
	18-20	0	1.5 3-8-12-12	Moist gray silty clay in top 0.75' changing to a brownish orange fine to medium sand with some gravel.	
20	20-22	0	1.25 9-11-13-18	Brown fine sand and poorly sorted gravel with layers of coarse tan and gray sand, rock fragment in bottom of spoon	
	22-24	0	1 9-15-23-27	Same as above, more gravel and rock fragments present.	
	24-26	0	1.75 5-6-4-6	Brownish gray medium sand, wet. Some gravel in top 4"	
25	26-28	0	1.5 3-9-16-23	Wet brown fine sand and brown silt	
	28-30	0	1.25 10-22-32-26	Same as above, gravel and pebble fragments present	
30	30-32	0	1.25 20-23-25-31	Same as above. Weathered green serpentine rock fragments towards bottom of spoon	
	32-34	0	1.5 24-26-31-30	Wet brown fine sand with some gravel and pebble fragments	
	34-36	0	1.75 4-19-26-28	Moist to dry dark gray clayey silt. Wet gray medium sand in bottom of spoon.	
35	36-38	0	1.5 8-8-16-27	Wet gray medium sand	

Depth (ft)					Well Schematic
	38-40	0	2 1-1-2-2	Brown coarse sand in top 6" changing to a brownish gray moist to wet clay	
40	40-42	0	1 1-1-2-2	Same as above changing to a dark gray clayey silt, slightly moist.	
	42-44	0	0.75 2-2-2-2	Dark brown clayey silt, slightly moist.	
	44-46	0	1.5 4-6-7-7	Same as above	
45	46-48	0	1 4-4-5-5	Same as above	
	48-50	0	1.75 4-5-6-5	Same as above. Set 4" steel casing to 48' BGS. Grouted in place. Drilling continued on 4/7/05 Advance Mud rotary to 50' BGS and continue split spoons.	
50	50-52	0	2 6-7-9-12	Dark grayish brown clayey silt, slightly moist.	
	52-54	0	2 13-17-18-28	Same as above	
	54-56	0	2 5-7-10-13	Dark grayish brown silt changing to a dark grayish brown silt and fine sand in bottom 6" of spoon. Slightly moist	
55	56-58	0	1.5 13-19-24-18	Moist brown silty fine sand in top 4" of spoon changing to a wet gray and tan coarse sand with some small gravel.	
	58-60	0		Advance mud rotary to 65' BGS and collect spoon	
60	60-62				
65	65-67	0	2 24-10-10-15	Greenish gray silt and fine sand, slight moisture. 1" lense of light gray medium sand at 66' BGS. Advance to 70' BGS	
70	70-72	0	6" 52-50 / 0.2	White/light gray fine sand, wet and compact. End boring, set well at 72' BGS	

Note: Highlighted cell indicates soil sample submitted for laboratory analysis.

AOI-5

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A13D

Project No. 113-950-032

Date M.W. completed 11/13/86

Supervising D & M Geologist David Wagner

Location -	Chevron Refinery
Driller -	Lambert, Inc.
Drilling Completed -	11/13/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

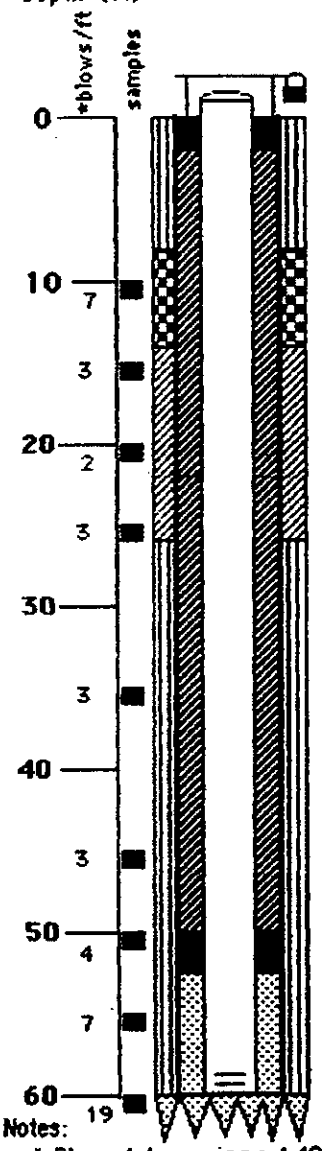
Borehole Diam. -	10"
Borehole Depth -	70'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	69'
Screen Setting -	59' - 69'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Bentonite

MEASUREMENTS(NGVD)

Top of Casing Elevation -	7.99'
Static Water Level Elevation -	-1.95'
Date Measured -	12/22/86
Surface Elevation -	8.10'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	--
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	



	Description
ML	Silt with some fine to coarse sand, trace fine gravel, black, saturated; petroleum odor; petroleum residues present
GW	Fine gravel with some silt, little fine to coarse sand, black, loose, saturated; strong petroleum odor
CL	Clay with little to some silt, dark gray, very soft, saturated; trace organics
	Grading to dark brown
ML	Increasing silt; silt with some clay
	Grading to medium brown
	Grading to brownish-gray
	Trace mica
	Silt with little to some clay, trace fine to medium sand, gray, medium stiff, saturated; trace organics; very micaceous

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE GROUT
- CAVE IN MATERIAL
- CONCRETE

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A13D (Cont.)

Project No. 113-950-032

Date M.W. completed 11/13/86

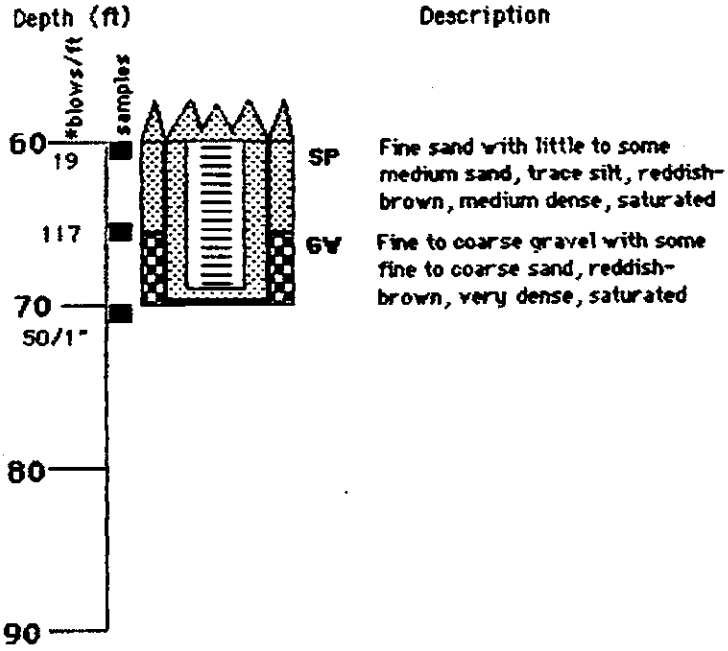
Supervising D & M Geologist David Wagner

Location - Chevron Refinery

Driller - Lambert, Inc.

Drilling Completed - 11/13/86

Type of Rig - Hollow Stem Auger



WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE GROUT
- CAVE IN MATERIAL
- CONCRETE

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A19D

Project No. 113-950-032

Date M.W. completed 10/30/86

Supervising D & M Geologist David Wagner

Location -	Chevron Refinery
Driller -	Lambert, Inc.
Drilling Completed -	10/30/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

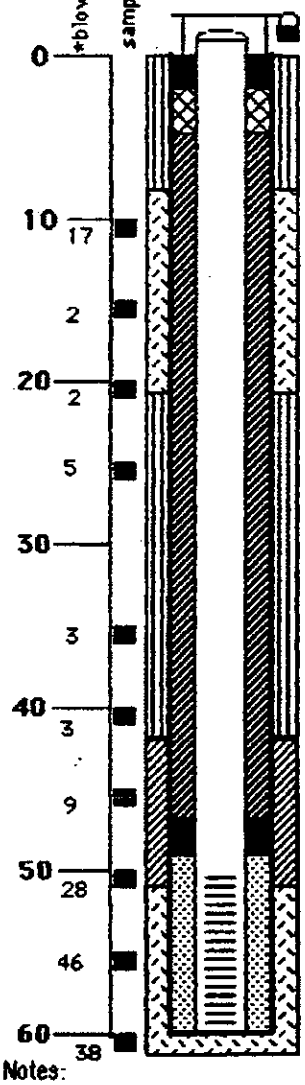
Borehole Diam. -	10"
Borehole Depth -	60'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	60'
Screen Setting -	50' - 60'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Bentonite

MEASUREMENTS(NGVD)

Top of Casing Elevation -	11.69'
Static Water Level Elevation -	-1.71'
Date Measured -	12/22/86
Surface Elevation -	8.69'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	



	Description
ML	Silt with some fine to coarse sand, trace clay, brown, soft, moist; petroleum odor
	Grading to very dark gray, saturated
SW	Fine to coarse sand with some fine gravel, little silt, blackish-gray, medium dense, saturated; resistance encountered - wood
ML	Silt with some clay, dark gray, soft, moist; organics; micaceous; weak petroleum odor
	SHELBY TUBE taken from 30' to 31.5'
	Increasing clay; silt and clay
CL	Clay with some silt and little fine sand, reddish-brown, soft, saturated, micaceous
SW	Fine to coarse sand with some fine gravel, reddish-brown, medium dense, saturated
	Grading to brownish-gray
	Increasing density : dense
	Increasing gravel: fine gravel and sand

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE GROUT
- CAVE IN MATERIAL
- CONCRETE

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A21D

Project No. 113-950-032

Date M.W. completed 10/28/86

Supervising D & M Geologist David Wagner

Location -	Chevron Refinery
Driller -	Lambert, Inc.
Drilling Completed -	10/28/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

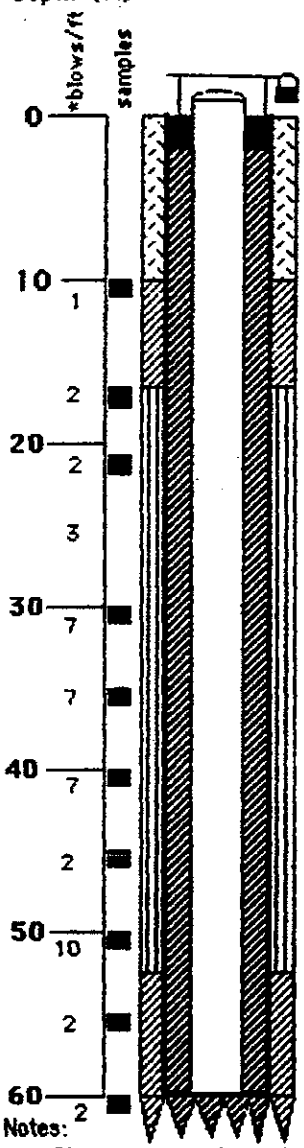
Borehole Diam. -	10"
Borehole Depth -	85'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	85'
Screen Setting -	75' - 85'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

MEASUREMENTS(NGVD)

Top of Casing Elevation -	12.18'
Static Water Level Elevation -	-4.13'
Date Measured -	12/22/86
Surface Elevation -	8.48'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	



	Description
SW	Fine to coarse sand with some silt, little fine gravel, very dark brown, soft, very moist; wood debris, brick, wire, etc.; petroleum odor; oily
CL	Clay with little silt, trace fine sand, very dark brown, soft, saturated; very strong petroleum odor; oily
ML	Silt with some clay, trace fine sand, medium gray, soft, saturated; trace mica; trace organics; petroleum odor
	Decreasing clay; little clay, weak petroleum odor
	SHELBY TUBE taken from 19' to 21'
	Decreasing clay and increasing fine sand; trace to little clay, little fine sand
	2" sand lense at 36'; fine to medium sand with little clay, medium gray, trace mica
	Silt with little to some clay, little fine sand, dark gray, soft, saturated; wood debris
	Increasing clay and decreasing fine sand; some clay, trace fine sand
	Decreasing clay: little clay
CL	No petroleum odor
	Clay with little silt, dark gray, soft, saturated; trace mica

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE/CEMENT
- CAVE IN MATERIAL
- CONCRETE

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A21D (Cont.)

Project No. 113-950-032

Date M.W. completed 10/28/86

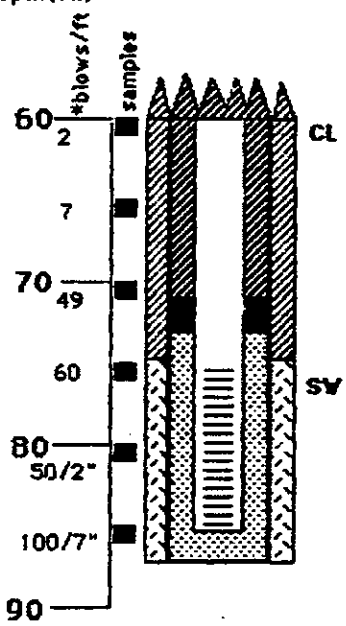
Supervising D & M Geologist David Wagner

Location - Chevron Refinery

Driller - Lambert, Inc.

Drilling Completed - 10/28/86

Type of Rig - Hollow Stem Auger



Description

Increasing silt : some silt

6" lense of fine to medium sand with little coarse sand at 66', grayish-brown, saturated

Clay with some silt, trace to little fine sand, dark-gray, soft, saturated

Little to some fine gravel and little fine to coarse sand

Fine to coarse sand with some fine gravel, brownish-gray, very dense, saturated

Fine to coarse sand with some fine gravel, trace clay(white), very light gray, very dense, saturated

Weathered bedrock : Wissahickon Schist

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE/CEMENT
- CAVE IN MATERIAL
- CONCRETE

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

AOI-6

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - B48D

Project No. 113-950-032

Date M.W. completed 11/6/86

Supervising D & M Geologist David Wagner

Location -	Chevron Refinery
Driller -	Lambert, Inc.
Drilling Completed -	11/6/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

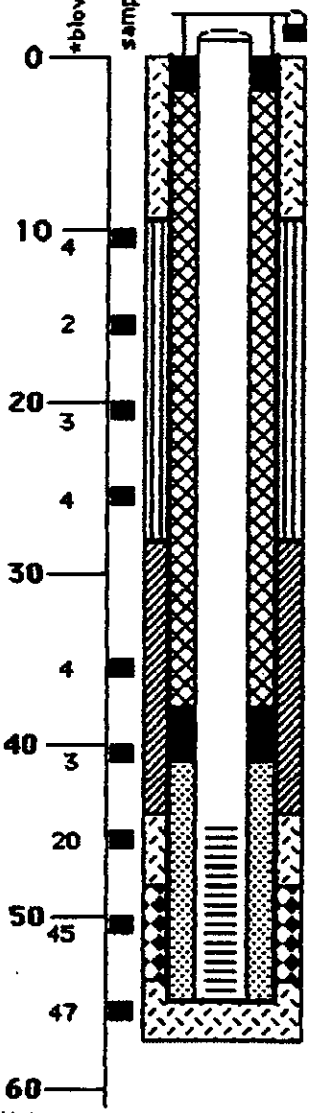
Borehole Diam. -	10"
Borehole Depth -	55'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	55'
Screen Setting -	45' - 55'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	

MEASUREMENTS(NGVD)

Top of Casing Elevation -	9.82'
Static Water Level Elevation -	-2.17'
Date Measured -	12/22/86
Surface Elevation -	8.90'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	



		Description
0	SW	Fine to coarse sand with little to some fine gravel, little clay and silt, very dark brown, soft, saturated; strong petroleum odor
10	ML	Silt with little clay, very dark brown, soft, very moist; micaceous; strong petroleum odor
20		Increasing clay; some clay with abundant organics
		Increasing clay; silt and clay
30		Decreasing clay; some clay and trace fine sand; organics; weak petroleum odor
	CL	Clay with some silt, dark gray, soft, very moist; organics; very weak petroleum odor SHELBY TUBE taken from 30' to 31.5'
40	SW	Fine to coarse sand with some fine gravel, trace silt, reddish-brown, medium dense, saturated
50	GP	Fine gravel with little to some fine to coarse sand, trace silt and clay, dark reddish-brown, dense, saturated; micaceous
	SW	Fine to coarse sand with some fine gravel, light reddish-brown to light reddish-gray, dense, saturated
60		

WELL CONSTRUCTION KEY

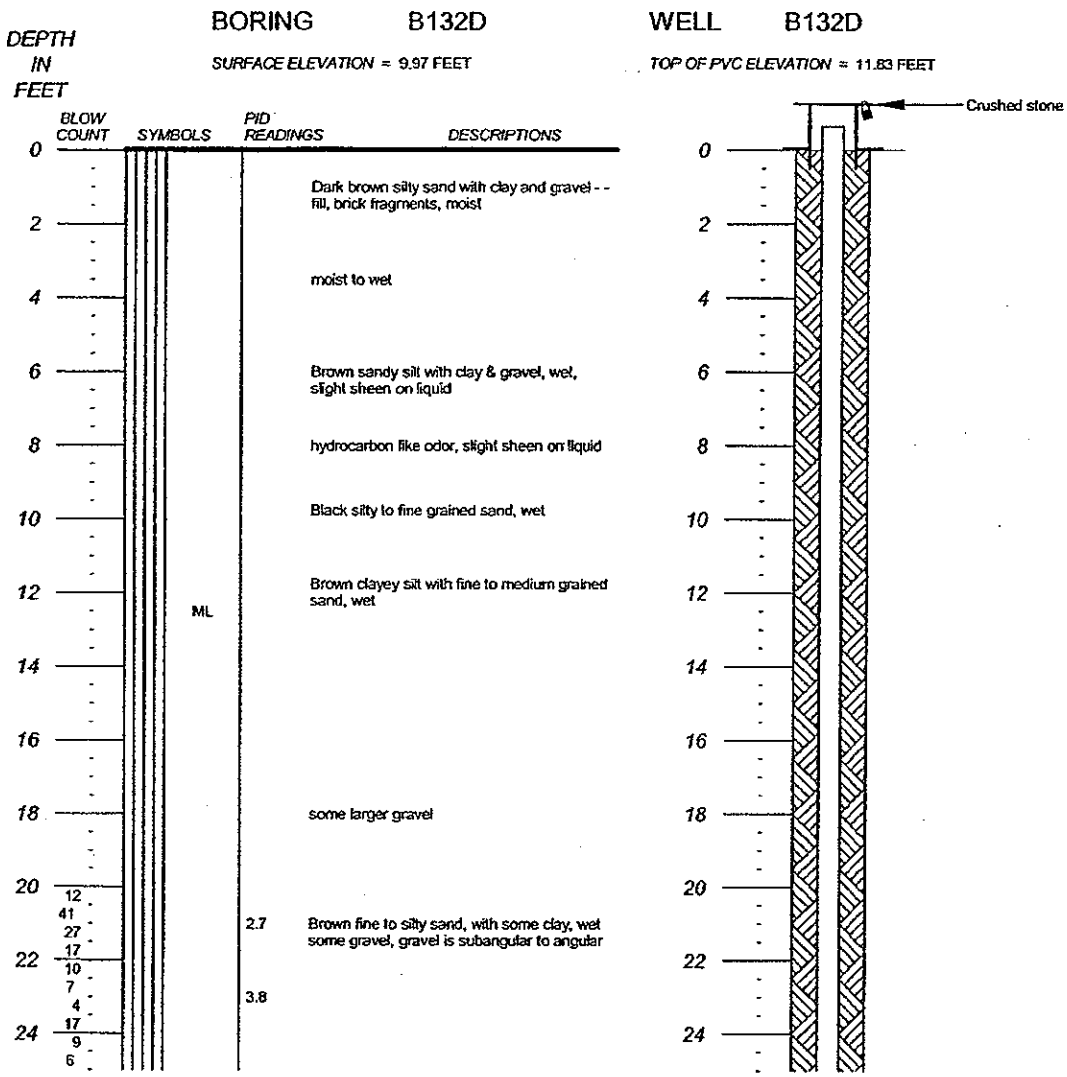
- FILTER PACK
- BENTONITE SEAL
- BENTONITE GROUT
- CAVE IN MATERIAL
- CONCRETE

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE



LOG OF SOIL BORING AND MONITORING WELL DETAIL
Girard Point
Sunoco Philadelphia Refinery
Philadelphia, PA

NOTES:

1. Boring installed by CT&E on March 7, 2001.
2. Boring was advanced by hollow stem auger. Sampling was performed by split-spoon samplers.
3. Boring was logged by Neil Laird of URS.
4. A solid bar indicates that a soil sample was collected at that depth.
5. PID reading - photoionization detector (11.7 ev lamp); readings in parts per million with respect to background (field screening not performed).
6. A blow count refers to the number of blows required to drive a standard split-spoon sampler a distance of 6-inches using a 140-lb hammer falling 30 inches.

URS

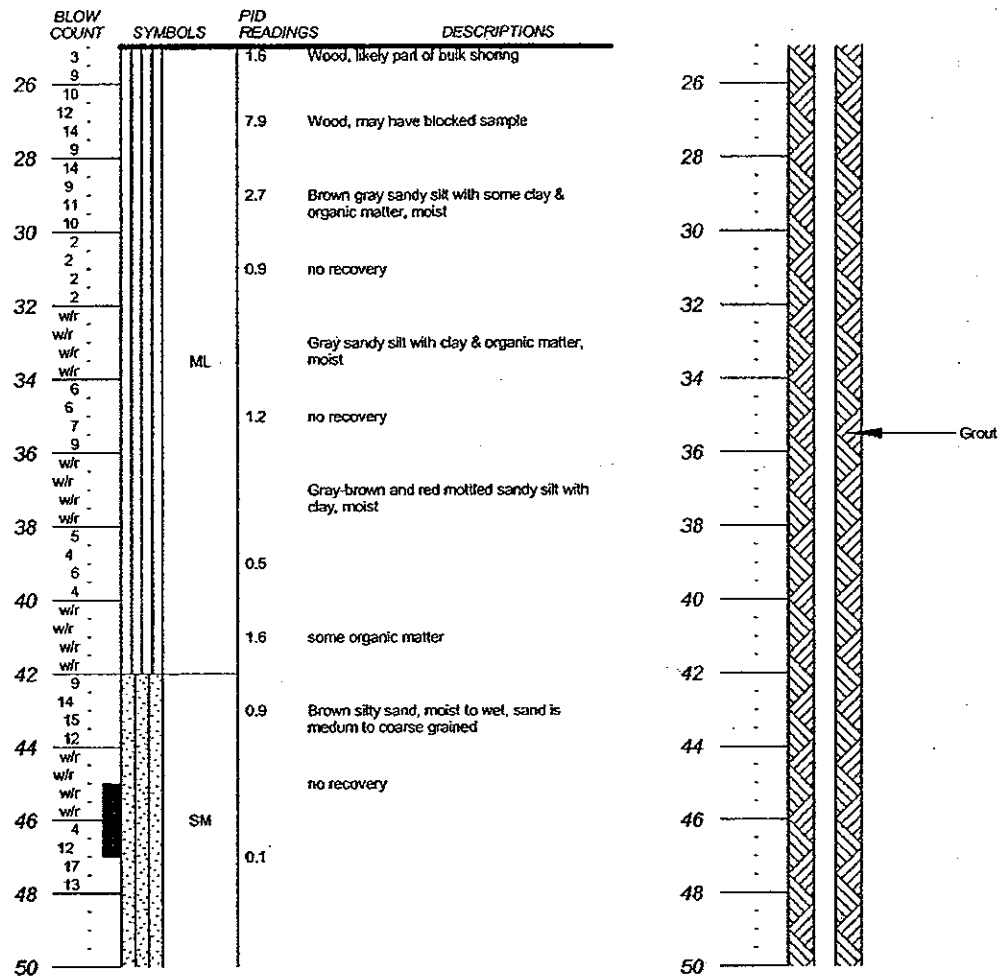
SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01

BORING B132D

SURFACE ELEVATION = 9.97 FEET

WELL B132D

TOP OF PVC ELEVATION = 11.83 FEET



LOG OF SOIL BORING AND MONITORING WELL DETAIL
Girard Point
Sunoco Philadelphia Refinery
Philadelphia, PA

NOTES:

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URS

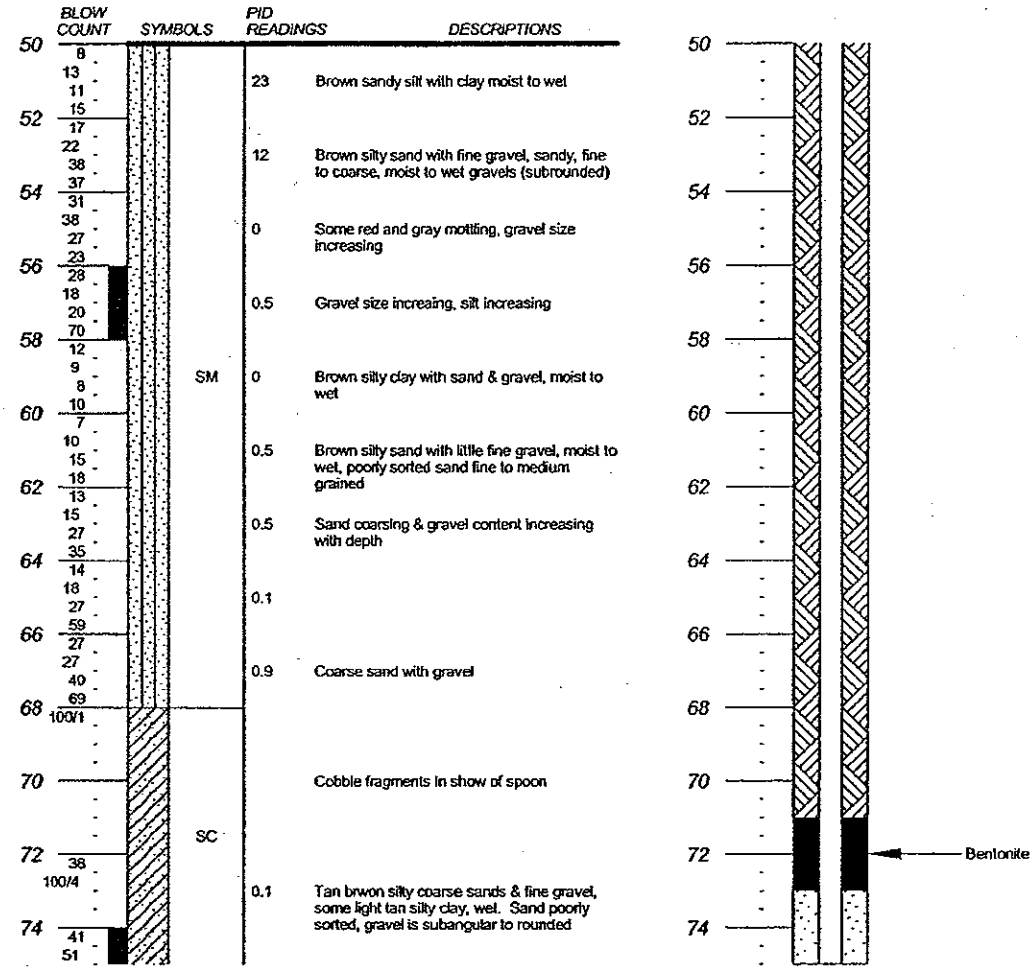
SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01

BORING B132D

WELL B132D

SURFACE ELEVATION = 9.97 FEET

TOP OF PVC ELEVATION = 11.83 FEET



LOG OF SOIL BORING AND MONITORING WELL DETAIL
Girard Point
Sunoco Philadelphia Refinery
Philadelphia, PA

NOTES:

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3. Boring was logged by Neil Laird of URS.
4. A solid bar indicates that a soil sample was collected at that depth.
5. PID reading - photoionization detector (11.7 ev lamp); readings in parts per million with respect to background (field screening not performed).
6. A blow count refers to the number of blows required to drive a standard split-spoon sampler a distance of 6-inches using a 140-lb hammer falling 30 inches.

URS

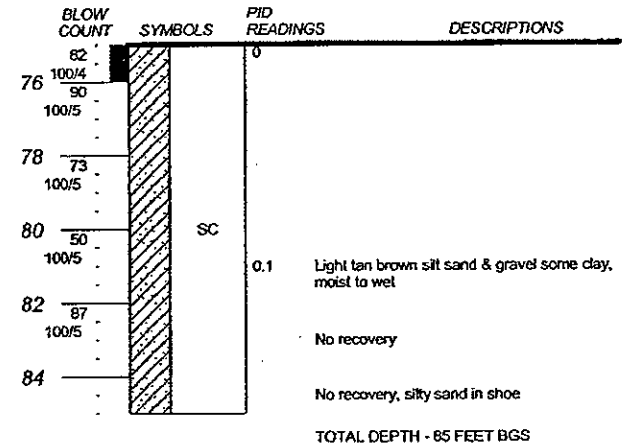
SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01

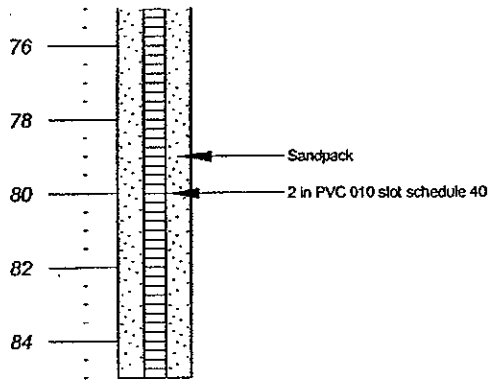
BORING B132D

SURFACE ELEVATION = 9.97 FEET

WELL B132D

TOP OF PVC ELEVATION = 11.83 FEET





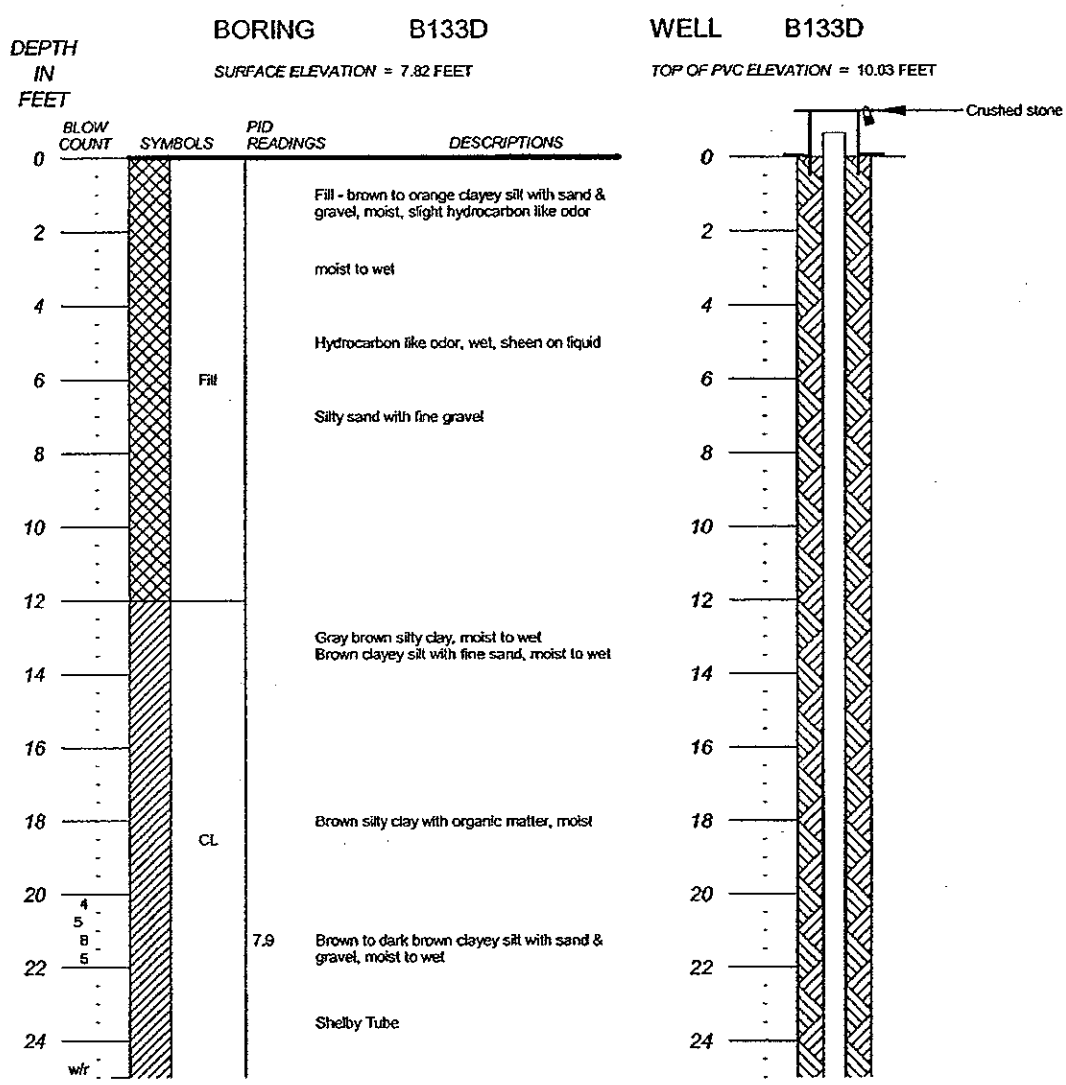
LOG OF SOIL BORING AND MONITORING WELL DETAIL
Girard Point
Sunoco Philadelphia Refinery
Philadelphia, PA

NOTES:

1. Boring installed by CT&E on March 7, 2001.
2. Boring was advanced by hollow stem auger. Sampling was performed by split-spoon samplers.
3. Boring was logged by Neil Laird of URS.
4. A solid bar indicates that a soil sample was collected at that depth.
5. PID reading - photoionization detector (11.7 ev lamp); readings in parts per million with respect to background (field screening not performed).
6. A blow count refers to the number of blows required to drive a standard split-spoon sampler a distance of 6-inches using a 140-lb hammer falling 30 inches.

URS

SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01



LOG OF SOIL BORING AND MONITORING WELL DETAIL
Girard Point
Sunoco Philadelphia Refinery
Philadelphia, PA

NOTES:

1. Boring installed by CT&E on March 5, 2001.
2. Boring was advanced by hollow stem auger. Sampling was performed by split-spoon samplers.
3. Boring was logged by Neil Laird of URS.
4. A solid bar indicates that a soil sample was collected at that depth.
5. PID reading - photoionization detector (11.7 ev lamp); readings in parts per million with respect to background (field screening not performed).
6. A blow count refers to the number of blows required to drive a standard split-spoon sampler a distance of 6-inches using a 140-lb hammer falling 30 inches.

URS

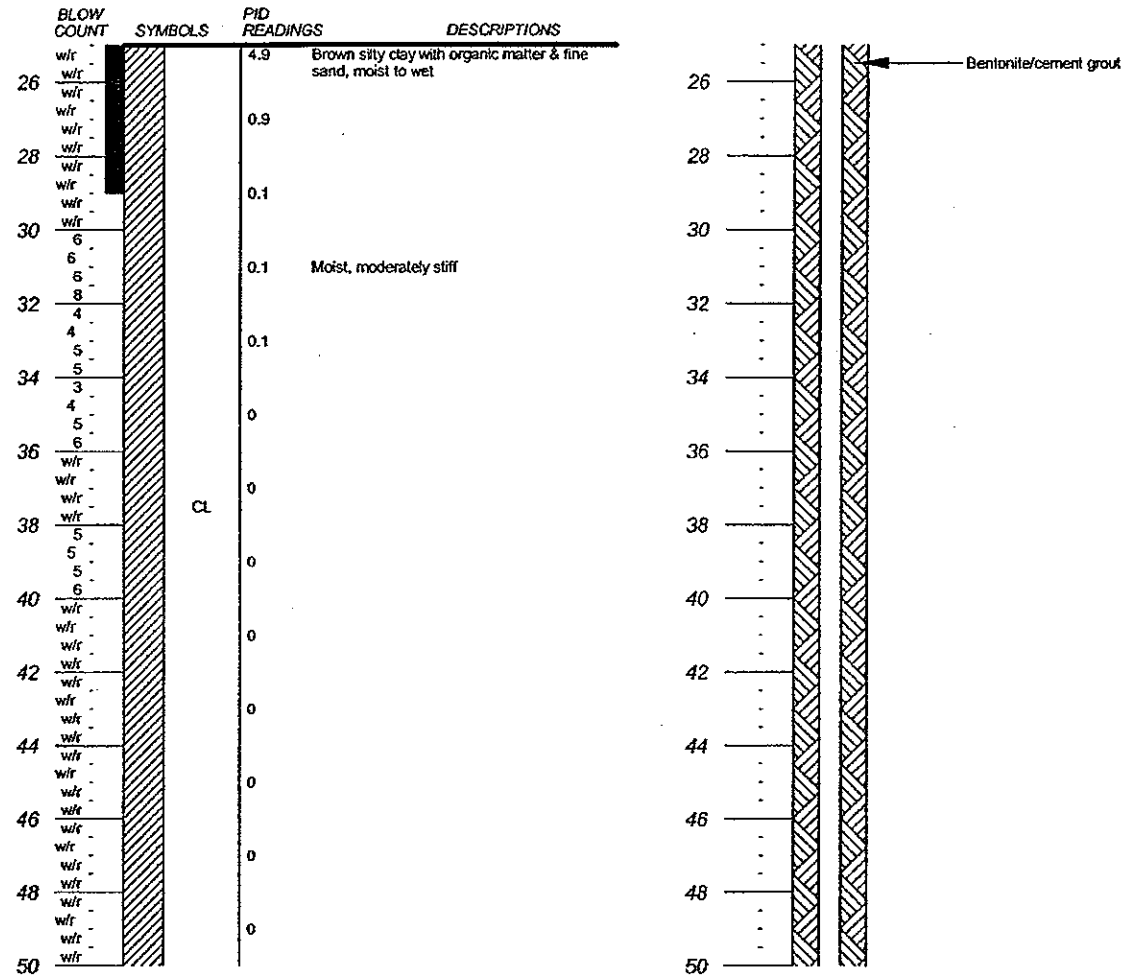
SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01

BORING B133D

SURFACE ELEVATION = 7.82 FEET

WELL B133D

TOP OF PVC ELEVATION = 10.03 FEET



LOG OF SOIL BORING AND MONITORING WELL DETAIL
Girard Point
Sunoco Philadelphia Refinery
Philadelphia, PA

NOTES:

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URS

SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01

BORING B133D

SURFACE ELEVATION = 7.82 FEET

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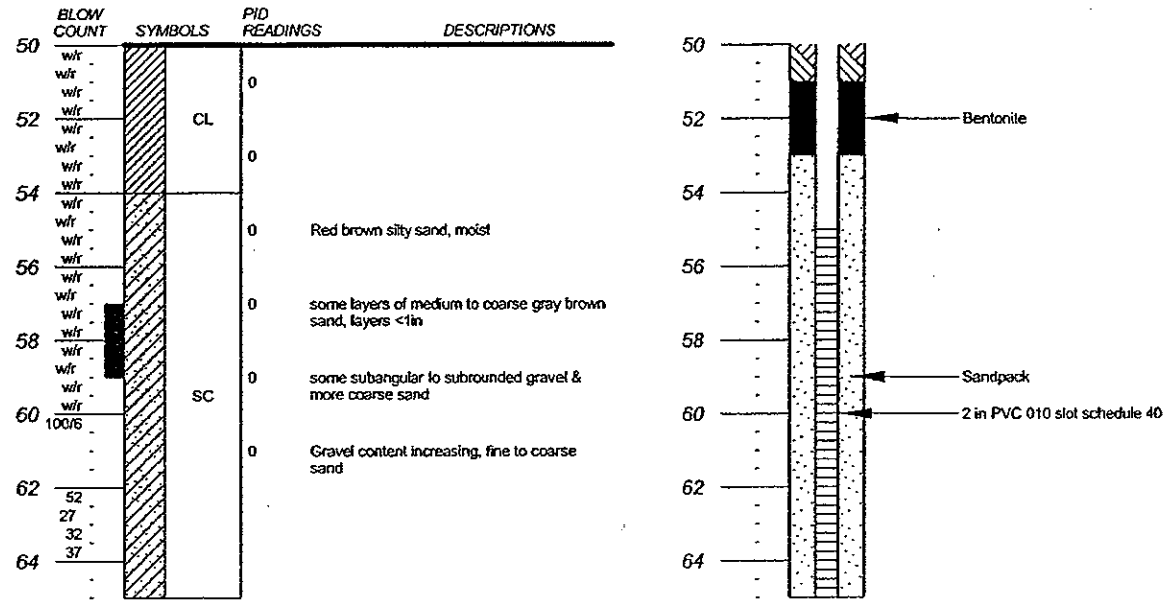

TOTAL DEPTH - 65 FEET BGS

LOG OF SOIL BORING AND MONITORING WELL DETAIL
Girard Point
Sunoco Philadelphia Refinery
Philadelphia, PA

NOTES:

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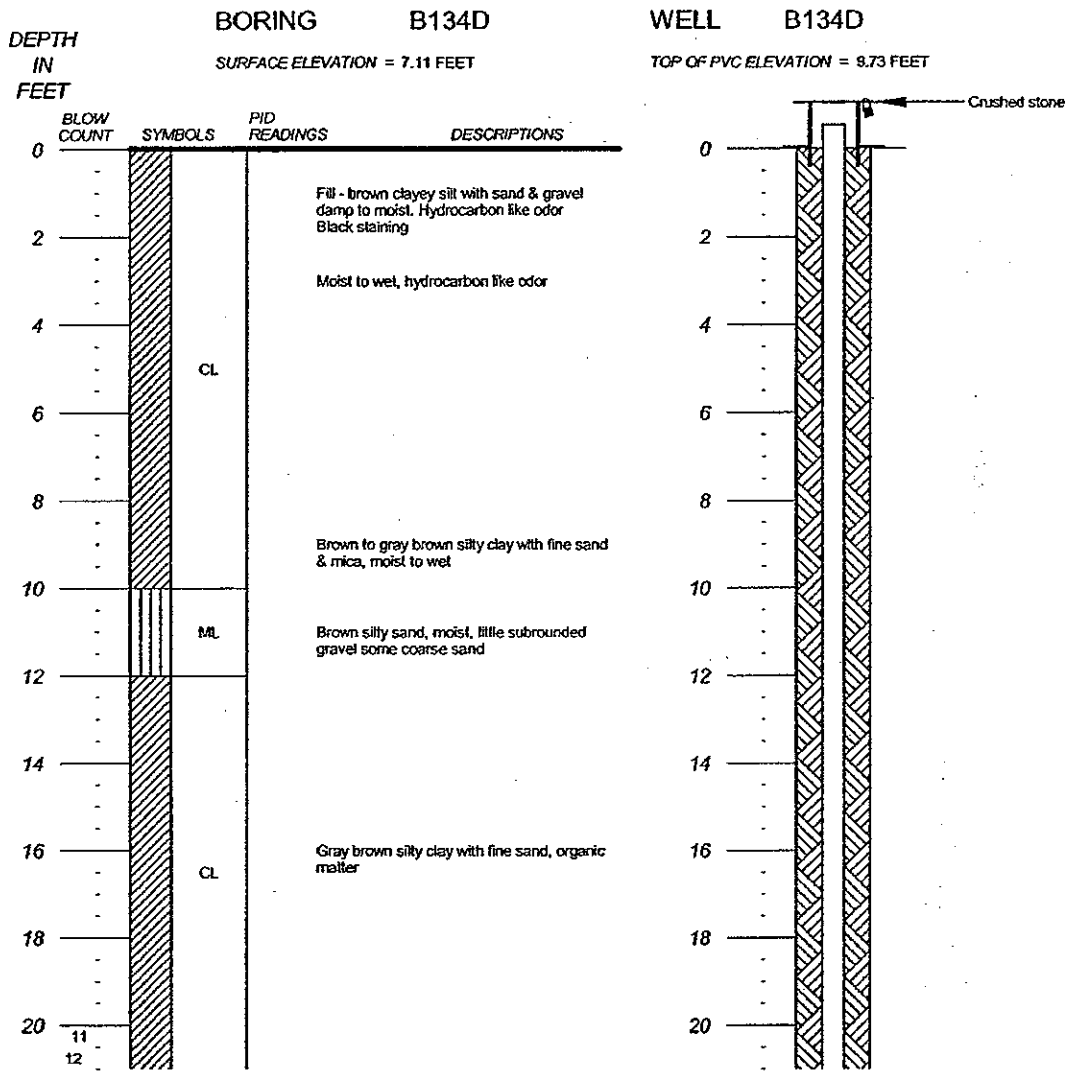
URS

SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01



LOG OF SOIL BORING AND MONITORING WELL DETAIL
Girard Point
Sunoco Philadelphia Refinery
Philadelphia, PA

NOTES:

1. Boring installed by CT&E on March 1, 2001.
2. Boring was advanced by hollow stem auger. Sampling was performed by split-spoon samplers.
3. Boring was logged by Neil Laird of URS.
4. A solid bar indicates that a soil sample was collected at that depth.
5. PID reading - photolonization detector (11.7 ev lamp); readings in parts per million with respect to background (field screening not performed).
6. A blow count refers to the number of blows required to drive a standard split-spoon sampler a distance of 6-inches using a 140-lb hammer falling 30 inches.

URS

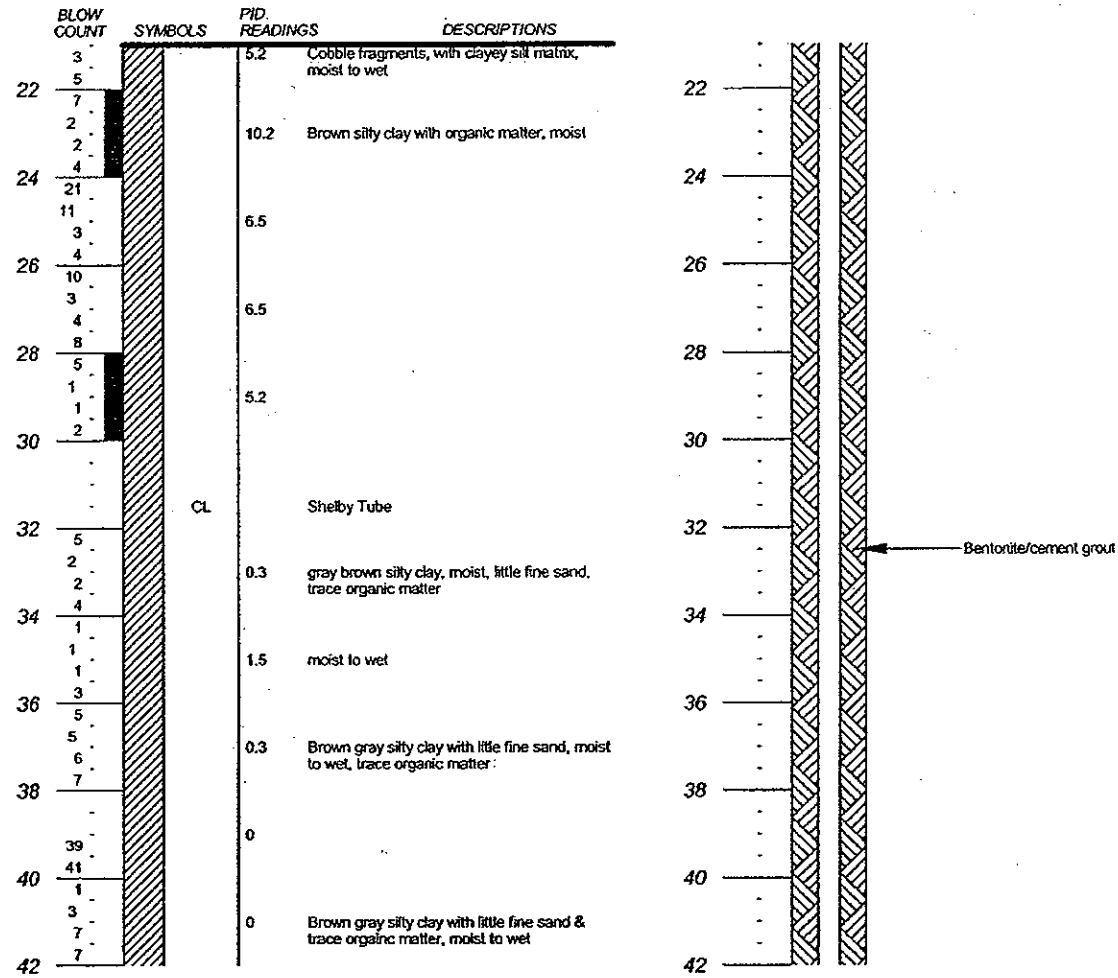
SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01

BORING B134D

SURFACE ELEVATION = 7.11 FEET

WELL B134D

TOP OF PVC ELEVATION = 9.73 FEET



LOG OF SOIL BORING AND MONITORING WELL DETAIL
Girard Point
Sunoco Philadelphia Refinery
Philadelphia, PA

NOTES:

1. Boring installed by CT&E on March 1, 2001.
2. Boring was advanced by hollow stem auger. Sampling was performed by split-spoon samplers.
3. Boring was logged by Neil Laird of URS.
4. A solid bar indicates that a soil sample was collected at that depth.
5. PID reading - photolonization detector (11.7 ev lamp); readings in parts per million with respect to background (field screening not performed).
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URS

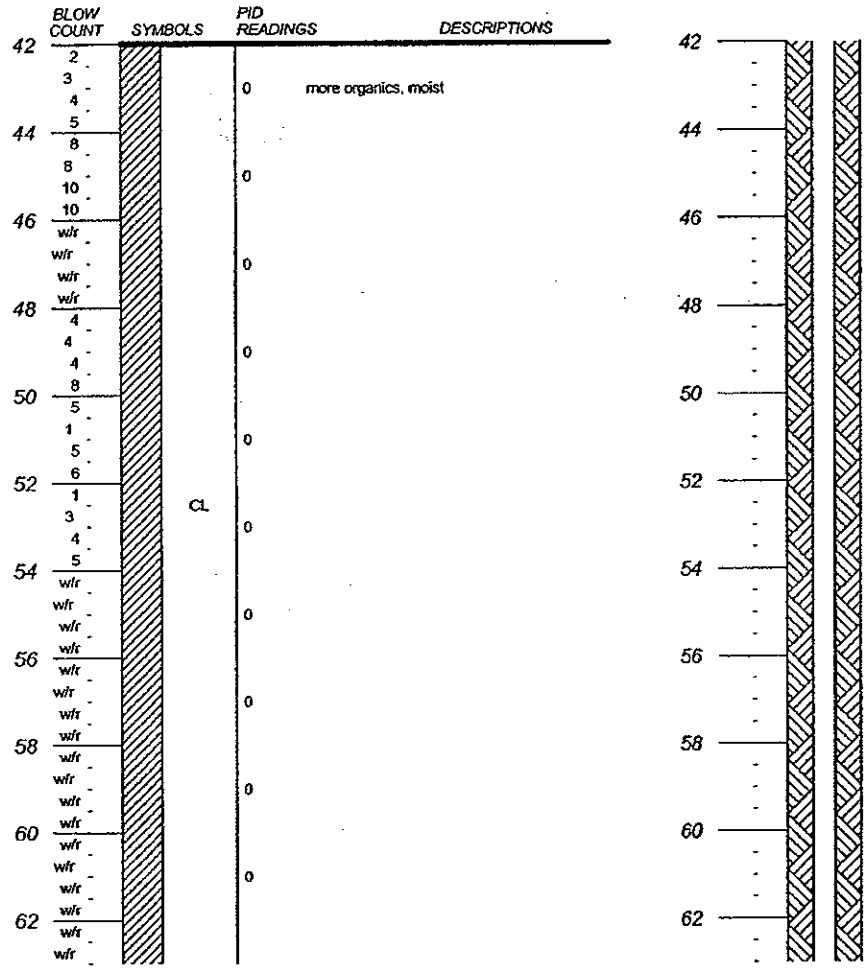
SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01

BORING B134D

WELL B134D

SURFACE ELEVATION = 7.11 FEET

TOP OF PVC ELEVATION = 9.73 FEET



LOG OF SOIL BORING AND MONITORING WELL DETAIL

Girard Point

Sunoco Philadelphia Refinery

Philadelphia, PA

NOTES:

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2. Boring was advanced by hollow stem auger. Sampling was performed by split-spoon samplers.
3. Boring was logged by Neil Laird of URS.
4. A solid bar indicates that a soil sample was collected at that depth.
5. PID reading - photoionization detector (11.7 ev lamp); readings in parts per million with respect to background (field screening not performed).
6. A blow count refers to the number of blows required to drive a standard split-spoon sampler a distance of 6-inches using a 140-lb hammer falling 30 inches.

URS

SOIL BORING & MONITORING WELL SUNGP.GPJ URS_WGPA.GDT 6/13/01

AOI-7

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - C50D

Project No. 113-950-032

Date M.W. completed 11/4/86

Supervising D & M Geologist David Wagner

Location -	Chevron Refinery
Driller -	Lambert, Inc.
Drilling Completed -	11/4/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

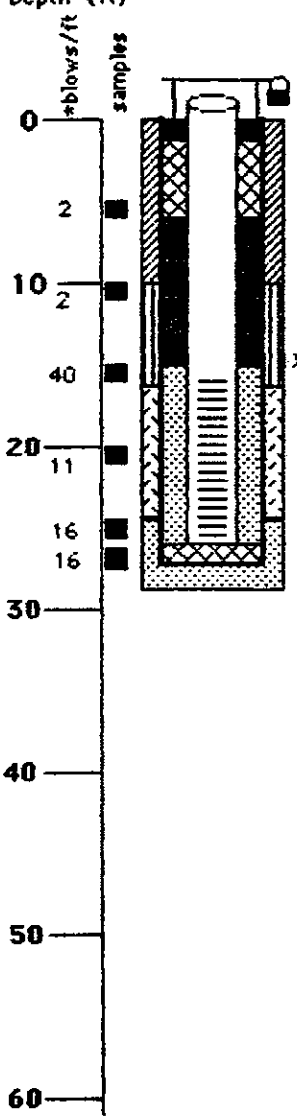
Borehole Diam. -	10"
Borehole Depth -	27'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	26'
Screen Setting -	16' - 26'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	

MEASUREMENTS(NGVD)

Top of Casing Elevation -	13.76'
Static Water Level Elevation -	1.43'
Date Measured -	12/22/86
Surface Elevation -	10.97'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	



Description

CL — Clay with some silt, blackish-gray, very soft, saturated; micaceous; organics; petroleum odor
SHELBY TUBE taken from 7' to 9'

ML — Increased silt; silt with some clay; strong petroleum odor

Little to some fine sand

SW — Fine to coarse sand with some fine gravel, medium brown, dense, saturated
Increasing gravel; sand and gravel, trace silt and clay

SP — Decreased fine gravel; fine to medium sand with trace to little gravel; petroleum odor

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE GROUT
- CAVE IN MATERIAL
- CONCRETE

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - C650

Project No. 113-950-032

Date M.W. completed 11/11/86

Supervising D & M Geologist David Wagner

Location -	Chevron Refinery
Driller -	Larrabert, Inc.
Drilling Completed -	11/11/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

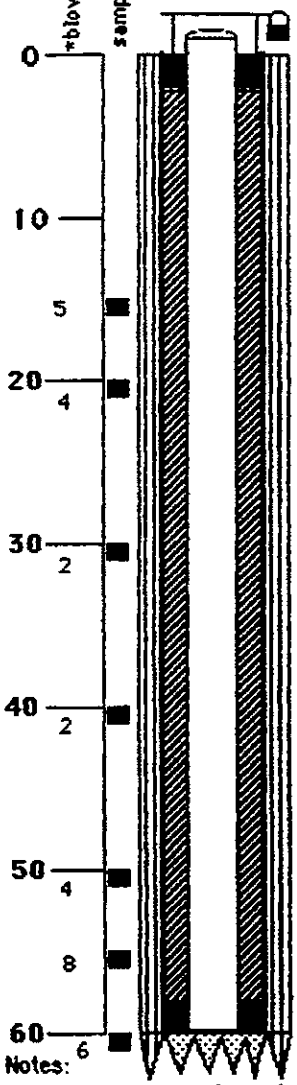
Borehole Diam. -	10"
Borehole Depth -	75'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	75'
Screen Setting -	65' - 75'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Bentonite

MEASUREMENTS(NGVD)

Top of Casing Elevation -	11.96'
Static Water Level Elevation -	-2.16'
Date Measured -	12/22/86
Surface Elevation -	9.94'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	



Description

ML Silt with trace to little fine to coarse sand, trace fine gravel, black, moist; strong petroleum odor; brick fragments

Silt with little clay, medium gray, soft, moist; organics

SHELBY TUBE taken from 25' to 27'
Trace mica

Decreasing density; very soft

Increasing density; soft
Decreasing clay; trace clay and trace fine sand

Increasing sand; little fine sand, stratified

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE GROUT
- CAVE IN MATERIAL
- CONCRETE

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.
** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - C65D (Cont.)

Project No. 113-950-032

Date M.W. completed 11/12/86

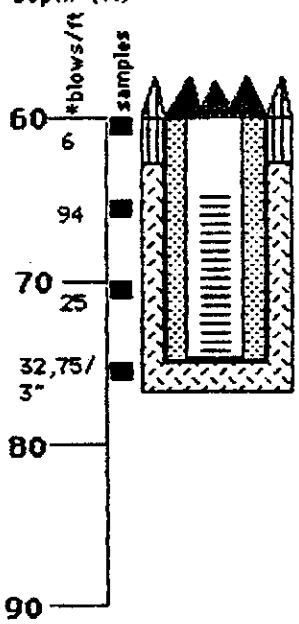
Supervising D & M Geologist David Wagner

Location - Chevron Refinery

Driller - Lambert, Inc.

Drilling Completed - 11/12/86

Type of Rig - Hollow Stem Auger



Description

ML 1" interbeds of fine to coarse sand from 60' to 62'

SW Fine to coarse sand with little fine gravel, trace to little clay, trace silt, brownish-gray, medium dense, saturated

Decreasing clay; no clay

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE GROUT
- CAVE IN MATERIAL
- CONCRETE

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

MONITORING WELL LOG: C-129 D

PROJECT:	**Sunoco-Philadelphia Refinery**	DRILLING CO.:	**ECDI**
SITE LOCATION:	**AOI-7**	DRILLING METHOD:	**Hollow Stem Auger & Mud Rotary**
JOB NO.:		SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Tiffani Doerr/Shaun Sikes**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**6/22/10-6/25/10**	WELLBORE DIAMETER:	**6.25"**
TOTAL DEPTH:	**66'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Clean gravel in top 6" - then black clay and gravel with large brick, asphalt, concrete and wood fill. Water with sheen to ~3' during clearing.	Hand cleared to 8'		
-5						
-10	0.0		(BC=12-21-18-12) 10" Recovery - wet, brn/red sand, gravels and brick (fill)		Grout/bentonite slurry (0'-47')	
	0.0					
	0.0		(BC=8-10-12-8) 12" Recovery - fill to 12.5'. Rest is black/dk brown fine SAND, trace clay, with gravel and brick near 14'.			
	0.0					
	0.1		(BC=10-7-9-12) Coarse mixed sands, trace sandy clay, black to dark brown.			
-15	0.0					
	1.0		(BC=9-15-18-21) 16'-17' same as above. At 17' - Dark gray/brown sandy CLAY, sl micaceous.			
	0.9					
	0.0		(BC=2-2-1-2) Same as above - 19'-20' is fine to med gray/brn Clayey Sand.			
	0.0					
-20	0.0		(BC=3-2-1-1) Same Clayey Sand grading to gray/dk gray CLAY with trace sand, sl micaceous.			
	0.0					

MONITORING WELL LOG: C-129 D

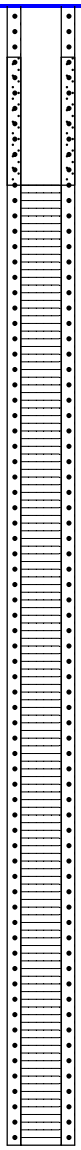
Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0		(BC=1-2-2-1) Same to 22.5' - then dk brn fine-med Sands with trace clay.			
	0.0					
	0.0		(BC=3-2-2-1) Dark gray/brn CLAY with trace sand.			
-25	0.0					
	0.0		(BC=2-2-2-1) Same with trace organics.			
	0.0					
	0.0		(BC=3-2-1-2) Same as above.			
	0.0					
-30	0.0		(BC=1-1-1-2) Same as above, increased sand content with depth.			
	0.0					
	0.0		(BC=1-1-2-3) Same as above, trace organics, sl micaceous.			
	0.0					
	0.0		(BC=4-8-9-5) Same to 35'. At 35' transition to red/brown fine SAND and GRAVEL.			
-35	0.0					
			(BC=5-5-8-12) No recovery except minor amt reddish-gray clayey fine sand with fine gravel in tip of spoon.			
			(BC=3-8-7-8) Same as above, few fines/clay, few gravels (multi-colored gravels).			
	0.0					
-40			(BC=9-9-8-14) Same as above, clayey fine sand w/ few fine gravels.			
	0.0					
-45			(BC=28-42-100/5) 8" Recovery - 1" of green SILT/fine SAND & 1" of reddish sandy CLAY, then large broken green siltstone and sandstone fragments.			
	0.0				#00 Sand (47'-49')	

MONITORING WELL LOG: C-129 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-50			(BC=8-14-22-24) Very little recovery - lg gravel (1-2") in pieces and little sand.		#1 Sand (49'-66') Screen (51'-66')	
-55	0.0		(BC=18-17-42-50/2) 6" Recovery - fine-coarse SAND from reddish to yellow.			
-60			Same as above	Mud rotary terminal depth = 69'		
-65			Same as above.			



MONITORING WELL LOG: C-134 D

PROJECT:	**Sunoco-Philadelphia Refinery**	DRILLING CO.:	**ECDI**
SITE LOCATION:	**AOI-7**	DRILLING METHOD:	**Hollow Stem Auger & Mud Rotary**
JOB NO.:		SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Tiffani Doerr/Shaun Sikes**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**6/11/10-6/22/10**	WELLBORE DIAMETER:	**6.25"**
TOTAL DEPTH:	**70'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Cleared to 10' - sandy gravel with some fill debris.	Hand cleared to 8'		
-5						
-10	0.0		(BC=4-4-5-6) 10" Recovery - very moist dark gray CLAY w/organics (grasses). Last 1/2" of spoon was lt gray fine sand.		Grout/bentonite slurry (0'-51')	
	0.0					
	0.0		(BC=5-3-2-2) 10 Recovery - same as above - increased organics content ~30%.			
	0.0					
	0.0		(BC=3-4-4-4) 20" Recovery - same as above 30-40% organics.			
-15	0.0					
	0.0		(BC=3-2-2-2) 18" Recovery - same as above - blackish gray.			
	0.0					
	0.0		(BC=2-2-3-3) 18" Recovery - same as above with less			

MONITORING WELL LOG: C-134 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0		organics ~10%.			
-20	0.0		(BC=2-1-1-1) Same as above with ~5% organics, dark gray again (not black).			
	0.0					
	0.0		(BC-1-1-1-1) Same as above.			
	0.0					
	0.0		(BC=1-1-2-2) Same as above.			
-25	0.0					
	0.0		(BC=2-3-4-4) Same as above.			
	0.0					
	0.0		(BC=1-1-2-2) Same as above.			
	0.0					
-30	0.0		(BC=2-2-2-2) Same as above, increased organic content - up to 20%.			
	0.0					
	0.0		(BC=4-2-3-2) Same as above.			
	0.0					
	0.0		(BC=3-2-2-3) Same as above.			
-35	0.0					
	0.0					
	0.0					
	0.0		(BC=1-1-1-1) 10" Recovery - same as above.			
	0.0					
-40	0.0		(BC=2-1-1-1) 18" Recovery - same as above.			
	0.0					

MONITORING WELL LOG: C-134 D

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0		(BC=2-2-4-3) Same with 3" layer of fine sand with trace gravel at 42.5'.			
	0.0					
	0.0		(BC=9-14-17-17) 10" Recovery - Reddish-brn fine SAND w/trace gravel grading to red-brn fine-coarse SAND w/fine GRAVEL (sub-round/sub-angular, white, pink, blk, gray qtz and qtzite).			
-45	0.0					
	0.0		(BC=12-24-19-15) 8" Recovery - Fine-coarse sand and 1-2" gravels (qtz&qtzite: red, white, green, blk).		#00 Sand (51'-53')	
	0.0					
-50					#1 Sand (53'-70')	
			(BC=48-100-50/2) 10" Recovery - Coarse sand and coarse gravel 2"+ (mostly gravel with sand).			
-55	0.0		12" Recovery - Same as above (gravels so tough - broke spoon tip)		Screen (55'-70')	
	0.0					
			(BC=52-64-76-37) 10" Recovery - Same as above			
	0.0					
-60				Mud rotary terminal depth = 72'		

MONITORING WELL LOG: C-134 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-65						
-70			Weathered schist bedrock - from cuttings: mica/black minerals in cuttings.			

MONITORING WELL LOG: C-144 D

PROJECT:	**Sunoco-Philadelphia Refinery**	DRILLING CO.:	**ECDI**
SITE LOCATION:	**AOI-7**	DRILLING METHOD:	**Hollow Stem Auger & Mud Rotary**
JOB NO.:		SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Tiffani Doerr/Shaun Sikes**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**6/28/10-7/9/10**	WELLBORE DIAMETER:	**6.25"**
TOTAL DEPTH:	**78'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Cleared to 8' - dark brown to black stained sandy gravel fill w/ lots of brick, wood and other fill. Water to ~4' during clearing.	Hand cleared to 8'		
-5						
-10	11.7		(BC=3-2-1-1) Black silty CLAY, soft, moist, sl odors, stained.		Grout/bentonite slurry (0'-59')	
	11.4					
	0.0		(BC=3-2-1-2) Dk gray CLAY w/silt and organic material ~10%, no odors.			
	0.0					
	0.0		(BC=1-1-2-1) Same as above.			
-15	0.0					
	0.0		(BC=1-2-2-2) 16" Recovery - same as above.			
	0.0					
	0.7		(BC=1-2-1-1) 20" Recovery - same as above.			
	0.0					
-20	0.0		(BC=WOH/1'-1-1) 4" Recvoery - same as above			
	0.0					
	0.0		(BC=WOH/6"-1-1-1) Gray silty clay with 20-30% organics			

MONITORING WELL LOG: C-144 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0		(grasses).			
	0.0		(BC=1-1-3-3) Same as above - less organics.			
-25	0.0					
	0.0		(BC=WOH/1'-1-1) Same as above.			
	0.0					
	0.0					
-30	0.0		(BC=WOH/2') Same as above - no organics and addition of mica flakes in last 6" (note clay does not feel as soft as blow counts indicate)			
	0.0					
-35	0.0		(BC=WOH/2') 12" Recovery - Gray CLAY, no organics, trace mica flakes.			
	0.0					
-40	0.0		(BC=WOH/2') 18" Recovery - gray clay with thin very fine light gray sand laminations. (minimal up to <1/4" spacing)			
	0.0					
-45	0.0		(BC=WOH/1'-1-1) Same as above.			
	0.0					
-50	0.0		(BC=WOH/2') No recovery - Rock frag in tip of spoon.			
	0.0					

MONITORING WELL LOG: C-144 D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-55	0.0		(BC=WOH/2') Same as above - last 9" has no layering, just gray fine sandy clay.			
	0.0				#00 Sand (59'-61')	
-60	0.0		(BC=8-5-5-7) 18" Recovery - medium stiff, dark gray/black CLAY, some organics, trace think lenses of fine sand.	Mud rotary terminal depth = 78'	#1 Sand (61'-78')	
	0.0		Reddish brown, orange fine-coarse SAND at 61.5'-62'. Some gravel in bottom of spoon.		Screen (63'-78')	
-65			(BC=18-14-6-5) No Recovery. Choppy drilling from 62-65' (sand/gravel)			
-70	0.0		(BC=5-4-3-3) Top 4" dark gray fine-med SAND. Rest is dk gray/black med stiff silty CLAY, some organics, trace fine-med sand lenses, micaceous.			
	0.0		Hard drilling - 73'-75' (gravels)			
-75	0.0		(BC=14-23-90-61) 20" Recovery - gray-brown med-coarse SAND and fine-coarse sub-round GRAVEL			
	0.0		Black and white weathered Schist at 76'.			

AOI-8

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D-4

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215-947-25

Client ... Arco
Project ... Well Installation
Location .. Passyunk Avenue .. Philadelphia PA
Project No. ... 2200
Boring No. .. B-6 ... Depth .. 44.5'
Elevation ...
Spoon Size .... 2" O.D. ... Casing Size .. Hollow Stem Augers
Core Size ... Bit No. ...
Hammers:
Spoon, weight .... 140# ... Drop ... 30"
Drive, weight ... Drop ...
Date Started ... 12-11-84

Driller ... S.E.
Helper .. W.H.
Inspector .. M.C.
Job No. ... 2390

Ground Water Data:
0 HOURS AFTER COMPLETION: ...
...
TOTAL PIPE INSTALLED: 47.5' TD.

DTW?

Date Completed .. 12-12-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL, ASH AND CINDERS.				3.0' STICK UP
		10.0'				HAD DIFFICULTY WITH SETTING PIPE.
		BLACK ORGANIC SILT, CLAY AND SANDS.				FINALLY WENT DOWN AND STAYED DOWN ON 2ND TRY.
		18.0'				
		GREY BROWN SAND, SILTS AND SMALL GRAVELS.	30.0 - 32.0	1		SATURATED SAMPLE
		MULTI-COLORED SAND, SILT, CLAY AND GRAVEL.				

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U-4

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215-947-25

Client ..... ARCO
Project ..... WELL INSTALLATION
Location ..... PASSYUNK AVENUE, PHILADELPHIA PA
Project No. 9200
Boring No. ..... B-6 (CONT'D) Depth ..... 44.5'
Elevation .....
Spoon Size ..... 2" O.D. Casing Size ..... HOLLOW STEM AUGERS
Core Size ..... Bit No. .....
Hammers:
Spoon, weight ..... 140# Drop ..... 30"
Drive, weight ..... Drop .....
Date Started 12-11-84

Driller ..... S.E.
Helper ..... W.H.
Inspector ..... M.C.
Job No. 8890

Ground Water Data:
0 HOURS AFTER COMPLETION):
.....
.....
TOTAL PIPE INSTALLED: 47.5'

Date Completed 12-12-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MULTI-COLORED SAND, SILT, CLAY AND GRAVELS. 44.5'	40.0 - 42.0	2		NO SAMPLES AFTER 40-42'
		COMPLETE AT 44.5'				

SHEET NO. 2 OF 2

East side of "area 2".
This is a monitor well.

N-9

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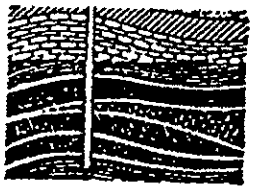

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215-947-2555

Client ....ARCO.....
Project ...WELL INSTALLATION.....
Location ..PASSYUNK AVENUE, PHILADELPHIA
Project No. ....9200..... FA
Boring No. ..B-12..... Depth ..78.0'.....
Elevation .....
Spoon Size ....—..... Casing Size ..CONVENTIONAL FLIGHT AUGERS
Core Size ..... Bit No. .....
Hammers:
Spoon, weight ....—..... Drop ....—.....
Drive, weight ..... Drop .....
Date Started ....11-26-84.....

Driller ...S.B.....
Helper ...W.H.....
Inspector ...M.C.....
Job No. ...2890.....

Ground Water Data:
0 HOURS AFTER COMPLETION: .....
.....
.....
TOTAL PIPE INSTALLED: 67.0' NW -- ?
DTD = 78'

Date Completed ...11-28-84.....

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		BLACKTOP PAVING 0.2'				
		ASH WOOD AND CINDER FILL. 13.0'				
		MULTI-COLORED FINE TO COARSE SAND AND GRAVEL 24.0'				
		LIGHT ORANGE FINE SAND 30.0'				
		LIGHT ORANGE BROWN MEDIUM TO COARSE SANDS AND GRAVELS AND SILTY CLAYS.	40.0-42.0'	1	DAMP TO MOIST	

N-9

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215-947-2555

Client ....ARCO.....
Project ...WELL INSTALLATION.....
Location ..PASSYUNK AVENUE, PHILADELPHIA
Project No. ....9200..... PA
Boring No. ..B-12 (CONT'D) Depth ..78.0'....
Elevation .....
Spoon Size ....—..... Casing Size ..CONVULSION FLIGHT AUGERS
Core Size ..... Bit No. .....
Hammers:
Spoon, weight ....—..... Drop ....—.....
Drive, weight ..... Drop .....
Date Started .....11-26-84.....

Driller ...S.A.....
Helper ...W.H.....
Inspector ...M.C.....
Job No. ...2890.....

Ground Water Data:
0 HRS. AFTER COMPLETION: .....
.....
.....
TOTAL PIPE INSTALLED: 67.0'.....

Date Completed ..11-28-84.....

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		LIGHT ORANGE BROWN MEDIUM TO COARSE SAND AND GRAVELS AND SILTY CLAYS. ± 45.0'				
		DARK GREY FINE TO COARSE SAND AND SILTY CLAYS. ± 51.0'	47.0 49.0	2		ATTEMPTED TO PUT PIPE DOWN TO 68.0' BUT WOULDN'T GO PAST APPROXIMATELY 63.0'.
		INTERBEDDED ORANGE TAN FINE SAND AND FINES. VERY FRIABLE WITH REDDISH BROWN FINE SANDS. BOTH SHOW SOME FINE MICA PARTICLES ± 63.0'	57.0 59.0	3	DRY SAMPLE	THE SAND AND GRAVEL INTERFACE. ATTEMPTED THIS PROCEDURE TWICE THEN MOVED ON TO ANOTHER HOLE.
		FINE TO COARSE GRAVELS AND SANDS MULTI-COLORED TRACE OF FINES ± 70.0'	65.0 67.0	4		
		COARSE SAND AND GRAVELS. MULTI-COLORED. PREDOMINATELY DARK REDDISH BROWN ± 78.0'	76.0- 78.0	5		
		COMPLETE AT 78'				

SHEET NO. ..... OF .....

North line of "area 3." U-13
South of tanks 550,629; 622,536

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215-947-2555

Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE & PHILADELPHIA PA
Project No. 9200
Boring No. B-16 Depth 50.0'
Elevation
Spoon Size 2" O.D. Casing Size 10(I.D.) 6"(I.D.)
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 12-13-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 2870

Ground Water Data:
0 HOURS AFTER COMPLETION:
TOTAL PIPE INSTALLED: 53.5'

? NW

Date Completed 12-13-84

TD 50

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		STONE AND SOIL FILL 1.5'				
		BLACK SILT AND CLAY. 8.0'				3½' STICK-UP
		BLACK COARSE TO FINE SAND AND GRAVEL. 19.0'				HEAVY PRODUCT ODOR. *
		REDDISH BROWN SILT AND CLAY 20.0				
		TAN TO ORANGE FINE TO COARSE SAND. 32.0'	30.0 - 32.0		1	
		REDDISH BROWN SILTY CLAY.				

SHEET NO. 1 OF 2

N-13

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Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE, PHILADELPHIA PA
Project No. 9200
Boring No. B-16 (CONT'D) Depth 50.0'
Elevation
Spoon Size 2" O.D. Casing Size HOLLOW STEM AUGERS
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 12-13-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 8890

Ground Water Data:
0 HOURS AFTER COMPLETION:

TOTAL PIPE INSTALLED: 53.5'

Date Completed 12-13-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		REDDISH BROWN SILTY CLAY. ± 45.0'	40.0 - 42.0	2		
		SAND 50.0'				
		COMPLETE AT 50.0'				

SHEET NO. 2 OF 2

N-19

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Client ....ARCO
Project ....WELL INSTALLATION
Location ..PASSYUNK AVENUE, PHILADELPHIA PA
Project No. 9200
Boring No. B-20 Depth 60.0'
Elevation
Spoon Size ....2" O.D. Casing Size HOLLOW STEM AUGERS
Core Size Bit No.
Hammers:
Spoon, weight ....140# Drop ....30"
Drive, weight Drop
Date Started ...12-13-84

Driller ...S.E.
Helper ..W.H.
Inspector ..M.C.
Job No. 2290

Ground Water Data:
0 HOURS AFTER COMPLETION:
ON 12/14 JETTED OUT
TOTAL PIPE INSTALLED: 64.0'

Date Completed ...12-14-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL BLACK SAND, ASH AND CINDER 8.0'				4.0' STICK UP
		DARK REDDISH BROWN FINE SAND AND TRACE OF FINES. 12.0'		DRY		
		DARK REDDISH BROWN. FINE SAND. TRACE OF FINES AND FINE TO MEDIUM GRAVELS. 25.0'				
		TAN FINE SAND ± 35.0'	30.0 - 32.0	No RECOVERY		
		REDDISH BROWN CLAYEY SILT				

SHEET NO. 1 OF 2

N-19

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Client ... ARCO
Project ... WELL INSTALLATION
Location ... PASSYUNK AVENUE, PHILADELPHIA PA
Project No. ... 9200
Boring No. B-20 (CONT'D) Depth 60.0'
Elevation ...
Spoon Size ... 2" O.D. Casing Size 10(0)-40.0 / 6" I.D. 40.0-64.0
Core Size ... Bit No. ...
Hammers:
Spoon, weight ... 140# Drop ... 30"
Drive, weight ... Drop ...
Date Started ... 12-13-84

Driller ... S.B.
Helper ... W.H.
Inspector ... M.C.
Job No. ... 2890

Ground Water Data:
0 HOURS AFTER COMPLETION:
ON 12/14 JETTED OUT
TOTAL PIPE INSTALLED: 64.0'

Date Completed ... 12-14-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		REDDISH BROWN CLAYEY SILT ± 45.0'	40.0 - 42.0	2		
		REDDISH BROWN SANDY SILTY CLAY ± 53.0	50.0 - 52.0	3		
		SAND ± 60.0'				
		COMPLETE AT 60.0'				

SHEET NO. 2 OF 2

NEW N-19

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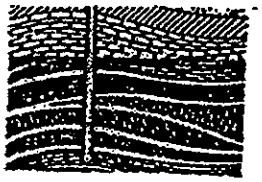

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Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE, PHILADELPHIA PA
Project No. 9200
Boring No. B-20 Depth 60.0'
Elevation
Spoon Size 2" O.D. Casing Size 10(10.0) 5" (5.0) NW (4.75)
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 12-13-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 2890

Ground Water Data:
0 HOURS AFTER COMPLETION:
ON 12/14 JETTED OUT
TOTAL PIPE INSTALLED: 64.0'

Date Completed 12-14-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL BLACK SAND, ASH AND CINDER 8.0'				4.0' STICK UP
		DARK REDDISH BROWN FINE SAND AND TRACE OF FINES. 12.0'		DRY		
		DARK REDDISH BROWN. FINE SAND. TRACE OF FINES AND FINE TO MEDIUM GRAVELS. 25.0'				
		TAN FINE SAND ± 35.0'	30.0- 32.0	No Recovery		
		REDDISH BROWN CLAYEY SILT				

new N-19

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Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE PHILADELPHIA PA
Project No. 2200
Boring No. B-20 (CONT'D) Depth 60.0'
Elevation
Spoon Size 2" O.D. Casing Size 10(50.0) 6" HW(60.0)
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 12-13-84

Driller S.G.
Helper W.H.
Inspector M.C.
Job No. 2890

Ground Water Data:
0 HOURS AFTER COMPLETION:
ON 12/14 JETTED OUT
TOTAL PIPE INSTALLED: 64.0'

Date Completed 12-14-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		REDDISH BROWN CLAYEY SILT ± 45.0'	40.0- 42.0	2		
		REDDISH BROWN SANDY SILTY CLAY ± 53.0	50.0- 52.0	3		
		SAND ± 60.0'				
		COMPLETE AT 60.0'				

SHEET NO. 2 OF 2

N-21

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Client ARCO

Project WELL INSTALLATION

Location PASSYUNK AVENUE, PHILADELPHIA PA

Project No. 9200

Boring No. B-24 Depth 51.5'

Elevation

Spoon Size 2" O.D. Casing Size 4 1/4" (HOLLOW STEM AUGERS)

Core Size Bit No.

Hammers:

Spoon, weight 140# Drop 30"

Drive, weight Drop

Date Started 11-30-84

Driller S.E.

Helper W.H.

Inspector M.C.

Job No. 2890

Ground Water Data:
0 HOURS AFTER COMPLETION):

TOTAL PIPE INSTALLED: 55.0'

Date Completed 11-30-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS SOIL FILL 7.0'				3.5' STICK UP
		BROWN FINE SAND 15.0'				HYDRO CARBON ODOR ENCOUNTERED.
		BROWN MEDIUM TO COARSE SAND AND FINE TO MEDIUM GRAVEL. 17.0'				
		DARK GREY FINE SAND AND SILT - POSSIBLE TRACE OF CLAY 20.0'				
		DARK GREY FINE SAND AND SILT. SOME CLAY. 30.0'	30.0'-32.0'	1		
		BROWNISH REDDISH SANDY SILT SOME MICA CRYSTALS. SOME CLAY. 40.0'	40.0'-42.0'	2		

SHEET NO. 1 OF 2

N-27

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Client ... Arco
Project ... Well Installation
Location ... Passyunk Avenue & Philadelphia PA
Project No. ... 9200
Boring No. B-38 ... Depth ... 60.5'
Elevation ...
Spoon Size ... 2" O.D. ... Casing Size 10(10.0) 6" H.S.A.
Core Size ... Bit No. ...
Hammers:
Spoon, weight ... 140# ... Drop ... 30"
Drive, weight ... Drop ...
Date Started ... 11-29-84

Driller ... S.E.
Helper ... W.H.
Inspector ... M.C.
Job No. ... 8890

Ground Water Data:
0 HOURS AFTER COMPLETION:
WATER AT 15.0'
TOTAL PIPE INSTALLED: 63.0'

Date Completed ... 11-29-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		ASH AND CINDER FILL. 5.0'				
		OTHER MISCELLANEOUS FILL 7.0'				
		ORANGISH - BROWN VERY FINE SILTY SAND. 15.0'	10.0'- 12.0'	1		SATURATED CONDITIONS AT 15.0'
		ORANGISH BROWN VERY FINE TO FINE SAND. SOME MEDIUM SAND TRACE OF FINES ± 27.0'	20.0'- 22.0'	2		
		DARK GREY SILTY CLAY. SOME MICA CRYSTALS. ± 37.0'	30.0'- 32.0'	3		DRY SAMPLE #3
			40.0'- 42.0'	4		DRY TO VERY SLIGHTLY MOIST #4.

SHEET NO. 1 OF 2

N-27

C.V.M. industries

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Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE & PHILADELPHIA PA
Project No. 9200
Boring No. B-28 (CONT'D) Depth 60.5'
Elevation
Spoon Size 2" O.D. Casing Size HW to 4" Core Run
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 11-29-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 8910

Ground Water Data:
0 HOURS AFTER COMPLETION:
WATER AT 15.0'
TOTAL PIPE INSTALLED: 63.0'

Date Completed 11-29-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		DARK RED BROWN SILTY SAND WITH MICA CRYSTALS. FINE SAND. GRADING INTO A SLIGHTLY DRIER LESS SILTS WITH MICA CRYSTALS. ±54.0'	50.0'- 52.0'	5		
		SAND AND GRAVEL MULTI-COLORED 60.0'	58.0'- 60.0'	6		
		WEATHERED SCHIST 60.5'	60.5'	7		
		COMPLETE AT 60.5'				MEASURED WELL AND FOUND 2.0' OF SILT. WILL RETURN TOMORROW AND JET.

SHEET NO. 2 OF 2

New N-27

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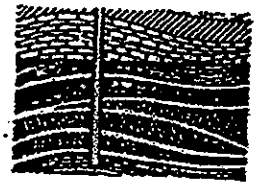

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Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE, PHILADELPHIA PA
Project No. 9200
Boring No. B-38 Depth 60.5'
Elevation
Spoon Size 2" O.D. Casing Size 5 (HOLLOW STEM AUGERS)
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 11-29-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 9290

Ground Water Data:
0 HOURS AFTER COMPLETION:
WATER AT 15.0'
TOTAL PIPE INSTALLED: 63.0'

Date Completed 11-29-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per6"	REMARKS
		ASH AND CINDER FILL. 5.0'				
		OTHER MISCELLANEOUS FILL 7.0'				
		ORANGISH - BROWN VERY FINE SILTY SAND. 15.0'	10.0'– 12.0'	1		SATURATED CONDITIONS AT 15.0'
		ORANGISH BROWN VERY FINE TO FINE SAND. SOME MEDIUM SAND TRACE OF FINES ± 27.0'	20.0'– 22.0'	2		
		DARK GREY SILTY CLAY. SOME MICA CRYSTALS. ± 37.0'	30.0'– 32.0'	3		DRY SAMPLE #3
			40.0'– 42.0'	4		DRY TO VERY SLIGHTLY MOIST #4.

New N-27

C.V.M. industries

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Client ARCO
Project WELL INSTALLATION
Location PARKWAY AVENUE PHILADELPHIA PA
Project No. 9200
Boring No. B-28 (CONT'D) Depth 60.5'
Elevation
Spoon Size 2" O.D. Casing Size HW/SW/NW
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 11-29-84

Driller S.E.
Helper W.N.
Inspector M.C.
Job No. 4870

Ground Water Data:
0 HOURS AFTER COMPLETION:
WATER AT 15.0'
TOTAL PIPE INSTALLED: 63.0'

Date Completed 11-29-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		DARK RED BROWN SILTY SAND WITH MICA CRYSTALS.				
		FINE SAND.				
		GRADING INTO A SLIGHTLY DRIER LESS SILTS	50.0'-			
		WITH MICA CRYSTALS.	52.0'	5		
		± 54.0'				
		SAND AND GRAVEL				
		MULTI-COLORED	58.0'-			
		60.0'	60.0'	6		
		WEATHERED SCHIST.				
		60.5'	60.5'	7		
		COMPLETE AT				MEASURED WELL AND FOUND 2.0' OF SILT.
		60.5'				WILL RETURN TOMORROW AND JET.

SHEET NO. 2 OF 2

N-30

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215-947-2555

Client ....Arco.....
Project ....Well Installation.....
Location ..Passyunk Avenue ..Philadelphia PA
Project No. ....9200.....
Boring No. B-37 (CONT'D) Depth ..60.0'....
Elevation .....
Spoon Size ....2" O.D..... Casing Size ..HW(6.0 NQ(4.76
Core Size ..... Bit No. .....
Hammers:
Spoon, weight ....140#..... Drop....30".....
Drive, weight ..... Drop .....
Date Started ....12-5-84.....

Driller ..S.E.....
Helper ..W.H.....
Inspector ..M.C.....
Job No. ....2870.....

Ground Water Data:
0 HOURS AFTER COMPLETION:
.....
.....
TOTAL PIPE INSTALLED: 63.5'

Date Completed ..12-6-84.....

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MULTI-COLORED TO ORANGE SILTS AND CLAYEY SILTS. ± 45.0'				
		DARK GREY AND BROWN SILTY CLAY WITH TRACE OF MICA CRYSTALS. ± 55.0'	50.0 - 52.0	2		
		REDDISH - BROWN FINE TO MEDIUM SANDS. ± 60.0'				
		COMPLETE AT 60.0'				

SHEET NO..... OF .....

N-30

C.V.M. industries

geotechnical division inc.
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215-947-2555

Client ... Arco
Project ... Well Installation
Location ... Packing Area, Philadelphia PA
Project No. ... 9200
Boring No. ... B-37 Depth ... 60.0'
Elevation ...
Spoon Size ... 2" O.D. Casing Size ... Hollow Stem Augers
Core Size ... Bit No. ...
Hammers:
Spoon, weight ... 140# Drop ... 30"
Drive, weight ... Drop ...
Date Started ... 12-5-84

Driller ... S.E.
Helper ... W.H.
Inspector ... M.L.
Job No. ... 8870

Ground Water Data:
0 HOURS AFTER COMPLETION):
TOTAL PIPE INSTALLED: 63.5'

Date Completed ... 12-6-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		SOIL FILL 3.0'				
		ASH AND CINDER FILL 14.0'				
		ORANGE BROWN SAND AND FINE TO MEDIUM GRAVELS. 26.0'				
		ORANGE SILTS AND CLAY. 30.0'				
		MULTI-COLORED TO ORANGE SILTS AND CLAYEY SILTS.	40.0 - 42.0	1		

SHEET NO. 1 OF 2

N-46

C.V.M. industries

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215-947-2555

Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE - PHILADELPHIA PA
Project No. 9200
Boring No. B-40 Depth 55.0'
Elevation
Spoon Size 2" O.D. Casing Size 10" I.D. FLUSH COUPLED
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 12-4-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 8390

Ground Water Data:
0 HOURS AFTER COMPLETION:

TOTAL PIPE INSTALLED: 58.5'

Date Completed 12-5-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS SOIL FILL 3.0'				
		DARK GREY ORGANIC SILT. 7.0'				
		TAN TO MULTI-COLORED FINE TO COARSE SAND AND GRAVEL. 25.0'				HYDRO CARBON ODOR APPARENT
		SILTY FINE TO COARSE SAND. TANNISH-GREY ± 35.0'	30.0'-32.0'	1		MOIST

SHEET NO. 1 OF 2

N-46

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215-947-2555

Client ... Arco
Project ... Well Installation
Location ... Passyunk Avenue, Philadelphia PA
Project No. ... 9200
Boring No. B-40 (CONT'D) Depth ... 55.0'
Elevation ...
Spoon Size ... 2" O.D. Casing Size ... 10 3/4" O.D. Steel Risers
Core Size ... Bit No. ...
Hammers:
Spoon, weight ... 140# Drop ... 30"
Drive, weight ... Drop ...
Date Started ... 12-4-84

Driller ... S.E.
Helper ... W.H.
Inspector ... M.C.
Job No. ... 2890

Ground Water Data:
0 HOURS AFTER COMPLETION:
TOTAL PIPE INSTALLED: 58.5'

Date Completed ... 12-5-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		DARK GREY SILTY CLAY. ± 46.0'	40.0 – 42.0	2		
		REDDISH BROWN FINE MEDIUM AND COARSE SAND. TRACE OF FINES. ± 55.0'	50.0 – 52.0	3		
		COMPLETE AT 55.0'				

SHEET NO. 2 OF 2

U-50

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Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE, PHILADELPHIA PA
Project No. 9200
Boring No. B-57 Depth 60.0'
Elevation
Spoon Size 2" O.D. Casing Size HOLLOW STEM AUGERS
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 12-6-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 9290

Ground Water Data:
0 HOURS AFTER COMPLETION:

TOTAL PIPE INSTALLED: 64.0'

Date Completed 12-7-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per6"	REMARKS
		MISCELLANEOUS SOIL FILL (SANDS SILTS AND CLAY)				
		10.0'				
		MULTI-COLORED FINE TO COARSE SAND AND GRAVEL.				STRONG HYDROCARBON AROMA
		38.0'				
		DARK GREY SANDY SILTY CLAY COARSE SAND FINE GRAVEL.				

N-50

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215-947-2555

Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE, PHILADELPHIA PA
Project No. 9200
Boring No. B-57 (CONT'D) Depth 60.0'
Elevation
Spoon Size 2" O.D. Casing Size HOLLOW STEM AUGERS
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 12-6-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 8910

Ground Water Data:
0 HOURS AFTER COMPLETION:

TOTAL PIPE INSTALLED: 64.0'

Date Completed 12-7-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		DARK GREY SANDY SILTY CLAY.	40.0'+			
			42.0'	1		
		COARSE SAND FINE GRAVEL.	50.0'+			
			52.0'	2		
		55.0'				
		FINE TO MEDIUM REDDISH BROWN SAND. 60.0'				
		COMPLETE AT 60.0'				

SHEET NO. ..... OF .....

U-21

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215-947-2555

Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE, PHILADELPHIA PA
Project No. 9200
Boring No. B-24 (CONT'D) Depth 51.5'
Elevation
Spoon Size 2" O.D. Casing Size (HOLLOW) STEM AUGERS
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 11-30-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 9290

Ground Water Data:
0 HOURS AFTER COMPLETION:
TOTAL PIPE INSTALLED: 55.0'

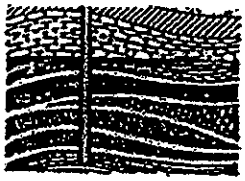
Date Completed

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		BROWN SAND TRACE OF FINES	50.0'-52.0'	3		
		51.5'				
		COMPLETE AT 51.5'				

SHEET NO. 2 OF 2

N-21

C.V.M. industries



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Client ARCO
Project WELL INSTALLATION
Location PASSYUNK AVENUE PHILADELPHIA PA
Project No. 9200
Boring No. B-24 (CONT'D) Depth 51.5'
Elevation
Spoon Size 2" O.D. Casing Size 10 3/4" O.D. SCHEDULE 40 PIPE
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 11-30-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 8890

Ground Water Data:
0 HOURS AFTER COMPLETION:

TOTAL PIPE INSTALLED: 55.0'

Date Completed

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		BROWN SAND	50.0'- 52.0'	3		
		TRACE OF FINES				
		51.5'				
		COMPLETE AT 51.5'				

SHEET NO. 2 OF 2

NEW N-21

C.V.M. industries

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post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client ARCO
Project WELL INSTALLATIONS
Location PASSYUNK AVENUE, PHILADELPHIA, PA
Project No. 9200
Boring No. B-24 Depth 51.5'
Elevation
Spoon Size 2" O.D. Casing Size 4" I.D. FLUSH JOINTS
Core Size Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 11-30-84

Driller S.E.
Helper W.H.
Inspector M.C.
Job No. 9290

Ground Water Data:
0 HOURS AFTER COMPLETION:
TOTAL PIPE INSTALLED: 55.0'

Date Completed 11-30-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS SOIL FILL 7.0'				3.5' STICK UP
		BROWN FINE SAND 15.0'				HYDRO CARBON ODOR ENCOUNTERED.
		BROWN MEDIUM TO COARSE SAND AND FINE TO MEDIUM GRAVEL. 17.0'				
		DARK GREY FINE SAND AND SILT - POSSIBLE TRACE OF CLAY 20.0'				
		DARK GREY FINE SAND AND SILT. SOME CLAY. 30.0'	30.0'-32.0'	1		
		GREENISH REDDISH SANDY SILT SOME MICA CRYSTALS. SOME CLAY. 40.0'	40.0'-42.0'	2		

AOI-9

MONITORING WELL LOG: S-74D2 SRTF

PROJECT:	**Sunoco - Philadelphia Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-9 - SRTF**	DRILLING METHOD:	**Mud Rotary**
JOB NO.:		SAMPLING METHOD:	**Split Spoon Sampling**
LOGGED BY:	**Tiffani Doerr**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**7/13-7/14/2009**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**42'**	ELEVATION:	**-**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Fill - mostly gravel with some sandy clay material with glass pieces			
-5				Previoiusly cleared to 10', backfilled with sand		
-10				Steel casing set to 10', drilled to 16' then started spoons		
-15	0.0		Saturated, gray/brown organic clay, few very fine sands, much organic /plant material, slight odors, BC=14-16-22-24 (12" recovery)			
	0.0		Same as above, BC=1-1-1-1 (6" recovery)			
-20					32' PVC Riser	

MONITORING WELL LOG: S-74D2 SRTF

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-25	0.0		Same material, less plant matter, no sands, BC=9-22-24-36 (Full recovery)			
	0.0					
	0.0		Same as above, little plant material, no sands, BC=16-14-13-12			
-30	0.0					
			Clay with 1/4-1/2" gravels - mix of rounded and angular quartz, quartzite and sandstone gravels (red/yellow/green/pink)			
-35	0.0			Loss of drilling fluids @ 36' (used thicker mix)		
			Loose sands			
-40			Coarse, multi-colored (varying composition) sands	Tried spoon @ 40' - no recovery/spoon refusal	10' PVC Screen	
-45				Rotary/auger refusal at 46' (some collapse - well installed to 42')		

MONITORING WELL LOG: S-120D SRTF

PROJECT:	**Sunoco - Philadelphia Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-9 - SRTF**	DRILLING METHOD:	**6" Hollow Stem Auger**
JOB NO.:		SAMPLING METHOD:	**Split Spoon Sampling**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**6/12/2009**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**35'**	ELEVATION:	**-**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0						
-5				Cleared to 10', backfilled with sand		
-10	-		Sand from backfill (10% recovery)			
	-		Same			
	0.0		Gray, fine sandy clay with organic matter (wood), wet, no odor, BC=2-3-3-4 (Full Recovery)			
	0.0					
	0.0		Same as above, change in color to dark gray, BC=3-2-4-5 (Full Recovery)			
-15	0.0				25' PVC Riser	
	0.0		Dark gray fine sandy clay, very moist, no odor, wood/organic matter in last 6", BC=2-2-3-6 (Full Recovery)			
	0.0					

MONITORING WELL LOG: S-120D SRTF

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0		Dark gray coarse sand, trace clay, wet, no odor, BC=5-4-3-4 (6" Recovery)			
	0.0					
-20	0.0		Brown/red coarse sand and gravel, wet, no odor, BC=9-10-15-19 (10" Recovery)			
	0.0					
	0.0		Medium brown coarse sand and gravel, wet, no odor, trace gray clay, BC=11-13-16-21 (Full Recovery)			
	0.0					
	0.0		Top 12" - Dark gray fine sand and clay, wet, Bottom 6" - medium brown coarse sand and gravel, wet, no odor, BC=10-10-9-10 (18" Recovery)			
-25	0.0					
	0.0		Top 6" - Gray fine sand and clay, wet, Bottom 6" - Medium brown coarse sand and gravel, wet, no odor, BC=17-14-16-20 (12" Recovery)			
	0.0					
	0.6		Medium brown, wet, fine - coarse sand and gravel, no odor, BC=14-15-17-11 (Full Recovery)			
	0.0					
-30	0.0		Gray sandy clay and gravel, wet, Bottom 4" - coarse sand and gravel, BC=17-7-12-22 (Full Recovery)		10' PVC Screen	
	0.0					
	2.0		Coarse sand and gravel, wet, Bottom 6" - slight odor with yellow tint, BC=12-13-50/1 (12" Recovery)			
	1.7					
	1.6		Coarse sand and gravel, yellow/brown tint, slight odor, BC=15-40/1-27 (10" Recovery)	Auger refusal @ 35'		
-35						

AOI-10

MONITORING WELL LOG: W-1D

PROJECT:	**Sunoco-Philadelphia Refinery**	DRILLING CO.:	**Parratt Wolff**
SITE LOCATION:	**AOI-10**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:		SAMPLING METHOD:	**4' Acetate Sleeves & SS**
LOGGED BY:	**Tiffani Doerr**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**4/5/11-4/6/11**	WELLBORE DIAMETER:	**6.25"**
TOTAL DEPTH:	**76.5'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0	0.0		1' topsoil beneath grass.	Core samples from surface to depth using acetate sleeves; no utility clearance.		
	0.0		FILL: medium brown and orange fine sand w/clay; whole brick 1.5'-2'. No odors.	0'-2' Sample submitted to laboratory for analysis		
	0.0		(BC=47/2'-4-8-16-24) Same as above to 5.5'. Fill: Dark gray/black cinders and sand, very little fines, with some brick and concrete pieces. Odors.			
-5	0.0					
	0.0					
	0.0					
	0.0		(BC=5-6-3-3-3-3-3-2) Fill: saturated cinders, sand, loose, petroleum globules on water. Sheen. Odors.			
	0.0					
-10	0.0				Grout slurry (0'-57.5')	
	0.0					
	0.0		(BC=2-3-2-1-2-1-1-1) 6" Recovery: m-c light brown SAND.			
	0.0					
	0.0					
-15	0.0					
	0.0		(BC=2-2-2-2-2-3-2-2) 16'-17' mix of loose saturated sands and light gray clay. 17'-20' light gray CLAY; trace round gravel near 17', rest clay has 5% organics (grasses).			
	0.0					
	0.0					
-20	0.0		(BC=WOH/1'-2-0-2-2-2-2) Same w/ ~15% organic material.			
	0.0					
	0.0					

MONITORING WELL LOG: W-1D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	0.0					
	0.0		(BC=WOH/2'-1-1-1-1) Same: sl micaceous, no odors.			
-25	0.0					
	0.0					
	0.0					
	0.0		(BC=WOH/2') Split Spoon: Same: light gray clay, sl micaceous some organics.			
-30	0.0		(BC=WOH/2'-3-2-2-3) Same: trace round gravel, 10% organics; trace layers of very fine light gray sands.			
	0.0					
			(BC=WOH/2'-1-1-1-1) Same: no gravel, trace organics, trace fine sands.			
-35	0.0					
	0.0					
			(BC=WOH/2') Same as above.			
-40	0.0		(BC=WOH/3'2-2) Same as above.			
	0.0					
			(BC=WOH/2'-3-3-3-3) Same as above.			
-45	0.0					
	0.0					
			(BC=WOH-3-3-5) Split Spoon: same as above.			

MONITORING WELL LOG: W-1D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-50	0.0		(BC=WOH/1'-3-3-4-2-3-3) Fine sand to 52', clay with organics to 54'.			
	0.0					
			(BC=WOH/1'3-4-6-7-4-4) Gray clay with fine sands.			
-55	0.0					
	0.0					
			(BC=3-3-3-3) Split Spoon: Med gray clay with few very fine thin sand layers. 2" coarse gray sand at 60'.		Bentonite (57.5'-62.5')	
-60	0.0		(BC=1-1-3-3-3-3-3-4) Top 6" coarse gray sand; rest gray clay, no sands, browning near bottom, not micaceous.			
	0.0					
					Sand (62.5'-66.5')	
			(BC=WOH/1.5'-8-8-5-6-5) To 66' coarse sand; to 68' dark gray-brn silty clay with few black organic layers.			
-65						
			(BC=WOH-7-14-18) Dark gray alternating silty clay and med sand. @69.5' coarse SAND and GRAVEL mixed (gravel f-m well rounded, multi-colored).			
-70	0.0		(BC=12-25-12-17-75/0.7') Red-brown f-c mixed SAND and GRAVEL: Coarse gravel in tip of sleeve (red, black & gray sandstones).		Screen (66.5'-76.5')	
	0.0					
			Auger to 74' through gravels.			
			(BC=4-3-5-15-35-75/1") Stiff dark gray CLAY with trace fine round gravel. Bottom few inches are black/white mica - weathered SCHIST.			
-75	0.0					
	0.0					

W-9

Sheet 1 of 2

ENSR

Project No. 6445-017 Date - Start 3/6/92 Finish 3/12/92 Boring B-20

Project Name SUN OIL Drilling Co. EMPIRE

Location West Yard (SWMU-1) Drilling Method Mud Rotary

Total Depth 79' Inspector SFS Reviewer Charles E. Martin

Remarks Log rewritten From Field original (MW)

Depth Feet	Sample Type & No.	Blows per 6 in:	Depth Range	Rec.	Graphic Log	Lithologic Description	Equipment Installed HNU	SAMPLE
	S-1	5-10-8-7	0-2	14"	ML	black SILT, dry, hydrocarbon odor	32	
	S-2	5-8-10-	2-4	16"		-same-	44	120A
5	S-3	4-4-4-8	4-6	8"		black SILT w/ sand, fr gravel (sat.) strong HC odor	36	
	S-4	6-6-5-7	6-8	24"	SP	black M-C SAND and GRAVEL (to 3/4" ø) strong HC odor	10	120B
	S-5	4-3-1-2	8-10	20"		-same- w/ F Gravel seam	15	
10	S-6	2-7-13-9	10-12	20"	Pt	black PEAT, (HC sat) wood frag.	13	
	S-7	4-3-4-5	12-14	18"	OH/OL	gray-green SILT w/ CLAY (soft, plastic) strong HC odor	15	
	S-8	1-2-2-1	14-16	3"		-same- w/ wood frags.	25	
15	S-9	2-2-12	16-18	24"		"	36	
	S-10	1-2-1-1	18-20	24"			25	
20	S-11	3-2-2-3	20-22	20"	OH/OL	brown-grey SILT w/ CLAY and organics (peat-like)	20	
	S-12	1-1-1-2	22-24	22"		-same-	34	
25	S-13	1-1-2-2	24-26	24"		"	105?	
	S-14	1-1-1-1	26-28	22"		"	Meter broken	
	S-15	2-1-1-1	28-30	24"		"	"	GEOTE
30	S-16	NR	30-32	—		(no sample)	—	
	S-17	NR	32-34	—		(no sample)	—	
35	S-18	1-2-1-1	34-36	24"	OH	gray CLAY, some Silt, wood frags.	3	
	S-19	1-2-1-1	36-38	24"		"	2.1	
	S-20	2-2-3-2	38-40	24"		"	2.5	

M690278

W-9

ENSR BORING LOG (continued)

Project 6445-017 Boring B-20 Sheet 2 of 2

Depth Feet	Sample Type & No.	Blows per 6 in.	Depth Range	Rec.	Graphic Log	Lithologic Description	Equipment Installed HNU
40	S-21	1-1-1-1	40-42	24"	ML	gray SILT and F SAND, some Clay	3.4
	S-22	2-2-1-2	42-44	0"		(no recovery)	—
45	S-23	1-1-1-1	44-46	24"	ML	gray SILT and F SAND, some Clay	5.6
	S-24	2-2-3-3	46-48	24"		— same — tr. Clay	10
						48	
	S-25	3-3-2-1	48-50	18"	OL	gray SILT and CLAY	11.2
50	S-26	1-1-1-1	50-52	0"		(no recovery)	—
	S-27	2-2-2-3	52-54	24"	ML	gray F SAND and SILT, tr. Clay	5
55	S-28	1-1-2-13	54-56	24"		— same —	16.4
						55.5	
	S-29	5-5-6-9	56-58	6"	SP	gray-brown M-C SAND, some Gravel	25
	S-30	44-6-10	58-60	6"		— same —	10.8
60	S-31	4-7-7-13	60-62	0"		(no recovery)	—
						62	
	S-32	7-8-9-11	62-64	18"	OL	dk brown SILT, tr. Clay, peat	8.9
						64	
65	S-33	22-21-16-18	64-66	6"	SP	red-brown M-C SAND and GRAVEL, some Silt	11
	S-34	14-16-18-20	66-68	8"			9.8
							1200
	S-35	14-23-21-20	68-70	21"			12
						69.5	
70	S-36	21-17-17-17	70-72	12"	CL	gray-green CLAY, some Silt (dense) — same —	10.2
					SP	72 gray-green M-C SAND	
	S-37	14-17-80-100/4	72-74	14"	CL	CLAY, some Silt	11.8
					SP	75 M-C SAND	
75	S-38	5-7-7-10	74-76	24"	CL	gray CLAY, some Silt	NR
						76	
	S-39	7-10-17-47	76-78	24"	SP	gray M-C SAND, some Gravel	NR
	S-40	17-47-100/.5	78-78.8	15"		78.8 — same — green SCHIST	NR
80						79' Bottom of boring @ 79'	

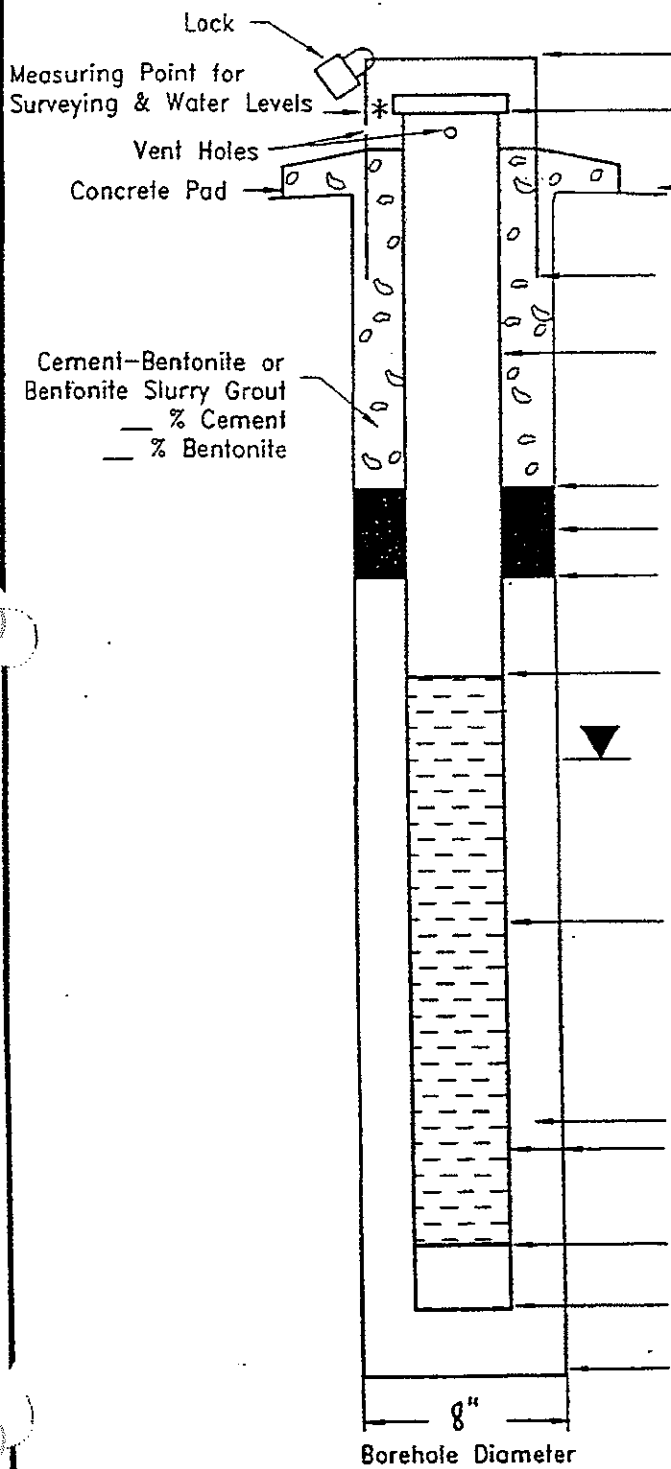
W-9

Project No: 6145-017 Client: SUN OIL Site: Philadelphia, PA | WELL No: MW-20

Well Location: WEST YARD | Date Installed: 3/12/92

Tractor: EMPIRE Method: MUD ROTARY Inspector: J. Rig

MONITORING WELL CONSTRUCTION DETAIL



		Depth from G.S. (feet)	Elevation (NGVD)
Top of Steel Guard Pipe		2.13	
Top of Riser Pipe		1.73	
Ground Surface (G.S.)		0.00	
Bottom of Steel Guard Pipe			
Riser Pipe:			
Length	52'		
Inside Diameter (ID)	2"		
Type of Material	PVC		
Top of Bentonite Seal		46'	
Bentonite Seal Thickness	2'		
Top of Sand		48'	
Top of Screen		50'	
Stabilized Water Level			
Screen:			
Length	10'		
Inside Diameter (ID)	2"		
Slot Size	0.020		
Type of Material	PVC		
Type/Size of Sand	Silica/#2		
Sand Pack Thickness	3"		
Bottom of Screen		60'	
Bottom of Tail Pipe:			
Length	.5'		
Bottom of Borehole		79'	

Approved:

* Describe Measuring Point:

Signature Date

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W-13

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Sheet 1 of

Project No. 6445-017 Date - Start 3/10/92 Finish 3/13/92 Boring B-25

Project Name Sun Oil Drilling Co. Empire

Location West Yard Drilling Method Mud Rotary

Total Depth 74' Inspector BEM Reviewer Charles E. Martin

Remarks

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
0						Drilling thru fill NO Samples Taken (Visible HC in mud)	
5							
10	S-1	1-0 0-0	10-15	16"	OL	SILT. Trace Clay, Peat; V-Soft. Grey Brown. WET	
15	S-2	1-0 1-0	15-17	20"	OL	As Above, moist, decreasing in % water with depth, and increasing with % Peat + Clay	10" casing
20	—	—	21-23	18"			Shelby Tube
25	S-3	1-0 0-0	25-27	24"	OL	As Above, Trace Peat + Clay damp	12 1AA
30	S-4	1-0 0-0	30-32	24	OL	SILT, Trace Peat, V. Soft, Brown damp	GeoTech
35	S-5	1-0 0-0	35-37	24"	OL	SIT. V-Soft. Layered, Brown damp River Sediment	
40							

V890278

ENSR Project Sun Oil BORING LOG (continued) Boring B-21 W-13 Sheet 2 of 2

Depth Feet	Sample Type & No.	Blows per 6 in.	Depth Range	Rec.	Graphic Log	Lithologic Description	Equipment Installed Sample
40	S-6	1-0 0-3	40-42	24	OL	SILT, V-SOFT, Layers, Brown, Damp, River Sediments	
45	S-7	1-0 0-0	45-47	24"	OL	SILT, V-Soft, Trace F. Sand Brown, WET	
50	S-8	1-0 0-0	50-52	24"	OL	SILT-AS Above, Layers, Damp Organic Layer - Leaves 1"	
55	S-9	1-0 0-0	55-57	10"	SP 56.5	Sand, med-Coarse, Poorly Sorted Trace Silt, Loose, Brown, WET	
60	S-10	8-16 25-27	60-62	15"	SP/SW	Sand, Fine-Crse, Trace Med Gravel and Silt, Med Dense, Brown, WET	121BA 121BB
65	S-11	30-26 30-36	65-67	8"	SP 66	Sand, med-Crse, Poorly Sorted, Trace Silt-med dense, Brown, WET	GEOTECH.
					ML	SILT, STIFF, Layers, Brown, Damp	
70	S-12	1-0 25, 32	70-72	15"		As Above Trace Clay	
					SP 71	Sand Fine to med, Trace F Gravel, Silt (loose, micaceous)	
	S-13	15-100/5"	73-74	8"	73	Weathered BEDROCK - mica schist	
75						BOH 74.0	

M690248

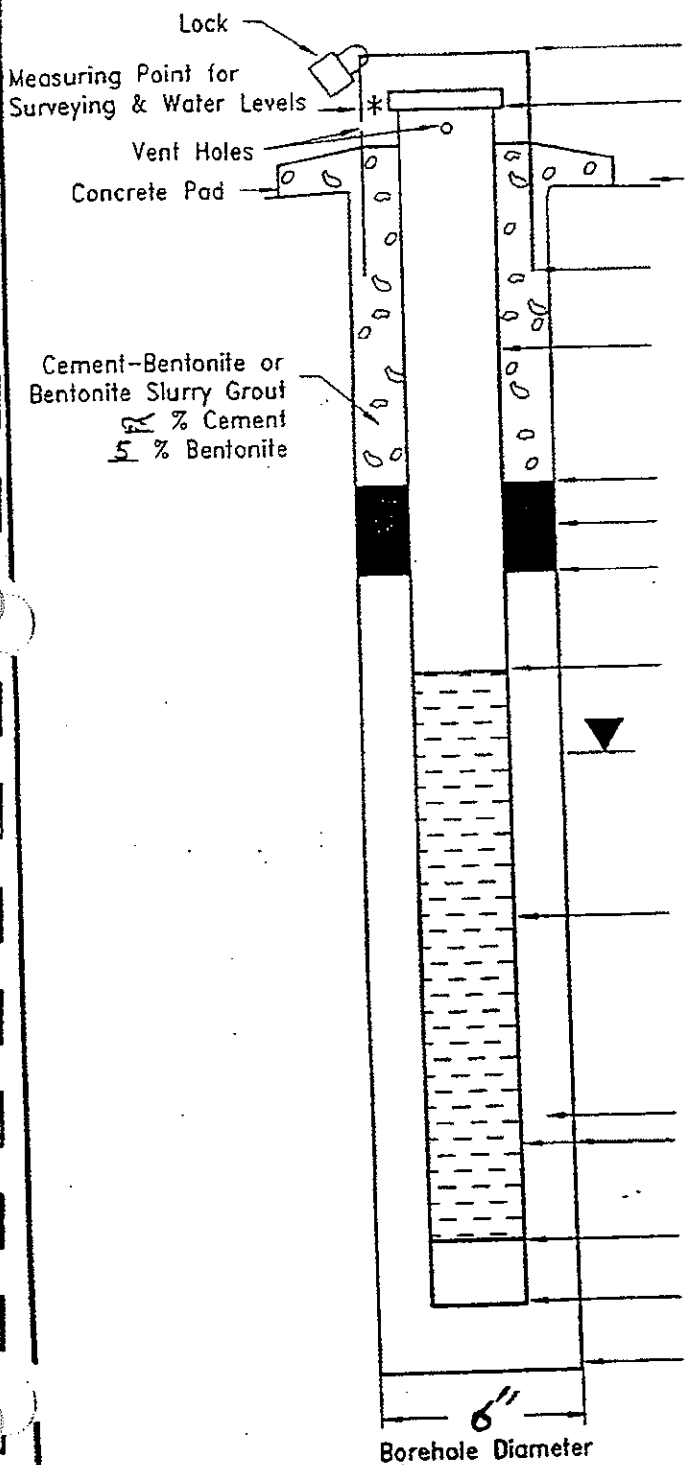
W-13

Project No: 1445-017 Client: Sun Oil Site: Sun Oil WELL No: MW-21

Well Location: West Yard Date Installed: 3/12/92

Contractor: Empire Method: Mud Rotary Inspector: BEM

MONITORING WELL CONSTRUCTION DETAIL



		Depth from G.S. (feet)	Elevation (NGVD)
Top of Steel Guard Pipe		1.70 2.0'	
Top of Riser Pipe		1.5'	
Ground Surface (G.S.)		0.00	
Bottom of Steel Guard Pipe		20.0'	
Riser Pipe: Length	59.0'		
Inside Diameter (ID)	2"		
Type of Material	PVC		
Top of Bentonite Seal		52.0'	
Bentonite Seal Thickness	2.0'		
Top of Sand		54.0'	
Top of Screen		57.0'	
Stabilized Water Level			
Screen: Length	10'		
Inside Diameter (ID)	2"		
Slot Size	.020		
Type of Material	PVC		
Type/Size of Sand	Omaic		
Sand Pack Thickness	2		
Bottom of Screen		67.0'	
Bottom of Tail Pipe: Length	3"	67.0'	
Bottom of Borehole		74.0'	

Approved:

* Describe Measuring Point:

Signature Date

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Sheet 1 of 2

Project No. 6445-017 Date - Start 3/23/92 Finish 3/24/92 Boring B-27 W-19

Project Name SUN OIL Drilling Co. EMPIRE

Location SWMU-1 (W. Yard Drilling Method MUD ROTARY

Total Depth 83' Inspector C. MARTIN Reviewer

Remarks Well along Tilly Lane; nxt to MW-17

Depth Feet	Sample Type & No.	Sample Blows per 6 in.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
5						FILL	
10					? MH	Silt (from cuttings)	
15	S-1	~~(push)~~ WOR	15-17	10"	CL 15.5' SP ?	~~Soft~~ gray CLAY black Med SAND	6" casing to 19'
20	S-2	WOR	20-22'	20"	OH	gray SILT (soft), ~~trclay~~, some clay, organics clean	
25	S-3	WOR	25-27	18"	OH	gr/brown SILT w/ organics, tr clay, C gravel	
30	S-4	WOR	30-32	18"	31.5' OH/PT	Same br. SILT and Organics (almost peat)	
35	S-5	WOR	35-37	15"	OH	gr/brown SILT, some clay, orgs	
					?	gr SILT w/ CLAY, some orgs.	

M690278

ENSR Project 6445-017 Boring B-7 Sheet 2 of 2

W-19

Depth Feet	Sample Type & No.	Blows per 6 in.	Depth Range	Rec.	Graphic Log	Lithologic Description	Equipment Installed
40	S-6	WOR	40-42	20"	OH	gr SILT w/ CLAY, some orgs. (some plasticity, soft)	
45	S-7	WOR	45-47	24"	OH	gr SILT and CLAY, tr. orgs.	
50	S-8	WOR	50-52	24"		— same —	
55	S-9	WOR	55-57	24"		— same — (no orgs.)	
60	S-10	WOR/1/1	60-62	22"	SP 60 / 60.5	M SAND	
					OH 61.8	gr SILT and CLAY w/ M SAND	
65	S-11	4/13/10/12	65-67	8"	SP	br M SAND, micaceous thin silt layers, tr-orgs.	P.67 S
70	S-12	—	70-72	12"	SM	br SILT + F SAND, micaceous, w/orgs. some M Sand	70
75	S-13	14/23/24/24	75-77	10"	SP	br M-C SAND w/ C Gravel (to 1.5")	
			77			(hard drilling starts here)	
80	S-14	24/17/14/27	80-82	2"	SP	gr (cobble frags. only)	80
						(loosing water/mud in gravel)	
83'						(v. hard drilling, probable Bedrock surface (no sample taken))	
						E.O.B. @ 83'	

1415 WI M50 Sand

M890248

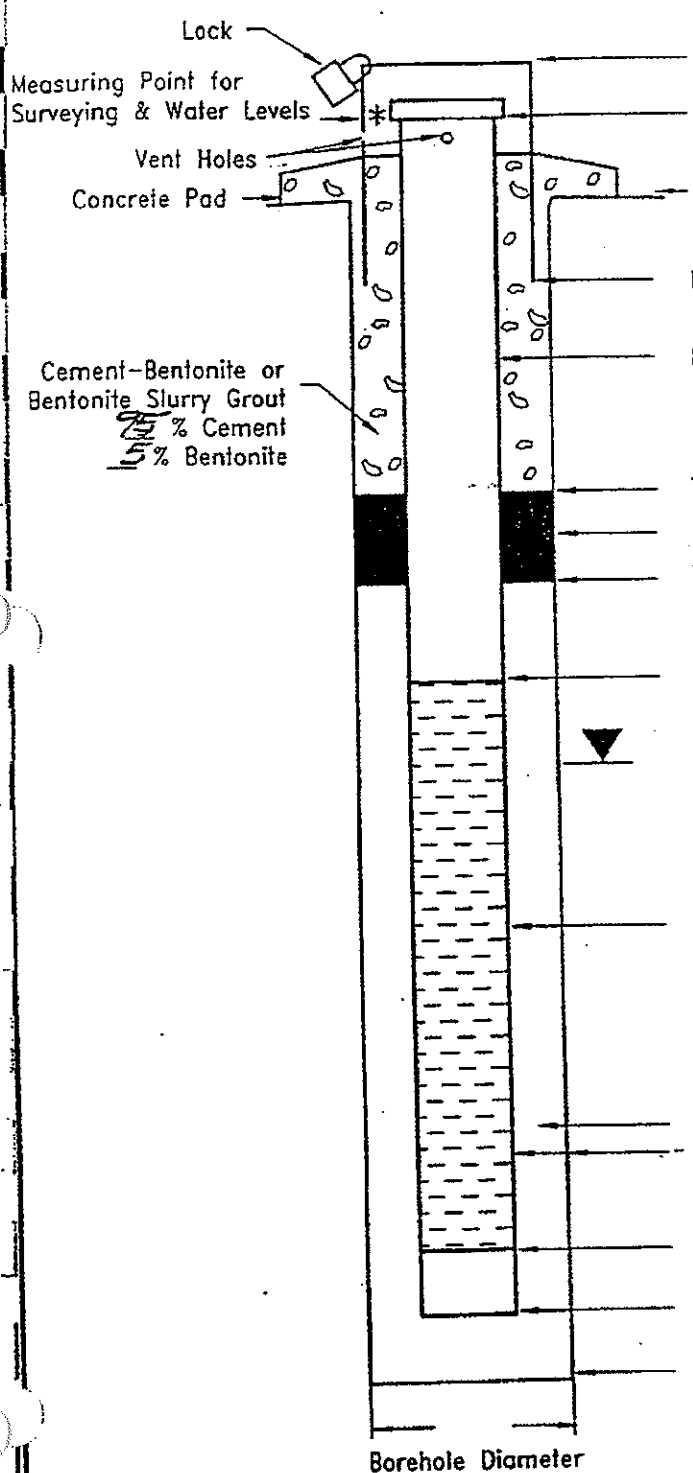
Project No: 6445-017 Client: SUN Site: SWMU-1 WELL No: MW-27

Well Location: SWMU-1 (Tilly Lane) Date Installed: 3/25/93

Contractor: EMPIRE Method: Mud Rotary Inspector: C. Martin

W-19

MONITORING WELL CONSTRUCTION DETAIL



		Depth from G.S. (feet)	Elevation (NGVD)
	SM 5/27/93		
Top of Steel Guard Pipe	2.05	~2.0	
Top of Riser Pipe	1.53	~1.5	
Ground Surface (G.S.)		0.00	
Bottom of Steel Guard Pipe		19'	
Riser Pipe: Length	72'		
Inside Diameter (ID)	2"		
Type of Material	PVC		
Top of Bentonite Seal		65	
Bentonite Seal Thickness	3"		
Top of Sand		67	
Top of Screen		70	
Stabilized Water Level			
Screen: Length	10'		
Inside Diameter (ID)	2"		
Slot Size	.020		
Type of Material	PVC		
Type/Size of Sand	#2 Morie		
Sand Pack Thickness	3"		
Bottom of Screen		79.70	
Bottom of Tail Pipe: Length	~~~~ ~0.30	80	
Bottom of Borehole		83	

Approved:

* Describe Measuring Point: top of PVC

Signature Date

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W-26

Sheet 1 of 1

ENSR

Project No. 6445-017 Date - Start 3/3/92 Finish 3/4/92 Boring B-19

Project Name SUN OIL Drilling Co. EMPIRE

Location SWMU-1 West Yard Drilling Method MUD ROTARY

Total Depth 37' Inspector C. MARTIN/S. SYMONDS Reviewer

Remarks

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
						(blank drill to 20')	
5	S-1 / AF-1	(B-18)	5-9				19'
						FILL	
10							
~12'							
15					CL/ML	CLAY/SILT	
16'							
20	S-1	—	20-22	12"	SW	brown M-C SAND w/ C Gravel (½-1") some F Sand v dense	GEO.
25	S-2	4-24-33-32	25-27	6"	SW	— same —	
28							
30	S-3	5-9-10-13	30-32	12"	BR	green/br. wthrd rock — gneiss (decomposed to silt consistency) granular composition, banding still evident	
35	S-4	—	37	8"	BR	— same —	
37						E.O.B @ 37'	

HNu=2 units

HNu=32 units

1400 ND

M690278

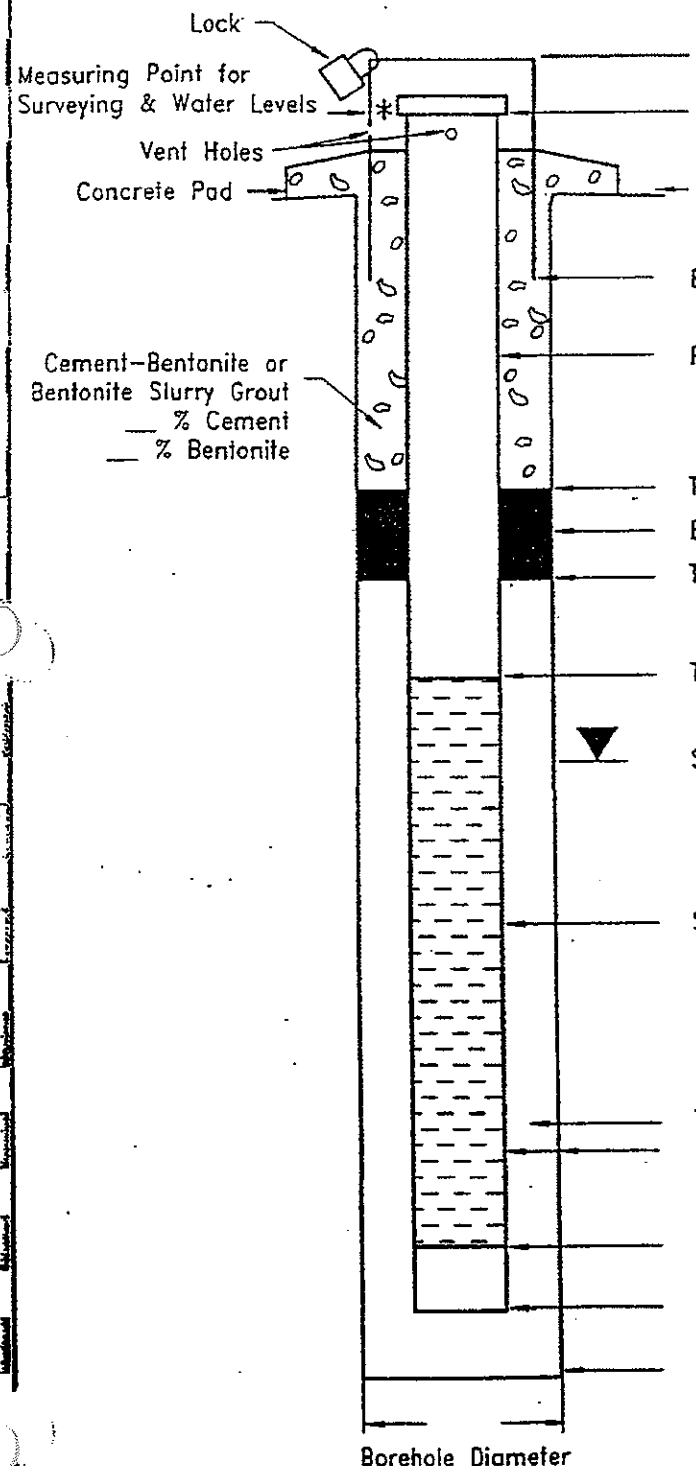
W-26

Project No: 6445-017 Client: SUN OIL Site: Sun Oil Refinery WELL No: B-19

Well Location: SEE MAP - SWMU (1) Date Installed: 3/4/92

Contractor: EMPIRE Method: Mud Rotary Inspector: SFS

MONITORING WELL CONSTRUCTION DETAIL



	Depth from G.S. (feet)	Elevation (NGVD)
Top of Steel Guard Pipe	1.70	
Top of Riser Pipe (TP 5/27/93)	1.45	
Ground Surface (G.S.)	0.00	
Bottom of Steel Guard Pipe		
Riser Pipe: Length 20'		
Inside Diameter (ID) 2 inch		
Type of Material PVC		
Top of Bentonite Seal	15'	
Bentonite Seal Thickness 2 FT		
Top of Sand	17'	
Top of Screen	18'	
Stabilized Water Level		
Screen: Length 5'		
Inside Diameter (ID) 2 inch		
Slot Size 0.010		
Type of Material PVC		
Type/Size of Sand		
Sand Pack Thickness		
Bottom of Screen	23'	
Bottom of Tail Pipe: Length 5	23	
Bottom of Borehole (TD 5/27/93)	27'	

natural cave in to 23 ft.

Approved:

* Describe Measuring Point:

Signature Date

ENSR

MONITORING WELL LOG: W-32D

PROJECT:	**Sunoco-Philadelphia Refinery**	DRILLING CO.:	**Parratt Wolff**
SITE LOCATION:	**AOI-10**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:		SAMPLING METHOD:	**4' Acetate Sleeves & SS**
LOGGED BY:	**Tiffani Doerr**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**4/7/11-4/8/11**	WELLBORE DIAMETER:	**6.25"**
TOTAL DEPTH:	**53'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0	0.0		8" topsoil - wooded area (BC=1-13-12-13-14-6-5-6) FILL: medium brown sl moist sand w/ little clay and gravel and slag material.	Core samples from surface to depth using acetate sleeves; no utility clearance.		
	0.0		(BC=3-4-3-3-2-3-2-2) Fill: Med brown sl moist clayey sandy soil w/lg piece of asphalt in tip	0'-2' Sample submitted to laboratory for analysis		
-5	0.3					
	34		(BC=5-11-6-7) Split Spoon: WASTE: (8'-9') Wet, loose, black sandy oily sludge material (not platy). (9'-10') Wood, dk gray/blk clayey sand w/rock frags, oily/wet at 10'.			
-10	71.7		(BC=3-5-6-2-2-2-2-5) (10'-14') Brick frags and black oily slag material.		Grout slurry (0'-47')	
	39.5					
-15			(BC=1-1-2-2-3-4-3-3) Clayey sand w/round gravel; pottery piece, oily.			
	83.6					
	27.6		(BC=5-11-10-4) Split spoon: Same as above.			
-20	104		(BC=4-2-2-3-3-3-5-5) Top 2" same. Rest: dark gray CLAY 5% organics, moist.			
	267					

MONITORING WELL LOG: W-32D

Aquaterra Technologies, Inc.

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-25	11.4		(BC=2-2-2-WOH-2-2-3-2) Same clay with 10% organics (grasses), wet.			
	5.4					
	6.7		(BC=WOH-WOH-2-2) Split spoon: Same w/loose graveley clay at 28-28.5'.			
-30	4.9		(BC=WOH/2'-1-2-4-3) Same: tight clay, gray/brown organic material, moist.			
	3.9					
	2.8		(BC=2-3-WOH/1'-3-4-3-3) Same as above to 36' - then soft brown clay w/organics.			
-35	4.9					
	5.7		(BC=2-4-3-3) Split spoon. Same as above.			
	5.6				Bentonite (37'-40')	
-40	2.5		(BC=3-3-2-1-2-4-2-3) Same as above to 42', then gray clay, tight, sl micaceous, trace fine sand.		Sand (40'-53')	
	4.6					
	4.4		(BC=3-2-3-2-4-2-3-3) No recovery.			
-45					Screen (43'-53')	
			(BC=2-1-2-1) Split spoon: Gray clay, wet, loose w/trace fine sand.			
	2.1					

MONITORING WELL LOG: W-32D

Aquaterra Technologies, Inc.

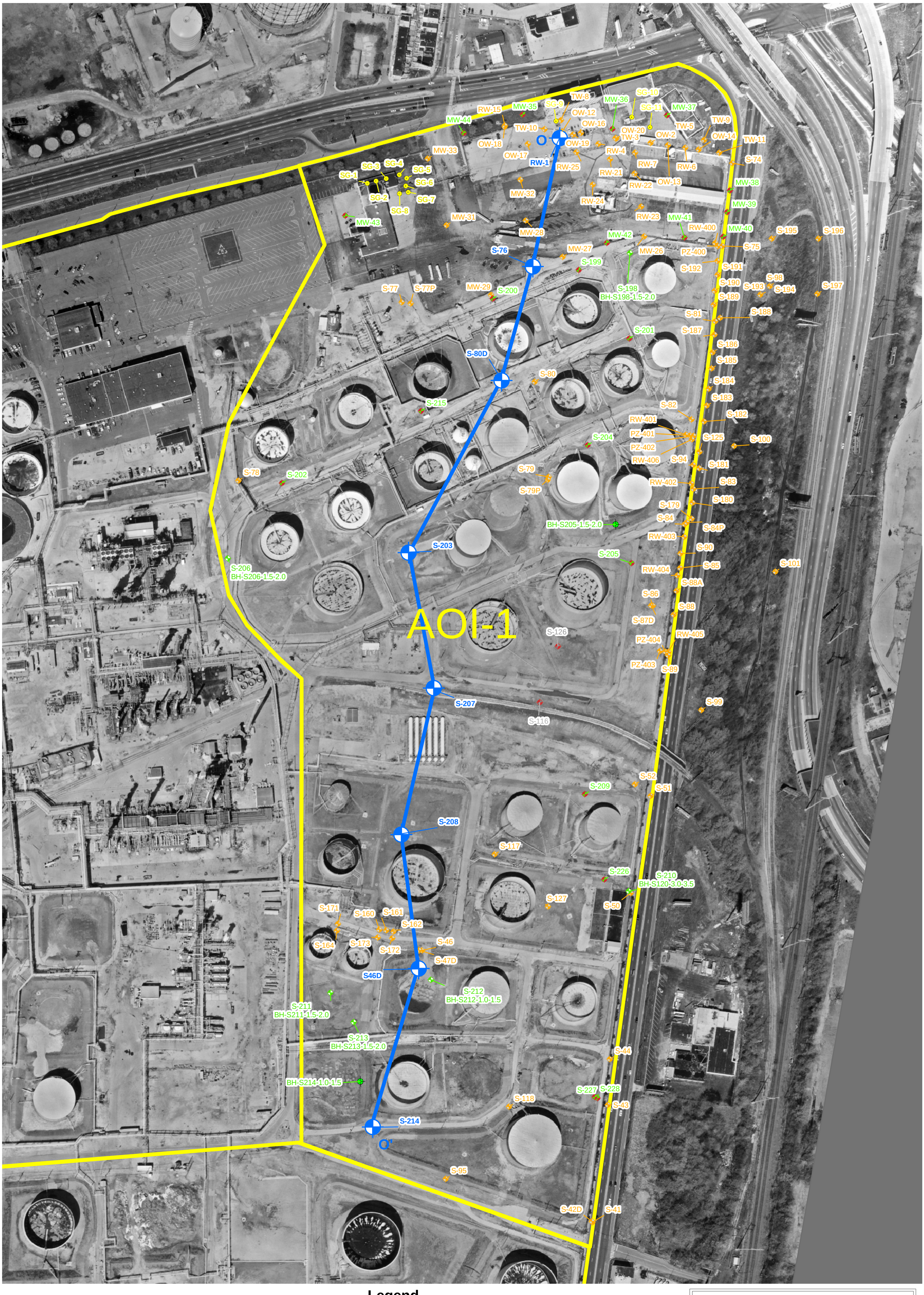
Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
-50	1.8		(BC=WOH/2'-WOH-3-3-3) Same to 52', from 52'-54' has 30% brown organic material. Spin augers to 54' (where last spoon ended) - @54' felt and heard sound of gravel in teeth of auger. High pressure gas/water emerging from well. Sand and sm gravel coming up with water, then mica flakes (black and white) up to 1cm coming up with water.			
	2.0					
	1.6					
-55						

Spin augers to 54' (where last spoon ended) - @54' felt and heard sound of gravel in teeth of auger. Immediately upon hitting gravel, water came up from hole at high pressure - exiting augers from bolt holes in side and shooting ~20' in either direction. Stop work. By end of day, water lessened but gas still at high pressure. After 2 days gas seemed to stop - (4/11/11) drive head was removed from augers - however, when drillers pulled slightly on the rods which were left down the hole, water initially shot up to top of mast and continued as artesian (1'-3' above top of augers) (must have plugged itself up over weekend). On 4/12/11 water only ~6" above top of augers and not constant. On 4-13-11: readings at well head: Methane 23.5%, CO2 2.7%, O2 14.2%, LEL 100%, H2S 0.0, PID 0.0ppm. On 4/14/11 and 4/15/11: water no longer coming up out of augers, but can be heard gurgling down the hole and obvious gas still emerging from borehole. On 4/18/11: LEL low outside well head - augers are pulled and well casing set - no cap put on well to allow for venting of vapors (vapors can still be seen emerging from casing during sampling on 4/27/11.

APPENDIX D

Site Wide Geologic Cross Sections

AOI-1



Legend

- Cross Section O - O'
- S-208 — Monitoring Well Used In Cross Section
- S-116 — Wells Investigated for Groundwater Mounding
- SG-1 — Soil Gas Monitoring Point
- BH-206-1.0-1.5 — Soil Samples Locations
- AOI Boundaries
- S-42D — New Lower Sand Monitoring Well
- S-206 — New Trenton Gravel Monitoring Well
- S-206 BH-206-1.0-1.5 — New Trenton Gravel Well With Soil Samples
- S-76 — All Existing Monitoring Points

N W E S

Figure 4: Cross Section Location Map
AOI 1 Site Characterization Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

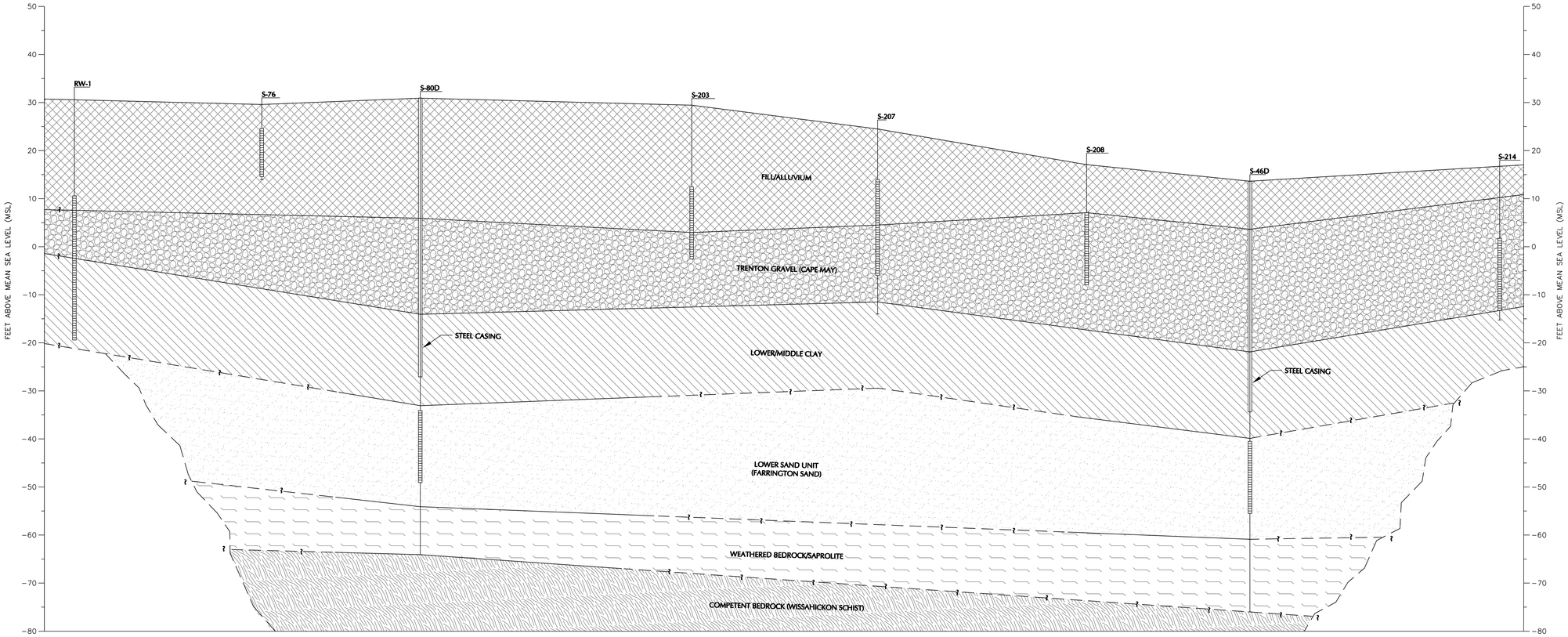
0 125 250 Feet

SCALE: 1" = 125'
DATE: June 20, 2005
DRN. BY: JSC
CKD. BY: JH
JOB#: 2574601

G:\Data\2574601\ArcGIS\MapDocuments\AOI 1 Site Characterization Report\Figure 4 - Cross Section Location Map.mxd

O
NORTH

O'
SOUTH



LEGEND

- FILL
- ALLUVIUM
- SAND AND GRAVEL
- CLAY/SILT
- SAND
- WEATHERED BEDROCK
- BEDROCK
- WELL SCREEN

10 0 2 4 10
VERTICAL SCALE IN FEET

100 0 50 100
HORIZONTAL SCALE IN FEET

Project: SUNOCO, INC. (R & M) PHILADELPHIA PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION O-O' SUNOCO PHILADELPHIA REFINERY AND BELMONT TERMINAL	Project No. 2574601	Drawing No. 6
		Date 1 JUNE 2005	
		Scale AS SHOWN	
		Drn. By DMM/RJA	
		Last Revised 8 JUNE 2005	1 Of 1

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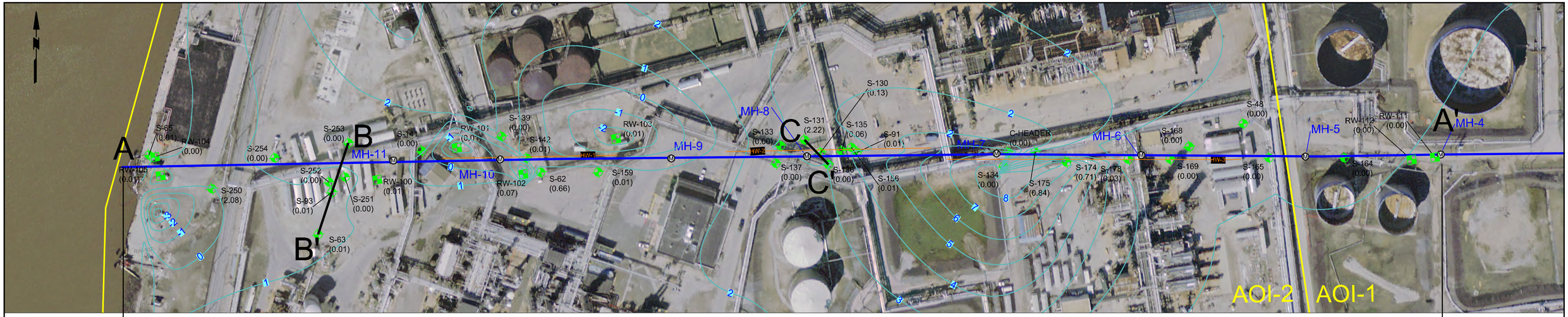
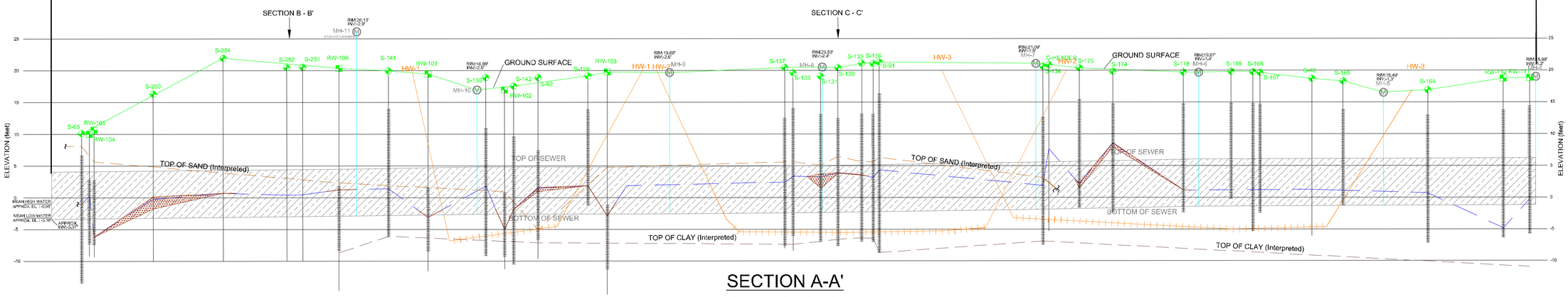
AOI-2

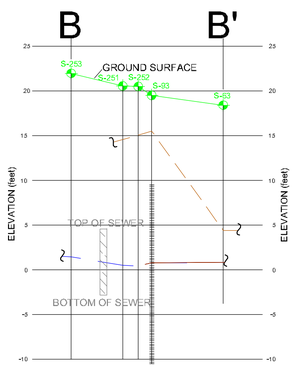




SECTION A-A'

HORIZONTAL SCALE IN FEET
80 0 40 80

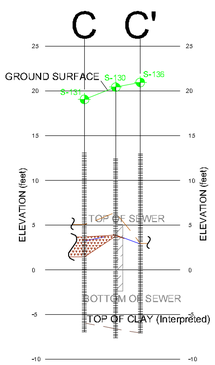
VERTICAL SCALE IN FEET
(10X VERTICAL EXAGGERATION)
8 0 4 8



SECTION B-B'

HORIZONTAL SCALE IN FEET
80 0 40 80

VERTICAL SCALE IN FEET
(10X VERTICAL EXAGGERATION)
8 0 4 8



SECTION C-C'

HORIZONTAL SCALE IN FEET
80 0 40 80

VERTICAL SCALE IN FEET
(10X VERTICAL EXAGGERATION)
8 0 4 8

LEGEND:

- S-###: MONITORING WELL USED IN GENERATION OF CROSS-SECTION
- S-###: MONITORING WELL NOT USED IN GENERATION OF CROSS-SECTION
- RW-###: RECOVERY WELL
- MH-##: SEWER MANHOLE
- TOP OF CLAY (Interpreted)
- TOP OF SAND (Interpreted)
- GROUND SURFACE (Estimated)
- OBSERVED PRODUCT JUNE 2009
- CORRECTED GROUNDWATER ELEVATION JUNE 2009
- POLLOCK STREET SEWER

NOTES:

1. ORIGINAL FIGURE 'POLLOCK STREET SEWER SECTION MAP WITH LIQUID LEVELS' OCTOBER 4, 2009, PROVIDED BY AQUATERRA TECHNOLOGIES, INC.
2. ELEVATION DATA OBTAINED FROM MAY 2009 WELL SURVEY. ELEVATIONS REFERENCED TO NAVD 88 DATUM.
3. MEAN HIGH WATER AND MEAN LOW WATER ELEVATIONS OBTAINED FROM PLAN ENTITLED 'SHEET PILING PLAN - TOP OF SEWER' BY JAMES T. SMITH ENGINEERING COMPANY.
4. OBSERVATIONS OF POLLOCK SEWER INTEGRITY OBTAINED FROM VIDEO INSPECTION DATED 12 MAY 2009 THROUGH 1 JULY 2009.
5. GROUNDWATER CONTOURS WERE PROVIDED FROM HULLGEC.

SUNOCO

Project

SUNOCO PHILADELPHIA REFINERY

PHILADELPHIA COUNTY PENNSYLVANIA

AO1 & AO2 Pollock Street Sewer Cross Section Plan

Project No.	002574601
Date	7/13/09
Scale	AS SHOWN
Drn. By	JWY
Last Revised	9/29/10

Figure No. 11

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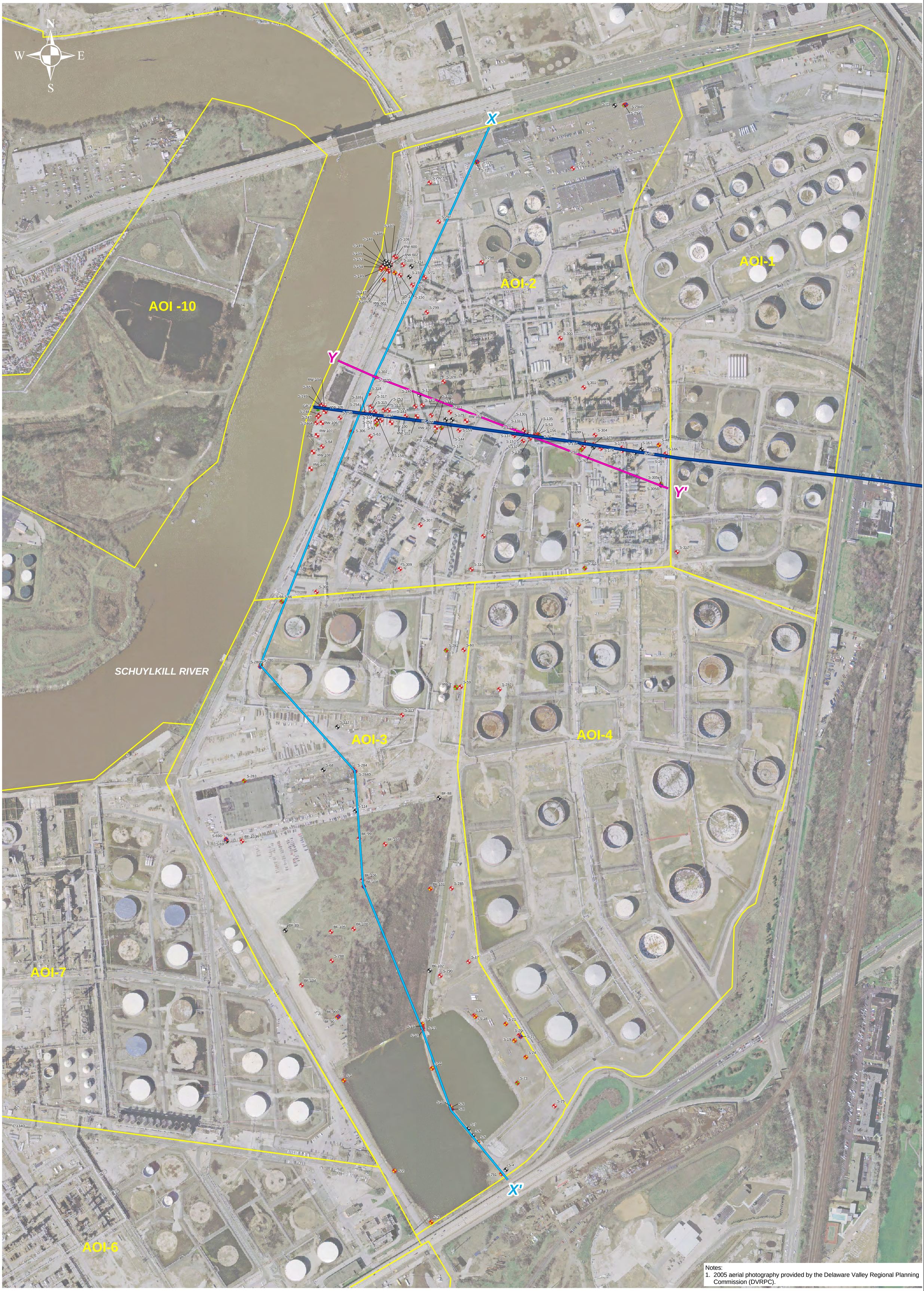
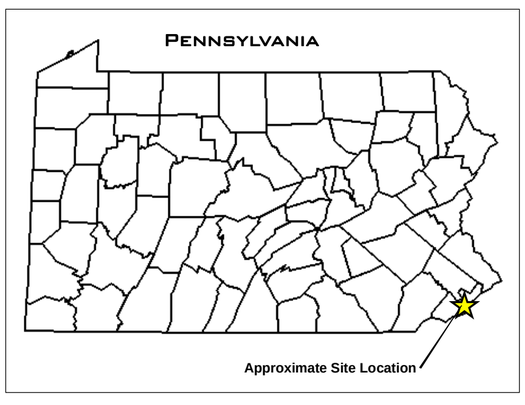
Filename: Q:\data6\2574601\Cadd Data – 2574601\Dwg\11–Pollock Street Sewer Cross Section Plan.081809–revised 2010–09–29.dwg Date: 9/29/2010 Time: 12:53 User: dwebster Style Table: Langan.stb Layout: D Size Sheet (Bottom)



Notes:
1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).



Legend

- Deep Monitoring Well
- Intermediate Monitoring Well
- Shallow Monitoring Well
- Shallow/Intermediate Monitoring Well
- Shallow/Intermediate Recovery Well
- Intermediate Recovery Well
- Piezometer
- Other Monitoring Well
- Abandoned/Damaged/Unable to Locate
- Cross Section Location (X - X')
- Cross Section Location (Y - Y')
- Pollock Street Sewer
- Area of Interest (AOI) Boundary

Figure 4: Cross Section Location Plan
AOI-2 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 70 140 280
Feet

SCALE: 1" = 140'
DATE: August 20, 2010
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

Q:\data6\2574601\ArcGIS\MapDocuments\AOI 2 SCR\Figure 4 - Cross Section Location Plan - AOI2_092310.mxd

NOTES:

1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
2. WELL SCREEN INTERVAL INFORMATION NOT AVAILABEL FOR S-2 AND S-68
3. GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.
4. BORING LOG FOR BF-108 COULD NOT BE LOCATED. THICKNESS OF LOWER/MIDDLE CLAY IN THIS AREA IS ESTIMATED BASED UPON LOG S-284D AND S-13.
5. S-292 AND S-70 WERE DRY.
6. S-66, S-112, S-117, AND S-6 WHERE NOT GAUGED.

LEGEND:

- FILL / ALLUVIUM
- SAND / GRAVEL (TRENTON GRAVEL)
- CLAY
- SAND
- BEDROCK (WISSAHICKON SCHIST)

- C-129D LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- INFERRED CONTACTS
- GROUNDWATER LEVEL

AOI - 2

AOI - 3

X

X'

S-72D S-292 S-297 S-151 S-71 S-70 S-299 S-302D S-318 S-316 S-306 AOI - 2 AOI - 3 S-308 S-66 S-280D S-112 S-284D S-114 BF-99 BF-106 BF-108 BF-100 S-13 S-11 S-8 S-6 S-5 S-291

HIGHWAY AOI - 2

AOI - 3 HIGHWAY

FILL / ALLUVIUM

SAND / GRAVEL (TRENTON GRAVEL)

POLLOCK STREET SEWER

MIDDLE CLAY

MIDDLE SAND

LOWER CLAY

LOWER SAND (FARRINGTON SAND)

BEDROCK (WISSAHICKON SCHIST)

LOWER/MIDDLE CLAY

ELEVATION (FEET MEAN SEA LEVEL)

40 30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90

VERTICAL SCALE IN FEET: 10 0 2 4 10

HORIZONTAL SCALE IN FEET: 200 0 100 200

SUNOCO	Project: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION X-X′	Project No. 2574601 Date 8/26/10 Scale 1" = 200' HOR. 1" = 10' VER. Drn. By JEM Last Revised X
			Figure No. 5A Of

Filename: O:\data6\2574601\Cadd Data – 2574601\Dwg\Geologic Cross-Sections\Cross-Section X-X'.dwg Date: 9/29/2010 Time: 11:42 User: jmay Style Table: Langan.stb Layout: 5A

NOTES:

1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
2. DEPTH OF BULKHEAD APPROXIMATED FROM DWG. NO. 9-0-1E/140011, SHEET PILING PLAN POLLOCK STREET SEWER OUTFALL, PREPARED BY TERRY FOUNDATION, INC., OCTOBER 11, 1995.
3. GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.

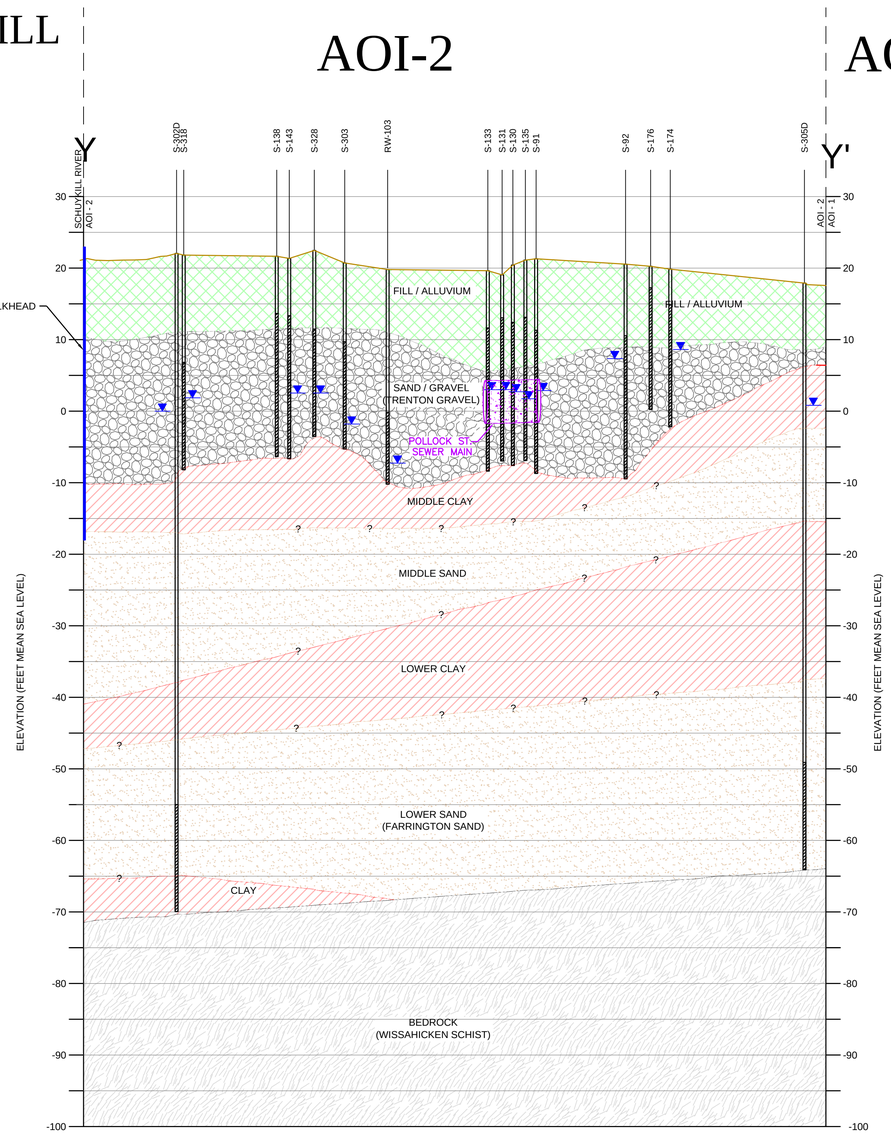
LEGEND:

- FILL / ALLUVIUM
- SAND / GRAVEL (TRENTON GRAVEL)
- CLAY
- SAND
- BEDROCK (WISSAHICKEN SCHIST)
- C-129D LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- INFERRED CONTACTS
- GROUNDWATER LEVEL
- BULKHEAD

SCHUYLKILL RIVER

AOI-2

AOI-1



10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

	Project: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION Y-Y'	Project No. 2574601 Date 8/26/2010 Scale 1" = 200' HOR. 1" = 10' VER. Drn. By JEM Last Revised X
			Figure No. 5B Of

Filename: Q:\data6\2574601\Cadd Data – 2574601\Dwg\Geologic Cross-Sections\Cross-Section Y-Y'.dwg Date: 9/29/2010 Time: 12:06 User: jmay Style Table: Langan.stb Layout: 5B

AOI-3

N
W
E
S

AOI -10

AOI-1

AOI-2

AOI-3

AOI-4

AOI-6

AOI-7

SCHUYLKILL RIVER

X
X'
Z
Z'
AA
AA'
BB
BB'

Notes:
1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).

PENNSYLVANIA

Approximate Site Location

Legend

- Deep Monitoring Well
- Intermediate Monitoring Well
- Shallow Monitoring Well
- Shallow/Intermediate Monitoring Well
- Shallow/Intermediate Recovery Well
- Intermediate Recovery Well
- Piezometer
- Other Monitoring Well
- Damaged/Abandoned/Unable to Locate
- Cross Section Location (AA - AA')
- Cross Section Location (BB - BB')
- Cross Section Location (X - X')
- Cross Section Location (Z - Z')
- Area of Interest (AOI) Boundary

Figure 4: Cross Section Location Plan
AOI-3 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 70 140 280
Feet

SCALE: 1" = 140'
DATE: August 20, 2010
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

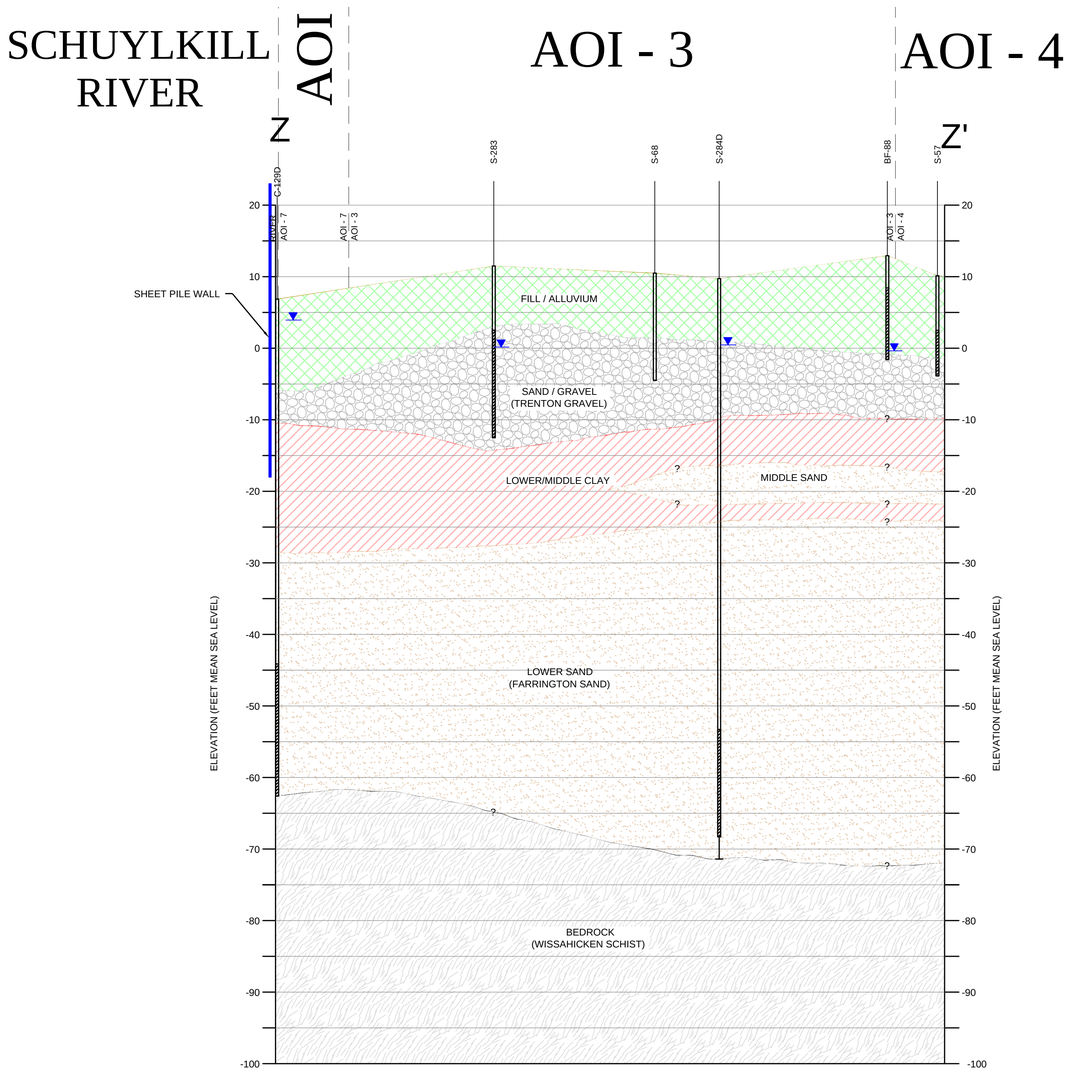
Q:\data6\2574601\ArcGIS\MapDocuments\AOI 3 SCR\Figure 4 - Cross Section Location Plan AOI-3_9-2-10.mxd

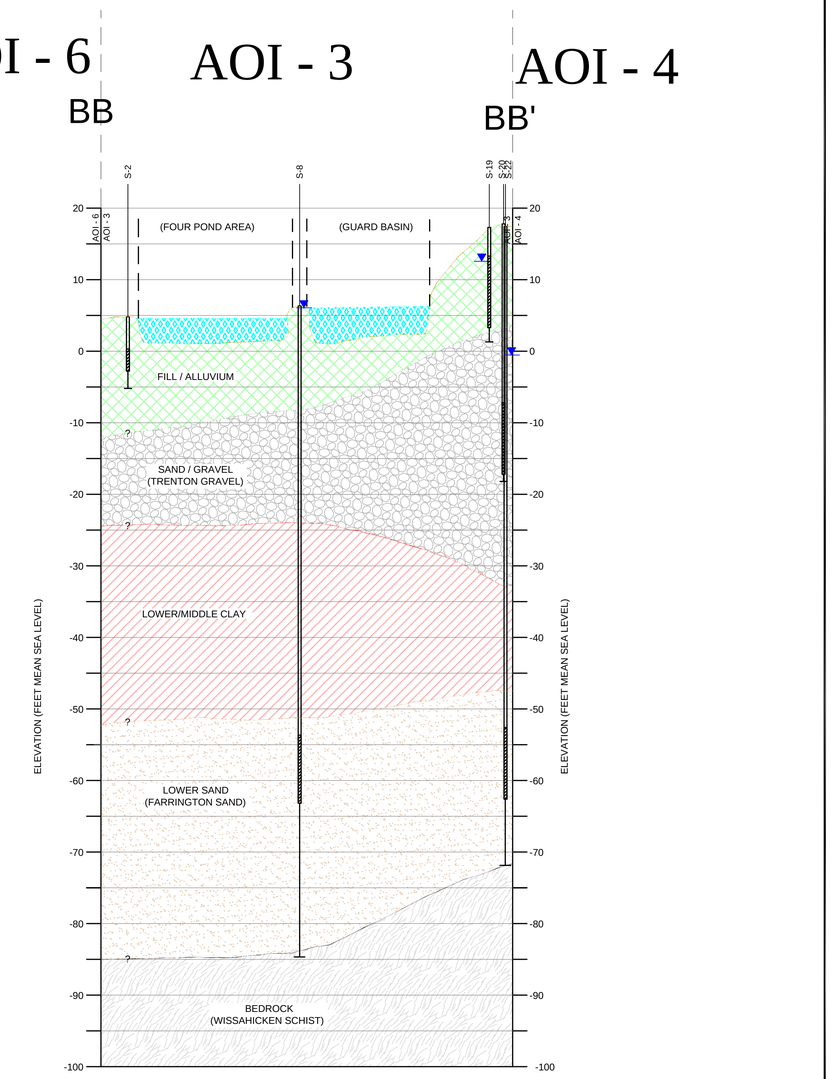
NOTES:

1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
2. WELL SCREEN INTERVAL INFORMATION NOT AVAILABLE FOR S-2 AND S-68
3. DEPTH OF SHEET PILE WAS DETERMINED FROM FIGURE 2-8 GENERALIZED GEOLOGICAL CROSS SECTION A-C DATED NOVEMBER 13, 1992 FROM DAMES AND MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVERON REFINERY, 1992, CROSS SECTION RENAMED C-J IN CCR.
4. GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.

LEGEND:

- WATER
- FILL / ALLUVIUM
- TRENTON GRAVEL
- CLAY
- SAND
- WEATHERED BEDROCK
- C-129D LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- INFERRED CONTACTS
- GROUNDWATER LEVEL
- SHEET PILE WALL





VERTICAL SCALE IN FEET
10 0 2 4 10

HORIZONTAL SCALE IN FEET
200 0 100 200

LANGAN ENGINEERING & ENVIRONMENTAL SERVICES

Mailing Address:
P.O. Box 1569
Doylestown, PA
18901-0219

Shipping Address:
Stone Manor Corporate Center
2700 Kelly Road, Suite 200
Warrington, PA 18976

T: 215.491 6500 F: 215.491 6501 www.langan.com

NEW JERSEY **PENNSYLVANIA** NEW YORK CONNECTICUT FLORIDA NEVADA VIRGINIA CALIFORNIA

NJ Certificate of Authorization No: 24GA27996400

Project
SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title
GEOLOGIC CROSS SECTION Z-Z' & GEOLOGIC CROSS SECTION BB-BB'

Project No. 2574601	Figure No. 5A
Date 8/26/10	
Scale 1" = 200' HOR. 1" = 10' VER.	
Drn. By JEM	
Last Revised X	Of

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Filename: O:\data6\2574601\Cadd Data – 2574601\Dwg\Geologic Cross-Sections\Cross-Section Z-Z'.dwg Date: 8/26/2010 Time: 13:09 User: jmay Style Table: Langan.stb Layout: 5A

NOTES:

1. **LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.**
2. **DEPTH OF SHEET PILE WAS DETERMINED FROM FIGURE 2-8 GENERALIZED GEOLOGICAL CROSS SECTION A-C DATED NOVEMBER 13, 1992 FROM DAMES AND MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVERON REFINERY, 1992, CROSS SECTION RENAMED C-J IN CCR**
3. **GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.**
4. **THICKNESS OF LOWER / MIDDLE CLAY IN AOI-7 IS ESTIMATED FROM DEEP MONITORING WELLS C-144D, C-134D, AND C-50D.**

LEGEND:

- FILL / ALLUVIUM
- SAND / GRAVEL (TRENTON GRAVEL)
- CLAY
- SAND
- BEDROCK (WISSAHICKON SCHIST)
- C-129D LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- INFERRED CONTACTS
- GROUNDWATER LEVEL
- SHEET PILE WALL

SCHUYLKILL RIVER

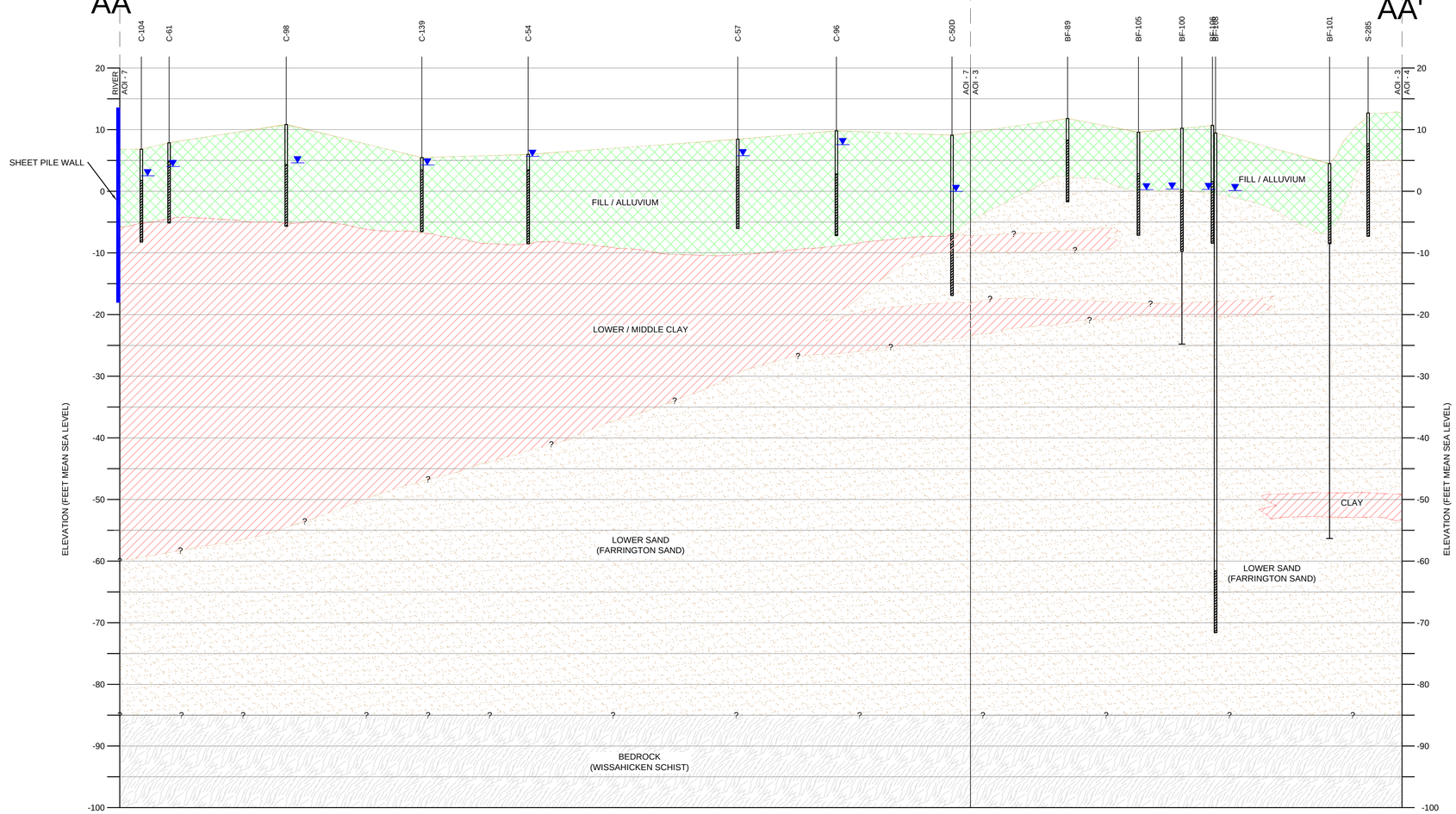
AOI - 7

AOI - 3

AOI - 4

AA

AA'



10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

SUNOCO	Project: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION AA-AA'	Project No. 2574601 Date 8/26/10 Scale 1" = 200' HOR. 1" = 10' VER. Drn. By JEM Last Revised X
			Figure No. 5B Of

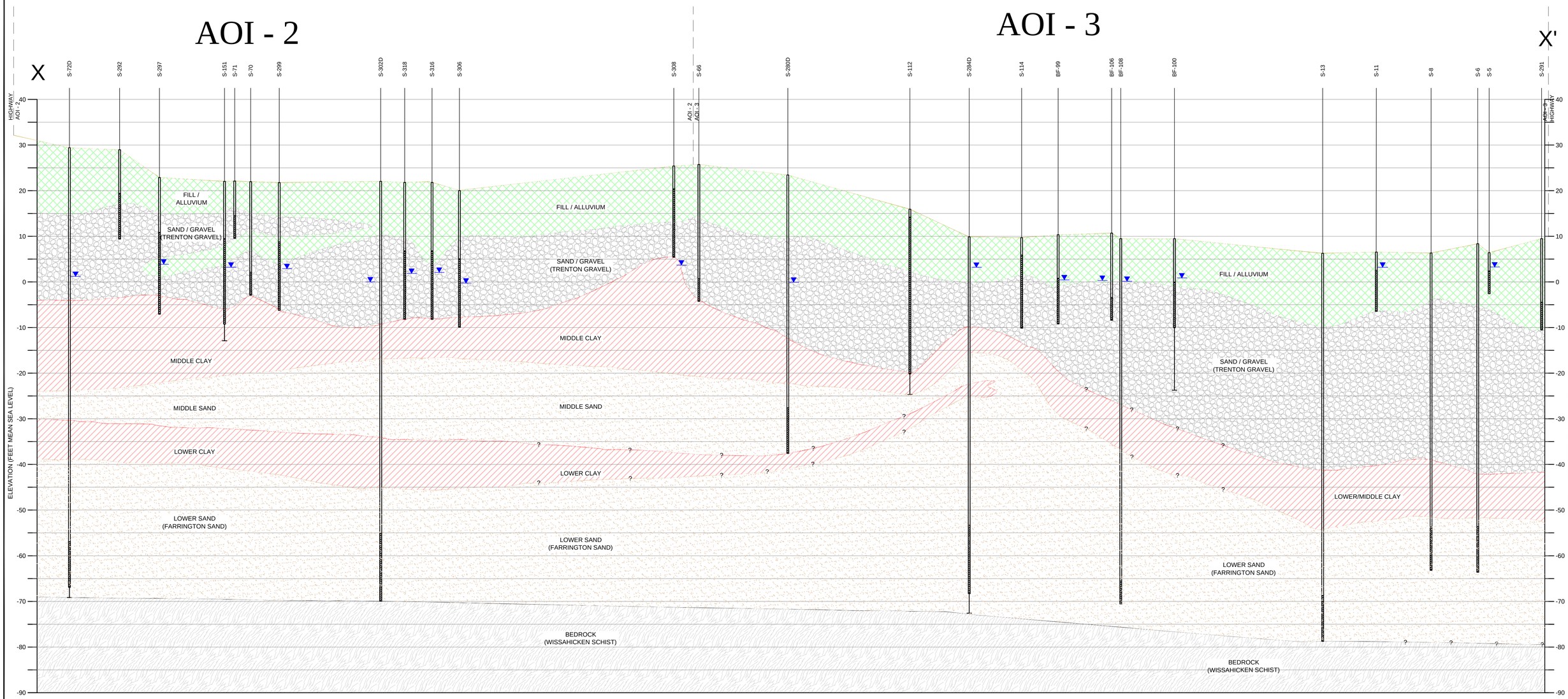
Filename: Q:\data6\2574601\Cadd Data – 2574601\Dwg\Geologic Cross-Sections\Cross-Section AA-AA'.dwg Date: 9/17/2010 Time: 11:04 User: jmay Style Table: Langan.stb Layout: 5B

NOTES:

1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
2. WELL SCREEN INTERVAL INFORMATION NOT AVAILABEL FOR S-2 AND S-68
3. GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.
4. BORING LOG FOR BF-108 COULD NOT BE LOCATED. THICKNESS OF LOWER/MIDDLE CLAY IN THIS AREA IS ESTIMATED BASED UPON LOG S-284D AND S-13.

LEGEND:

- FILL / ALLUVIUM
- SAND / GRAVEL (TRENTON GRAVEL)
- CLAY
- SAND
- BEDROCK (WISSAHICKON SCHIST)
- C-129D LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- INFERRED CONTACTS
- GROUNDWATER LEVEL
- SHEET PILE WALL



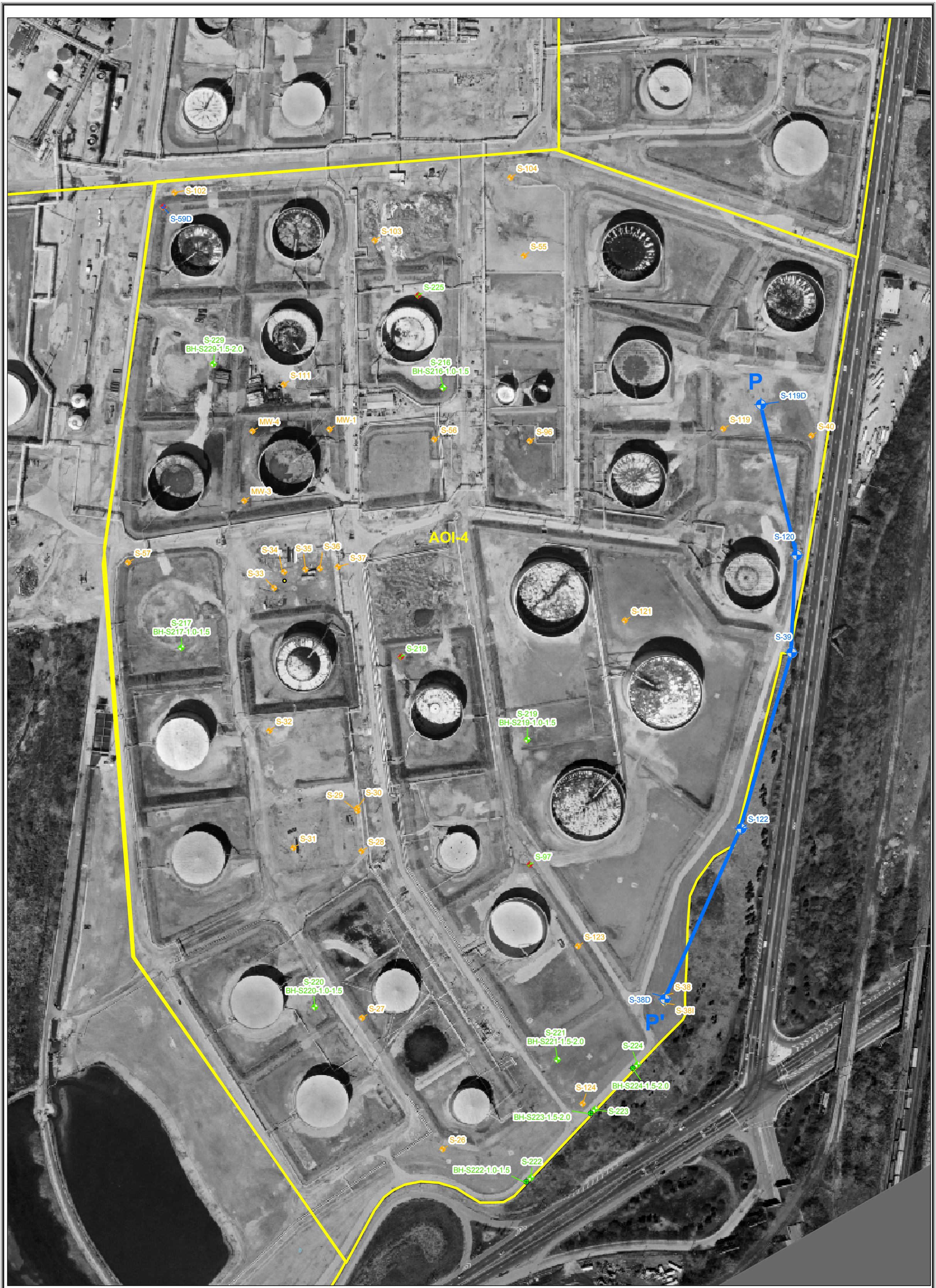
10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

Project: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION X-X'	Project No. 2574601 Date 8/26/10 Scale 1" = 200' HOR. 1" = 10' VER. Drn. By JEM Last Revised X	Figure No. 5C Of

Filename: Q:\data6\2574601\Cadd Data – 2574601\Dwg\Geologic Cross-Sections\Cross-Section X-X'.dwg Date: 9/7/2010 Time: 14:13 User: jmay Style Table: Langan.stb Layout: 5C

AOI-4



Legend

- Cross Section P - P'
- S-119D — Monitoring Well Used In Cross Section
- BH-206-1.0-1.5 — Soil Sample Locations
- AOI Boundaries
- S-59D — New Lower Sand Monitoring Well
- S-206 — New Trenton Gravel Monitoring Well
- BH-206-1.0-1.5 / S-206 — New Trenton Gravel Well With Soil Samples
- S-76 — All Existing Monitoring Points

N W E S

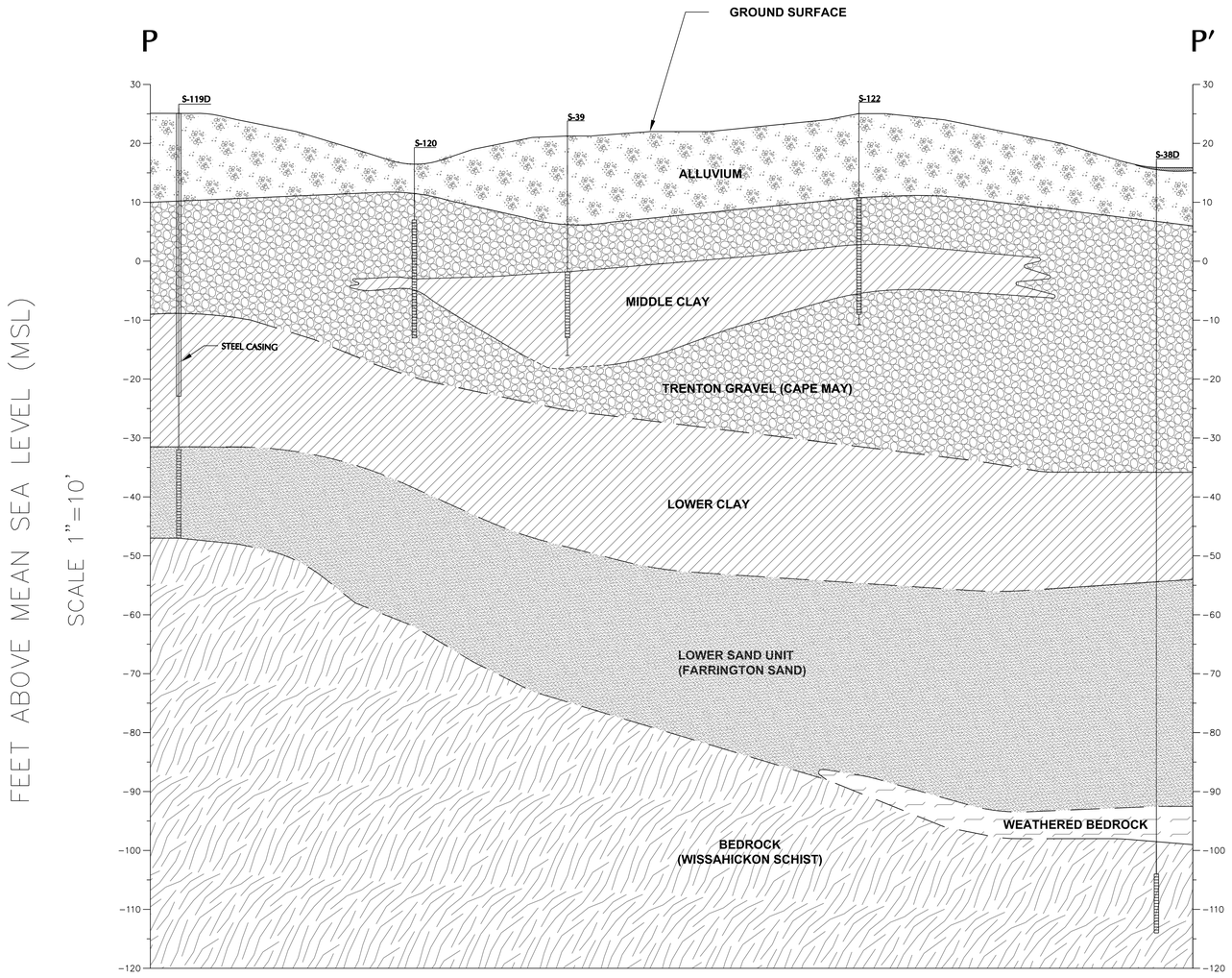
Figure 4: Cross Section Location Map
AOI 4 Site Characterization Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 125 250 Feet

SCALE: 1" = 125'
DATE: August 8, 2005
DRN. BY: JSC
CKD. BY: JH
JOB#: 2574601

Q:\Data\2574601\ArcGIS\MapDocuments\AOI 4 Site Characterization Report\Figure 4 - Cross Section Location Map.mxd



SCALE 1"=100'

LEGEND

- FILL
- ALLUVIUM
- SAND AND GRAVEL
- CLAY/SILT AND SOME SAND
- SAND
- WEATHERED BEDROCK
- BEDROCK
- S-119D WELL ID
- WELL SCREEN

10 0 2 4 10
VERTICAL SCALE IN FEET

100 0 50 100
HORIZONTAL SCALE IN FEET

Project: SUNOCO, INC. (R & M) — PHILADELPHIA — PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION P-P′ — SUNOCO PHILADELPHIA REFINERY AND BELMONT TERMINAL	Project No. 2574601	Drawing No. 5
		Date 10 AUGUST 05	
		Scale AS SHOWN	
		Drn. By AJC	
		Last Revised 25 AUGUST 05	1 Of 1

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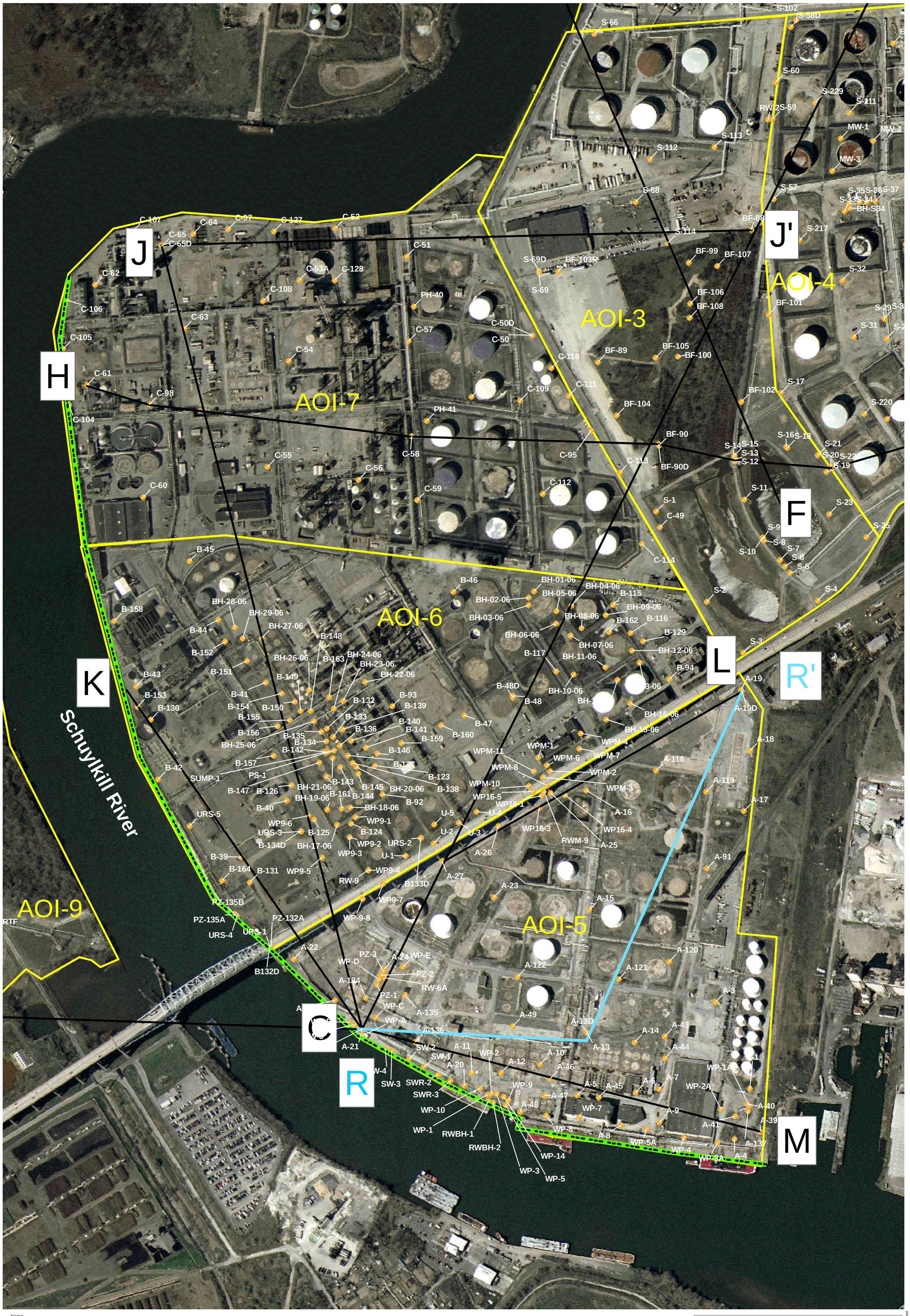
Filename: Q:\Data6\2574601\Cadd Data – 2574601\Dwg\Environmental\Figure5_P-P'.dwg Date: 8/25/2005 Time: 10:00 User: ssmith Style Table: Langan.stb Layout: E Size Sheet (Bottom)

AOI-5



Notes
1. Aerial Photograph, Intrasearch, Inc., 2002.
2. A-A' from Aquaterra Technologies, Supplemental Subsurface Evaluation: Jackson Street Sewer-North Yard, 2002.
3. B-B' from GES, Inc., Remedial Action Plan North Yard Southern Property Boundary (PGW Border), 1993
4. F-F' from ENSR, Investigation of Shallow and Deep Groundwater Quality, Philadelphia Refinery, 1994 (Location is approximate)
5. J-J' from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery,1992
6. C-J' from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
7. C-K from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
8. C-L from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
9. C-M from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
10. N-C-J' from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
11. C-J from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992

Legend

N
W E
S

A A' — Cross-Section Location

R R' — AOI 5 Cross Section Location

A-135 — All Known Existing Monitoring Points

AOI Boundary

Sheet Pile Wall

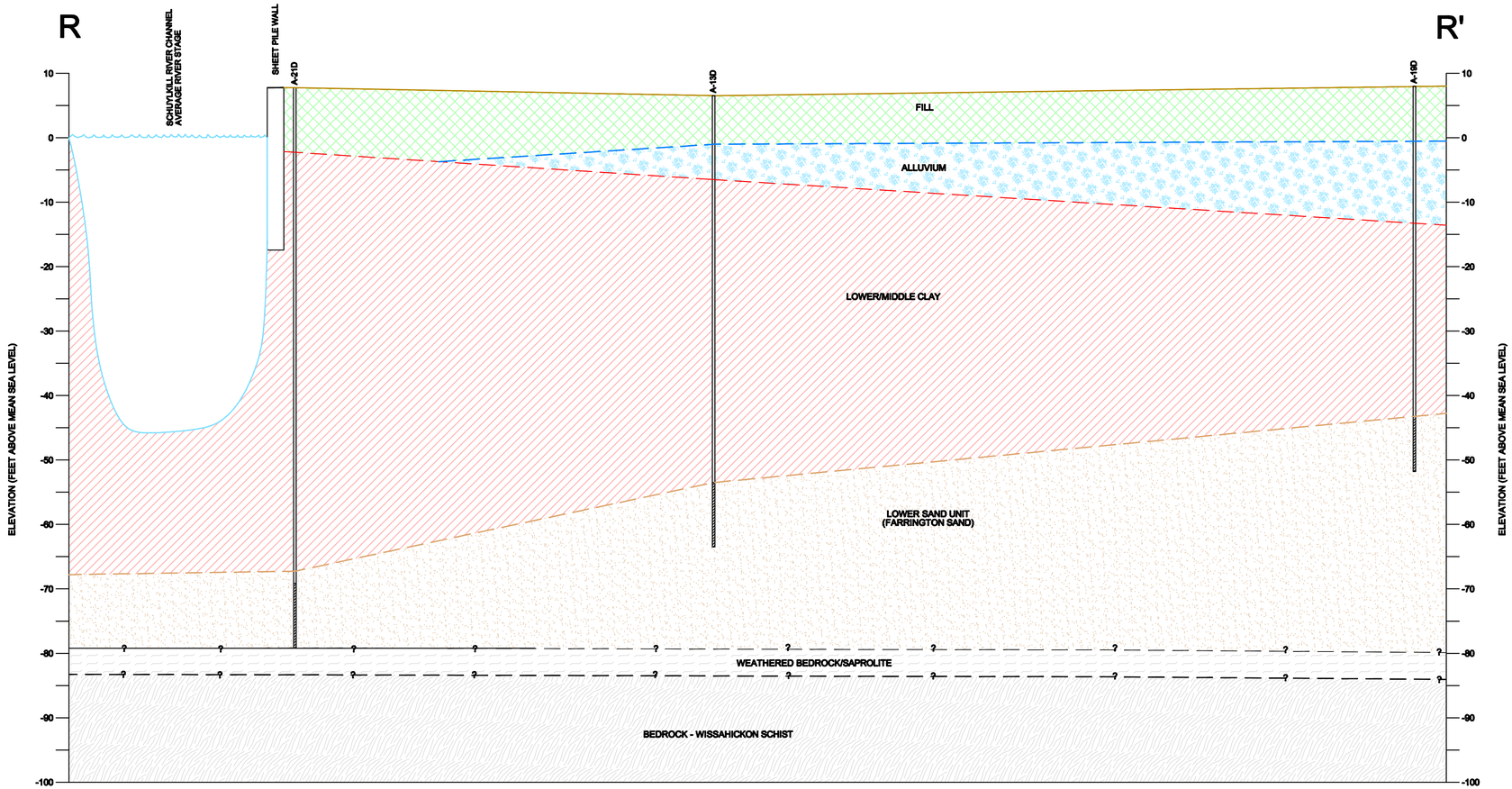
Figure 4: Cross Section Location Plan
AOI 5 Site Characterization Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 250 500 Feet

SCALE: 1" = 250'
DATE: August 9, 2007
DRN. BY: JSC
CKD. BY: JH
JOB#: 2574601

G:\Data\2574601\Arcgis\Mapdocuments\AOI 5 SCR 1\Figure 4_Cross Section Locations Plan.mxd



LEGEND:

- FILL
- SAND
- ALLUVIUM
- WEATHERED BEDROCK
- CLAY
- WISSAHICKON SCHIST
- B-129 LOCATION ID
- —?— —?— INFERRED CONTACTS
- WELL CASING
- WELL SCREEN

NOTES:

1. DEPTH OF SCHUYLKILL RIVER FROM SIMULATION OF GROUNDWATER FLOW IN THE POTOMIC-RARITAN-MAGOTHY AQUIFER SYSTEM NEAR THE DEFENSE SUPPLY CENTER PHILADELPHIA, AND THE POINT BREEZE REFINERY, SOUTHERN PHILADELPHIA COUNTY, PENNSYLVANIA BY CURTIS L. SCHREFFLER DATED 2001.
2. DEPTH OF SHEET PILE WALL DETERMINED FROM FIGURE 3-8 GENERALIZED GEOLOGIC CROSS SECTION A-C DATED 13 NOVEMBER 1992 FROM DAMES & MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVRON REFINERY, 1992. CROSS SECTION RENAMED C-J.
3. CONTACT BETWEEN FILL AND ALLUVIUM IS APPROXIMATED BASED ON AVAILABLE HISTORIC WELL LOGS.

10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

SUNOCO

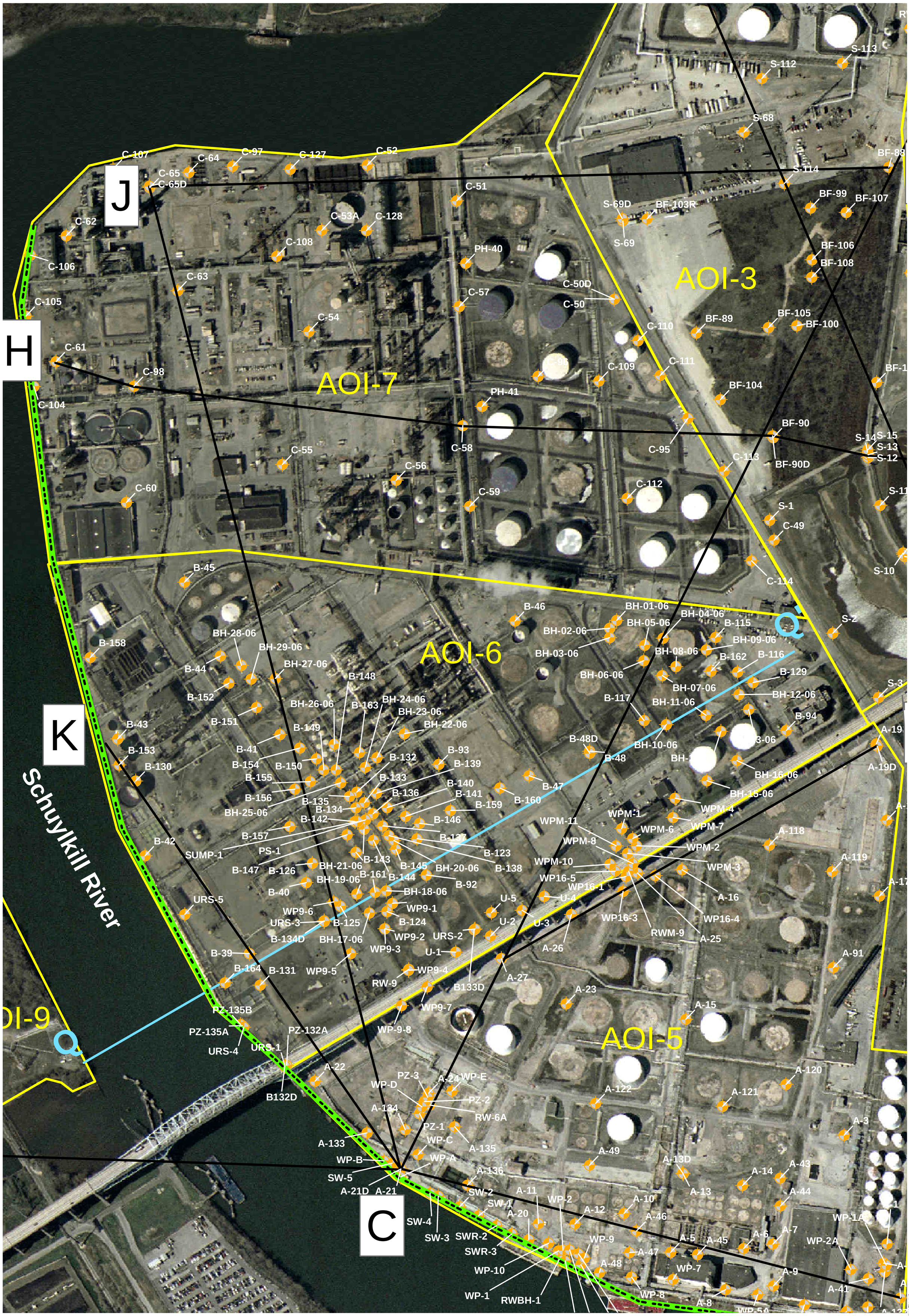
Project
SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title
GEOLOGIC CROSS SECTION R-R'

Project No. 2574601	Drawing No. 5
Date 14 AUGUST 2007	
Scale 1"=200' HOR. 1"=10' VER.	
Drn. By DMW/TS	
Last Revised X	Of

Filename: S:\Data6\2574601\CADD Drawings\Geologic Cross-Section R-Rborderedit.dwg Date: 8/24/2007 Time: 9:40 User: scarlisle Style Table: Langan.stb Layout: D Size Sheet (Bottom)

AOI-6



Notes
1. Aerial Photograph, Intrasearch, Inc., 2002.
2. A-A' from Aquaterra Technologies, Supplemental Subsurface Evaluation: Jackson Street Sewer-North Yard, 2002.
3. B-B' from GES, Inc., Remedial Action Plan North Yard Southern Property Boundary (PGW Border), 1993
4. F-F' from ENSR, Investigation of Shallow and Deep Groundwater Quality, Philadelphia Refinery, 1994 (Location is approximate)
5. J-J' from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery,1992
6. C-J' from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
7. C-K from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
8. C-L from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
9. C-M from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
10. N-C-J' from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992
11. C-J from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992

Legend

- A — A' : Cross-Section Location
- Q — Q' : AOI 6 Cross Section Location
- B-93 : All Known Existing Monitoring Points
- AOI Boundary
- Sheet Pile Wall

Figure 4: Cross Section Location Plan
AOI 6 Site Characterization Report
Sunoco Philadelphia Refinery
and Belmont Terminal
Philadelphia, Pennsylvania

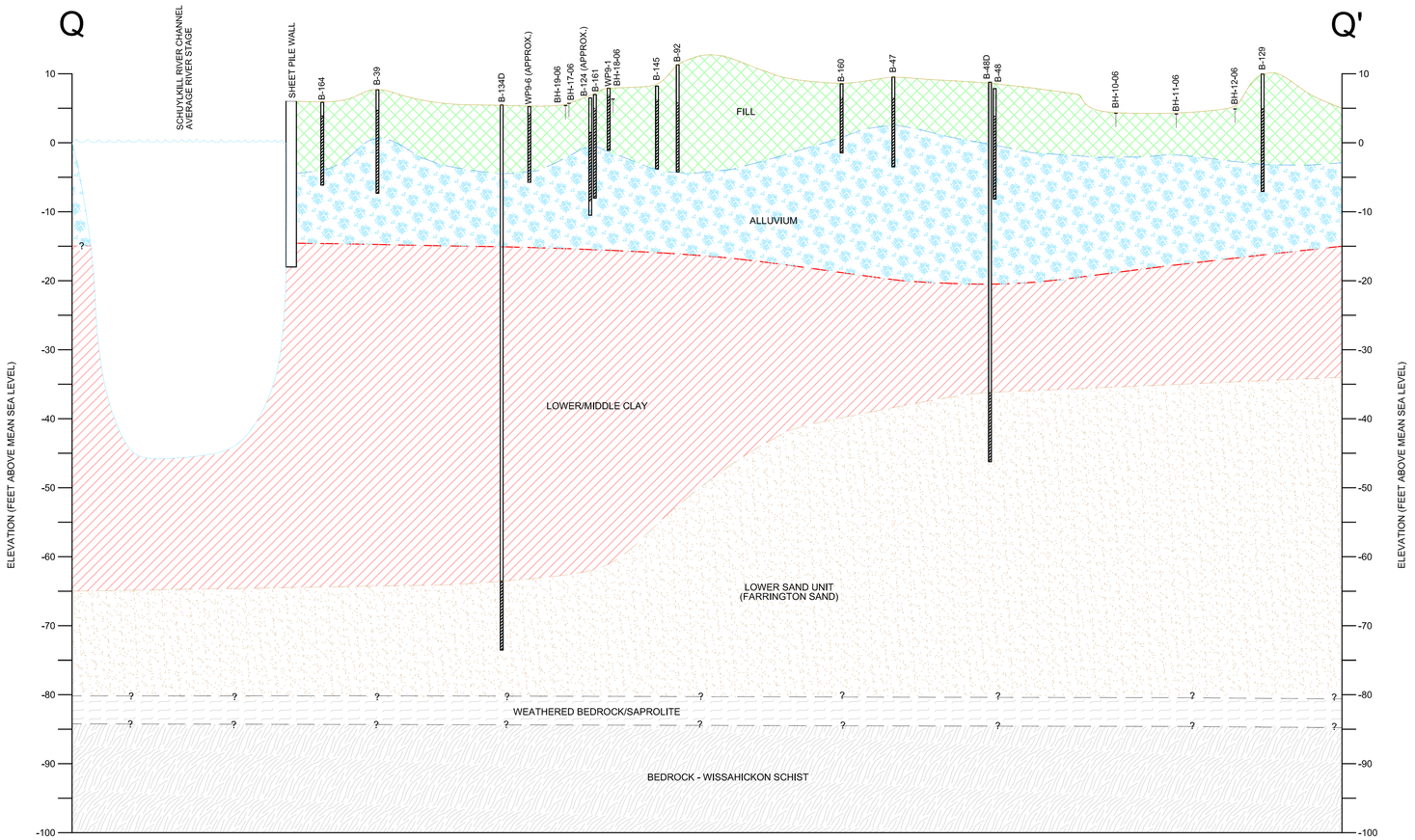
Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

SCALE: 1" = 200'
DATE: August 9, 2006
DRN. BY: AE
CKD. BY: JH
JOB#: 2574601

G:\Data\62574601\ArcGIS\MapDocuments\Current Conditions Report\Figure 4_Cross Section Locations Plan.mxd

LEGEND:

- FILL
- ALLUVIUM
- CLAY
- SAND
- WEATHERED BEDROCK
- WISSAHICKON SCHIST
- B-129 LOCATION ID
- INFERRED CONTACTS
- WELL CASING
- WELL SCREEN
- SOIL BORING



NOTES:

1. DEPTH OF SCHUYLKILL RIVER FROM SIMULATION OF GROUNDWATER FLOW IN THE POTOMIC-RARITAN-MAGOTHY AQUIFER SYSTEM NEAR THE DEFENSE SUPPLY CENTER PHILADELPHIA, AND THE POINT BREEZE REFINERY, SOUTHERN PHILADELPHIA COUNTY, PENNSYLVANIA BY CURTIS L. SCHREFFLER DATED 2001.
2. DEPTH OF SHEET PILE WALL DETERMINED FROM FIGURE 3-8 GENERALIZED GEOLOGIC CROSS SECTION A-C DATED 13 NOVEMBER 1992 FROM DAMES & MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVRON REFINERY, 1992. CROSS SECTION RENAMED C-J.
3. CONTACT BETWEEN FILL AND ALLUVIUM IS APPROXIMATED BASED ON AVAILABLE HISTORIC WELL LOGS.

10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

LANGAN
ENGINEERING & ENVIRONMENTAL SERVICES
30 South 17th Street, Suite 1500
Philadelphia, PA 19103
P: 215.864.0640 F: 215.864.0671
www.langan.com
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NJ Certificate of Authorization No: 24GA27996400

Project
SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title
GEOLOGIC CROSS SECTION Q-Q'

Project No. 2574601	Drawing No. 5
Date 30 AUGUST 2006	
Scale 1"=200' HOR. 1"=10' VER.	
Drn. By DMM/AE	
Last Revised X	Of

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Filename: S:\Data6\2574601\CADD Drawings\Geologic Cross-Section.dwg Date: 9/11/2006 Time: 10:39 User: aedelman Style Table: Langan.stb Layout: D Size Sheet (Bottom)

AOI-7

Legend

- Deep Monitoring Well
- Intermediate Monitoring Well
- Shallow Monitoring Well
- Shallow/Intermediate Monitoring Well
- Shallow/Intermediate Recovery Well
- Intermediate Recovery Well
- Piezometer
- Damaged/Abandoned/Unable to Locate
- Cross Section Location (AA - AA')
- Cross Section Location (CC - CC')
- Cross Section Location (Z - Z')
- Area of Interest (AOI) Boundary

Notes:
1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).
2. Groundwater elevations based on groundwater gauging data provided by Stantec July 2010.

Figure 4 - Cross Section Location Plan
AOI-7 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 100 200 400 Feet

SCALE: 1" = 200'
DATE: 9/13/2010
DRN. BY: MH
CKD. BY: DVA
JOB#: 2574601

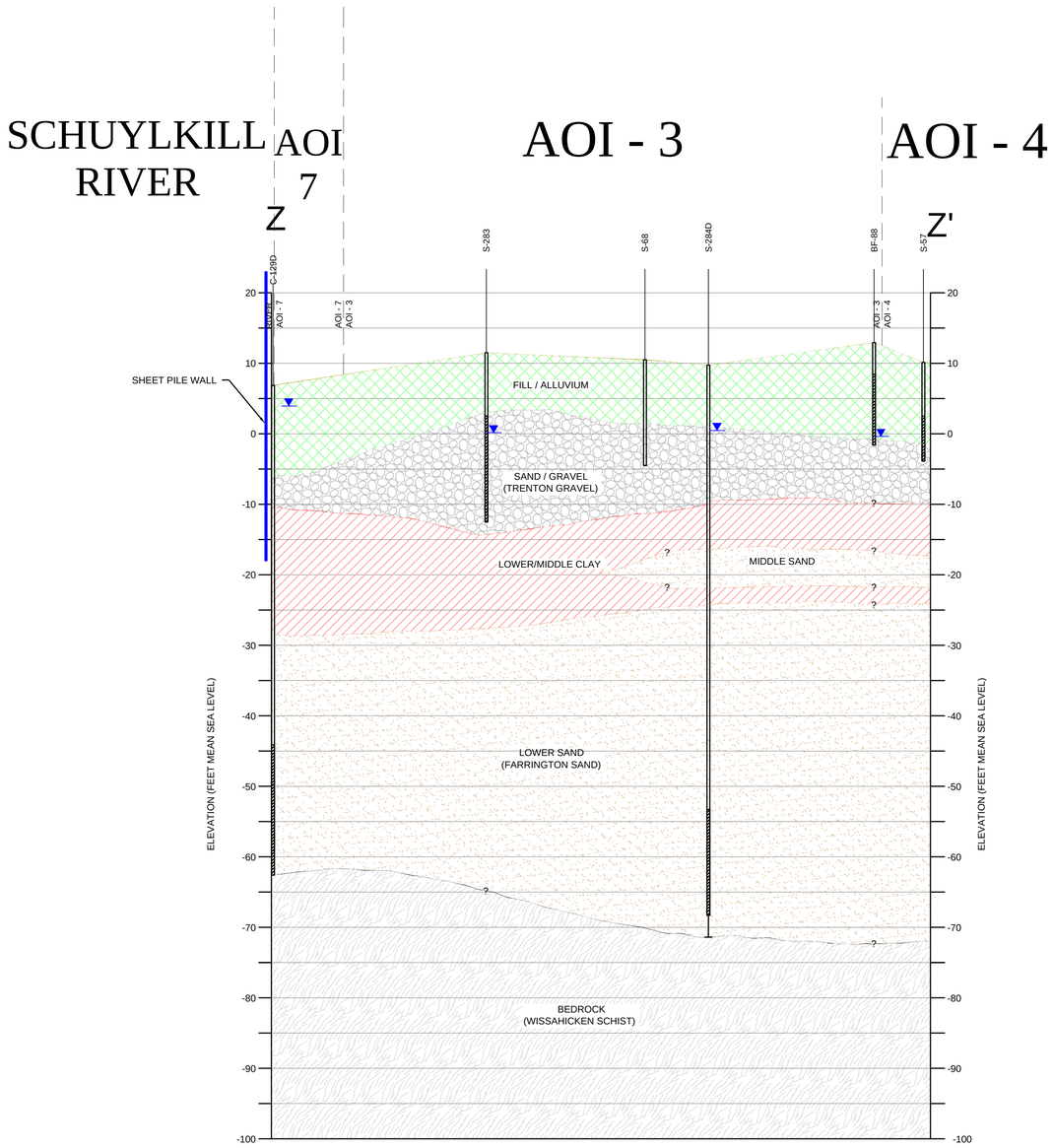
Q:\data6\2574601\ArcGIS\MapDocuments\AOI 7 SCR\Figure 4 - Cross Section Location Plan - AOI7_9-13-10.mxd

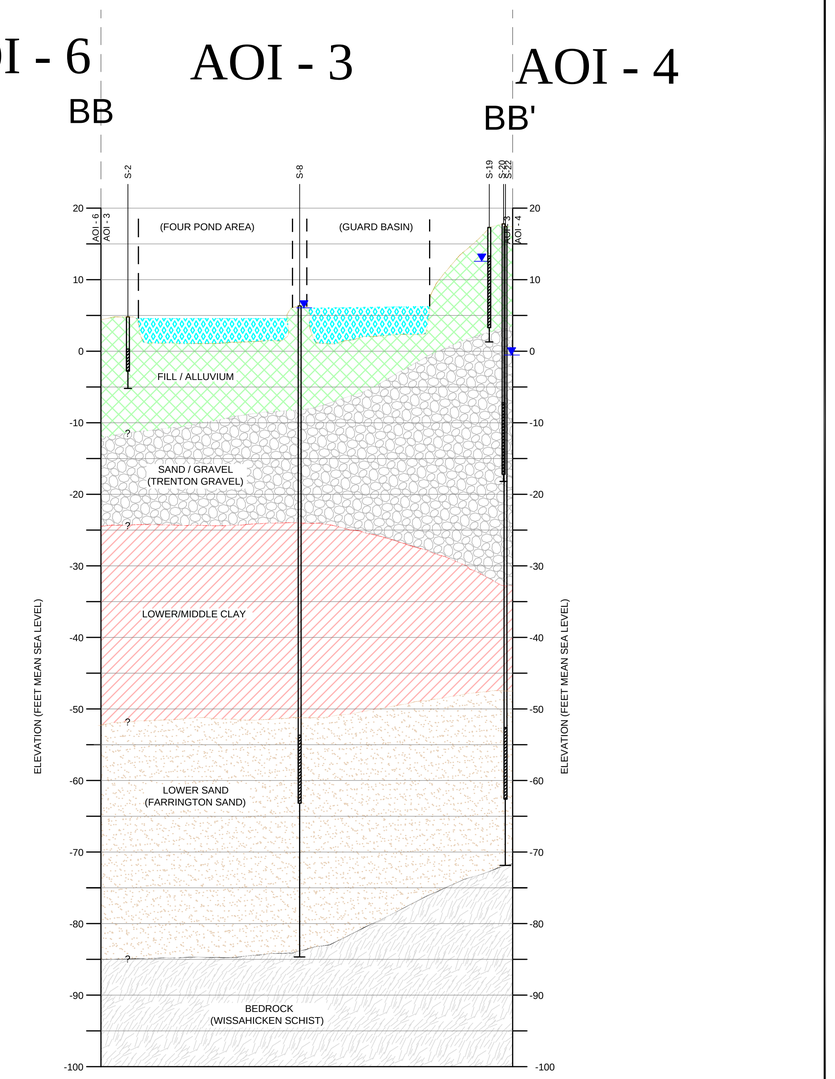
NOTES:

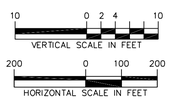
1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
2. WELL SCREEN INTERVAL INFORMATION NOT AVAILABLE FOR S-2 AND S-68
3. DEPTH OF SHEET PILE WAS DETERMINED FROM FIGURE 2-8 GENERALIZED GEOLOGICAL CROSS SECTION A-C DATED NOVEMBER 13, 1992 FROM DAMES AND MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVERON REFINERY, 1992, CROSS SECTION RENAMED C-J IN CCR.
4. GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.

LEGEND:

- WATER
- FILL / ALLUVIUM
- TRENTON GRAVEL
- CLAY
- SAND
- WEATHERED BEDROCK
- C-129D LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- INFERRED CONTACTS
- GROUNDWATER LEVEL
- SHEET PILE WALL







Project: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION Z-Z' & GEOLOGIC CROSS SECTION BB-BB'	Project No. 2574601 Date 8/26/10 Scale 1" = 200' HOR. 1" = 10' VER. Drn. By JEM Last Revised X	Figure No. 5A Of

Filename: O:\data6\2574601\Cadd Data – 2574601\Dwg\Geologic Cross-Sections\Cross-Section Z-Z'.dwg Date: 9/16/2010 Time: 10:29 User: jmay Style Table: Langan.stb Layout: 5A

NOTES:

1. **LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.**
2. **DEPTH OF SHEET PILE WAS DETERMINED FROM FIGURE 2-8 GENERALIZED GEOLOGICAL CROSS SECTION A-C DATED NOVEMBER 13, 1992 FROM DAMES AND MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVERON REFINERY, 1992, CROSS SECTION RENAMED C-J IN CCR**
3. **GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.**
4. **THICKNESS OF LOWER / MIDDLE CLAY IN AOI-7 IS ESTIMATED FROM DEEP MONITORING WELLS C-144D, C-134D, AND C-50D.**

LEGEND:

- FILL / ALLUVIUM
- SAND / GRAVEL (TRENTON GRAVEL)
- CLAY
- SAND
- BEDROCK (WISSAHICKON SCHIST)
- C-129D LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- INFERRED CONTACTS
- GROUNDWATER LEVEL
- SHEET PILE WALL

SCHUYLKILL RIVER

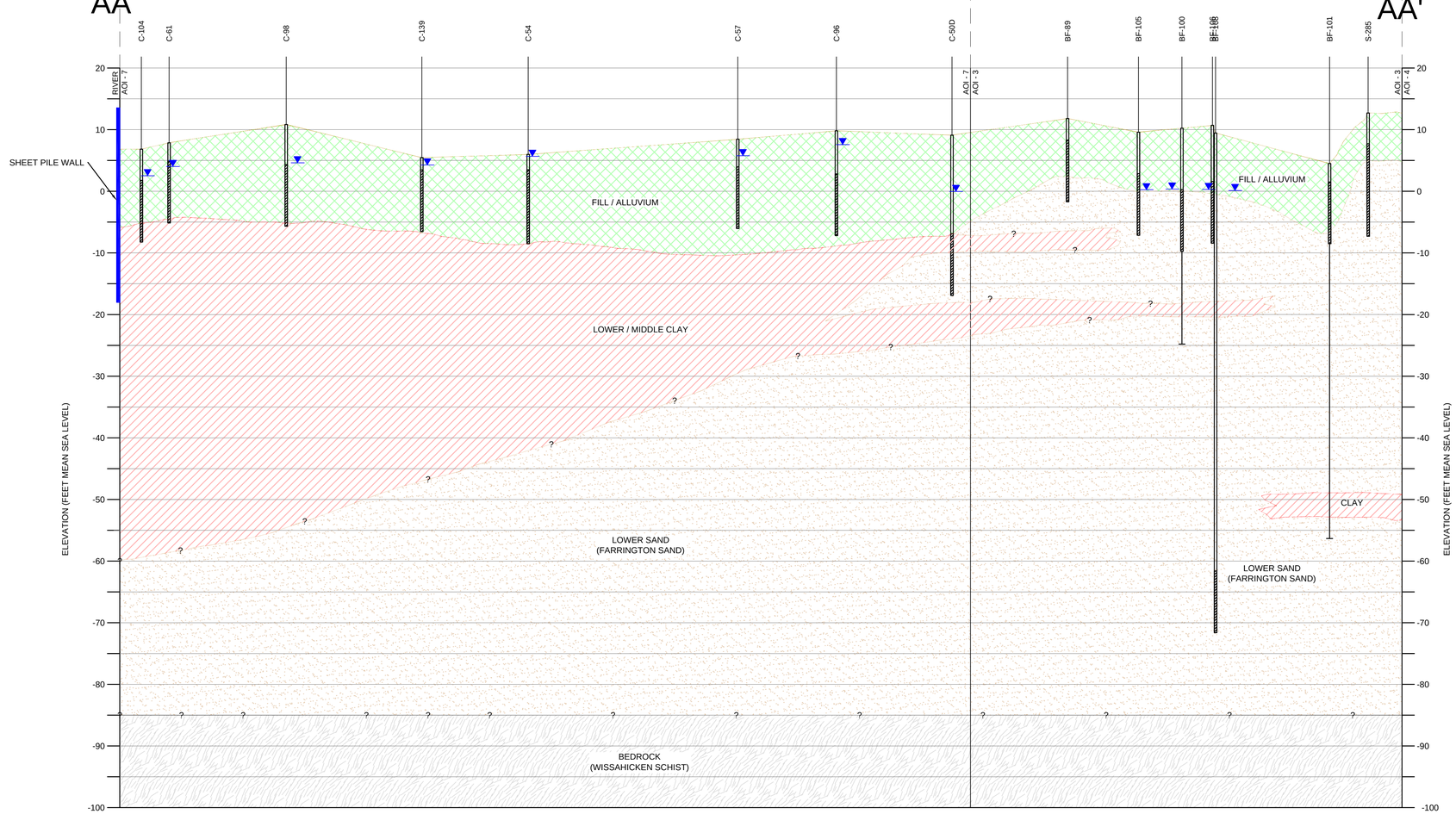
AOI - 7

AOI - 3

AOI - 4

AA

AA'



10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

SUNOCO	Project: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION AA-AA'	Project No. 2574601 Date 8/26/10 Scale 1" = 200' HOR. 1" = 10' VER. Drn. By JEM Last Revised X
			Figure No. 5B Of

Filename: Q:\data6\2574601\Cadd Data – 2574601\Dwg\Geologic Cross-Sections\Cross-Section AA-AA'.dwg Date: 9/17/2010 Time: 11:04 User: jmay Style Table: Langan.stb Layout: 5B

NOTES:

1. **LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.**
2. **DEPTH OF SHEET PILE WAS DETERMINED FROM FIGURE 2-8 GENERALIZED GEOLOGICAL CROSS SECTION A-C DATED NOVEMBER 13, 1992 FROM DAMES AND MOORE, RCRA VERIIFICATION INVESTIGATION REPORT, CHEVERON REFINERY, 1992, CROSS SECTION RENAMED C-J IN CCR**
3. **GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.**

LEGEND:

- FILL / ALLUVIUM
- SAND / GRAVEL (TRENTON GRAVEL)
- CLAY
- SAND
- WEATHERED BEDROCK (WISSAHICKON SCHIST)
- C-129D LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- INFERRED CONTACTS
- GROUNDWATER LEVEL
- SHEET PILE WALL

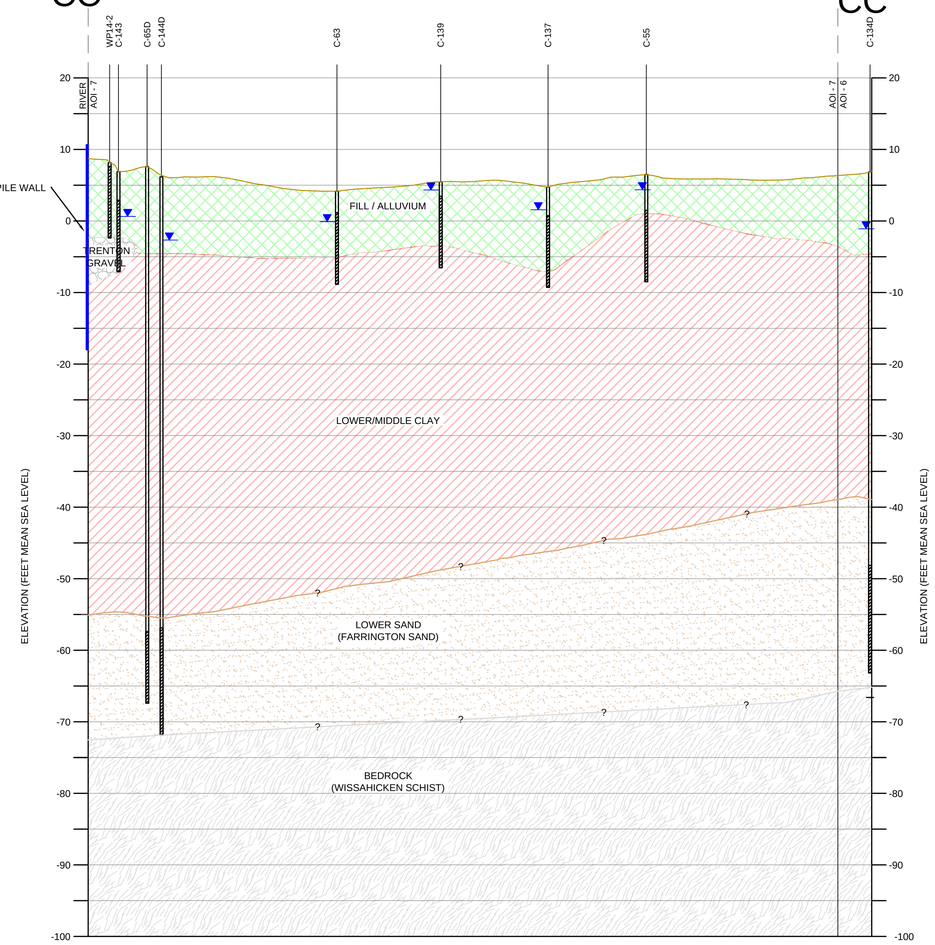
SCHUYLKILL RIVER

AOI - 7

AOI - 6

CC

CC'



10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

SUNOCO	Project: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION CC-CC'	Project No. 2574601 Date 8/26/10 Scale 1" = 200' HOR. 1" = 10' VER. Drn. By JEM Last Revised X Figure No. 5C Of

Filename: O:\data6\2574601\Cadd Data - 2574601\Dwg\Geologic Cross-Sections\Cross-Section CC-CC'.dwg Date: 8/31/2010 Time: 16:50 User: jmay Style Table: Langan.stb Layout: 5C

AOI-8

N

W E

S

Legend

- N-1 — All Existing Monitoring Points
- MW-5 — PGW Monitoring Well Location
- R-1 — PGW Recovery Well Location
- S — S' AOI 8 Cross Section Location
- T — T' AOI 8 Cross Section Location
- U — U' AOI 8 Cross Section Location
- Steel Bulkhead
- Wooden Bulkhead
- AOI 8 Boundary

Notes:
1. Bing Maps aerial imagery provided by © 2010 Microsoft Corporation and its data suppliers and obtained under the licensing agreement with ESRI.
2. Bulkhead referenced from Remedial Action Plan for the North Yard Bulkhead, ENSR Consulting and Engineering, October 1993.

Figure 4: Cross Section Location Plan
AOI 8 Site Characterization Report/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

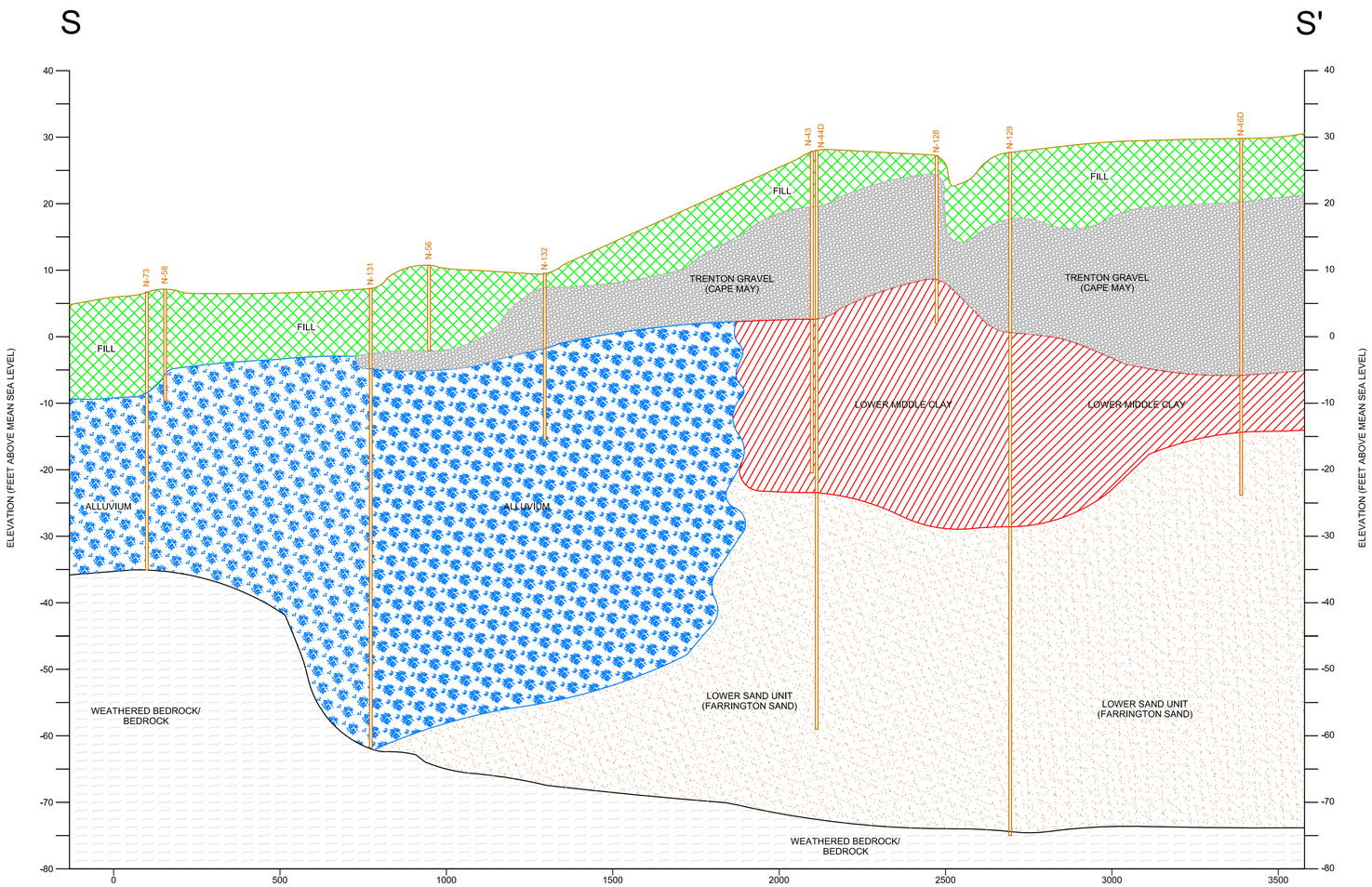
0 250 500 Feet

SCALE: 1" = 250'
DATE: April 13, 2011
DRN. BY: MFH
CKD. BY: DW
JOB#: 2574601

Path: \\angan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\AOI 8 SCR\SCR_RIR\Figure 4 - AOI 8 Cross Section Plan_4-13-11.mxd

LEGEND:

- FILL
- ALLUVIUM
- CLAY
- SAND
- WEATHERED BEDROCK / BEDROCK
- GRAVEL
- B-129 LOCATION ID
- WELL BORE HOLE



NOTES:

1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL/BORING LOGS.
2. WELL CONSTRUCTION INFORMATION IS NOT AVAILABLE FOR ALL WELLS. ONLY THE WELL BOREHOLE IS ILLUSTRATED ON THIS SECTION.

10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

SUNOCO

Project
SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title
GEOLOGIC CROSS SECTION S-S'
AOI 8 SITE CHARACTERIZATION REPORT

Project No. 2574601	Drawing No. 5a
Date 14 AUGUST 2007	
Scale 1"=200' HOR. 1"=10' VER.	
Drn. By DMM/TS	
Last Revised X	1 Of 1

Filename: G:\Other\Tfoster\2574601 SECTION S.dwg Date: 9/26/2008 Time: 10:08 User: tfoster Style Table: Langan.stb Layout: D Size Sheet (Bottom)

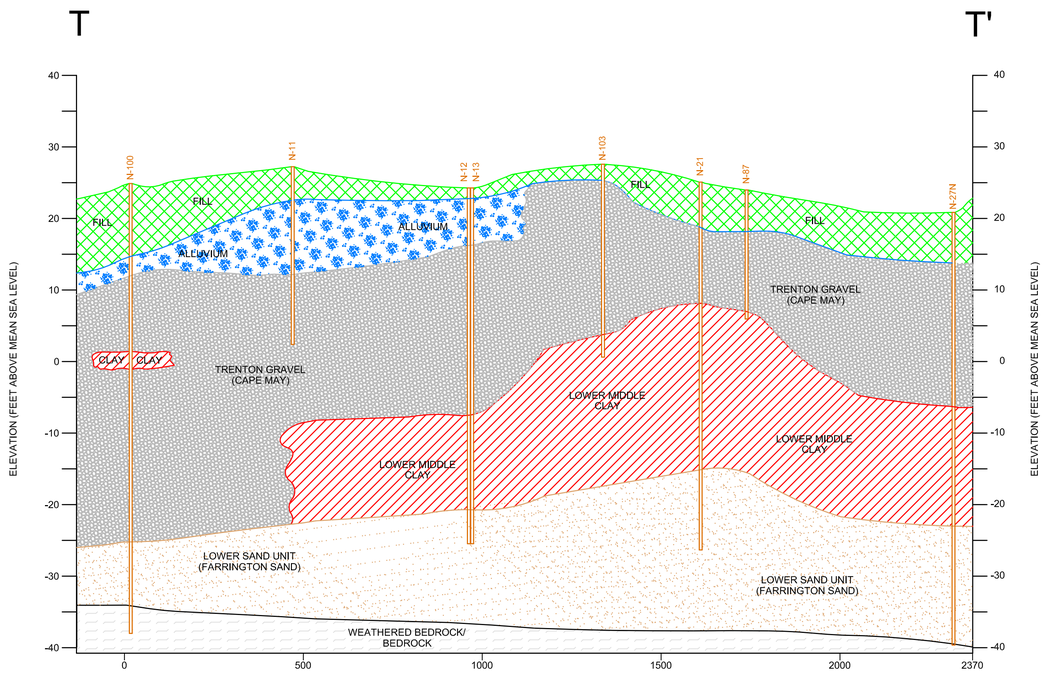
© 2006 Langan Engineering and Environmental Services Inc.

LEGEND:

- FILL
- SAND
- ALLUVIUM
- WEATHERED BEDROCK / BEDROCK
- CLAY
- GRAVEL
- B-129 LOCATION ID
- WELL BORE HOLE

NOTES:

1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL/BORING LOGS.
2. WELL CONSTRUCTION INFORMATION IS NOT AVAILABLE FOR ALL WELLS. ONLY THE WELL BOREHOLE IS ILLUSTRATED ON THIS SECTION.



10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

Project	SUNOCO PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA
Drawing Title	GEOLOGIC CROSS SECTION T-T' AOI 8 SITE CHARACTERIZATION REPORT
Project No.	2574601
Date	14 AUGUST 2007
Scale	1"=200' HOR. 1"=10' VER.
Drn. By	DMM/TS
Last Revised	X
Drawing No.	5b
	1 Of 1

Filename: G:\Other\Tfoster\2574601 SECTION T.dwg Date: 9/2/2008 Time: 14:09 User: acofrancesco Style Table: Langan.stb Layout: D Size Sheet (Bottom)

© 2005 Langan Engineering and Environmental Services Inc.

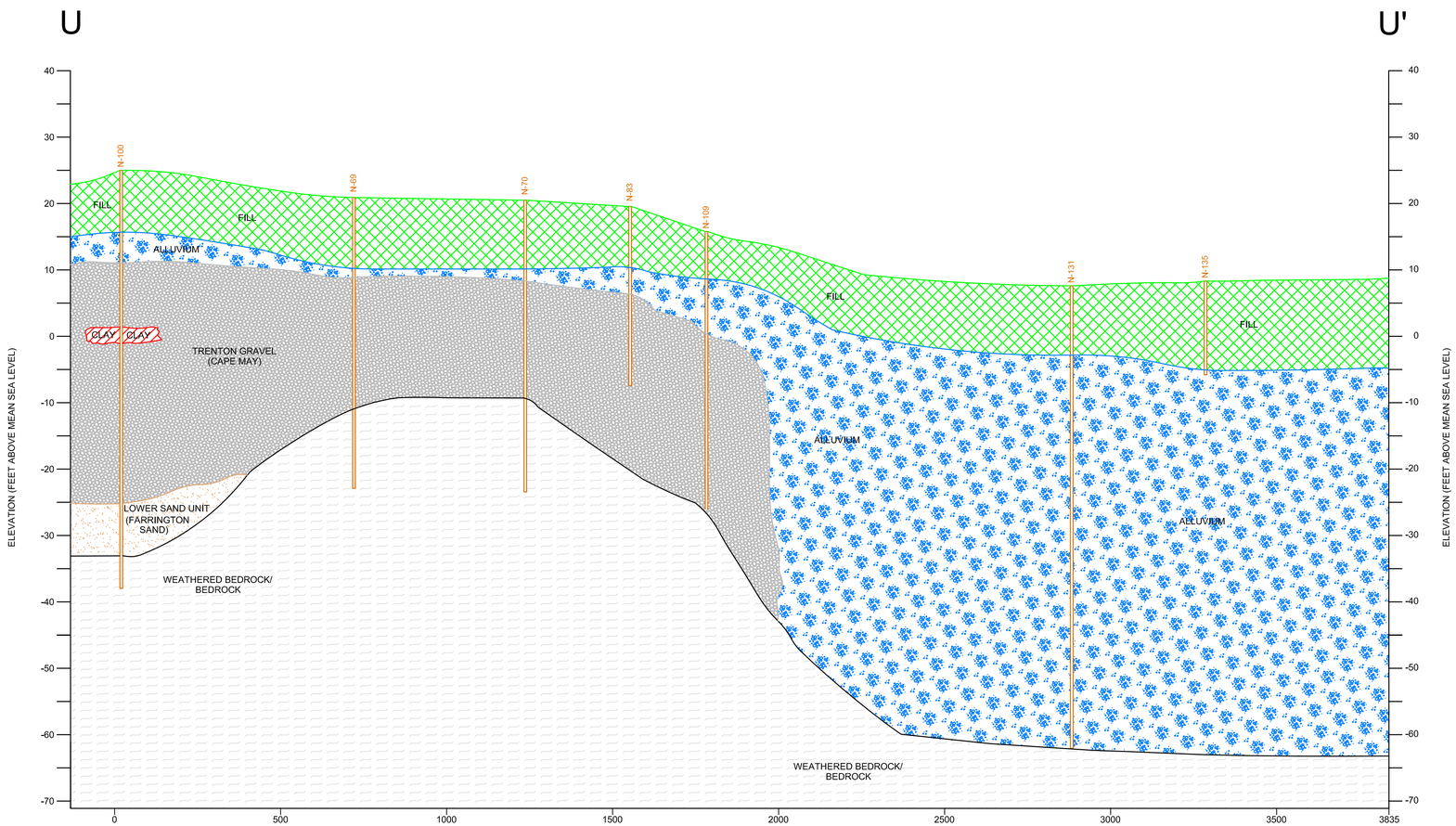
LEGEND:

- FILL
- SAND
- ALLUVIUM
- WEATHERED BEDROCK / BEDROCK
- CLAY
- GRAVEL
- B-129 LOCATION ID
- ——?—— ——?—— INFERRED CONTACTS
- WELL BORE HOLE

NOTES:

LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW OR HISTORIC WELL/BORING LOGS.

1. WELL CONSTRUCTION INFORMATION IS NOT AVAILABLE FOR ALL WELLS. ONLY THE WELL BOREHOLE IS ILLUSTRATED ON THIS SECTION.



VERTICAL SCALE IN FEET: 10 0 2 4 10

HORIZONTAL SCALE IN FEET: 200 0 100 200

Project: SUNOCO PHILADELPHIA REFINERY — PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION U-U' AOI 8 SITE CHARACTERIZATION REPORT	Project No. 2574601	Drawing No. 5C
		Date 14 AUGUST 2007	
		Scale 1"=200' HOR. 1"=10' VER.	
		Drn. By DMM/TS	
		Last Revised X	1 Of 1

Filename: G:\Other\Tfoster\2574601 SECTION U.dwg Date: 9/2/2008 Time: 9:06 User: acofrancesco Style Table: Langon.stb Layout: D Size Sheet (Bottom)

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AOI-9

Notes:
1. 2005 aerial photography provided by the Delaware Valley Regional Planning Commission (DVRPC).

Legend

N
W E
S

- Shallow Recovery Well
- Shallow Monitoring Well
- Deep Monitoring Well
- Abandoned/Damaged Well
- V — V' AOI 9 Cross Section Location (V - V')
- W — W' AOI 9 Cross Section Location (W - W')
- AOI Boundary

Figure 5A: Cross Section Location Plan
AOI-9 Site Characterization Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 175 350 Feet

SCALE: 1" = 175'
DATE: August 31, 2009
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

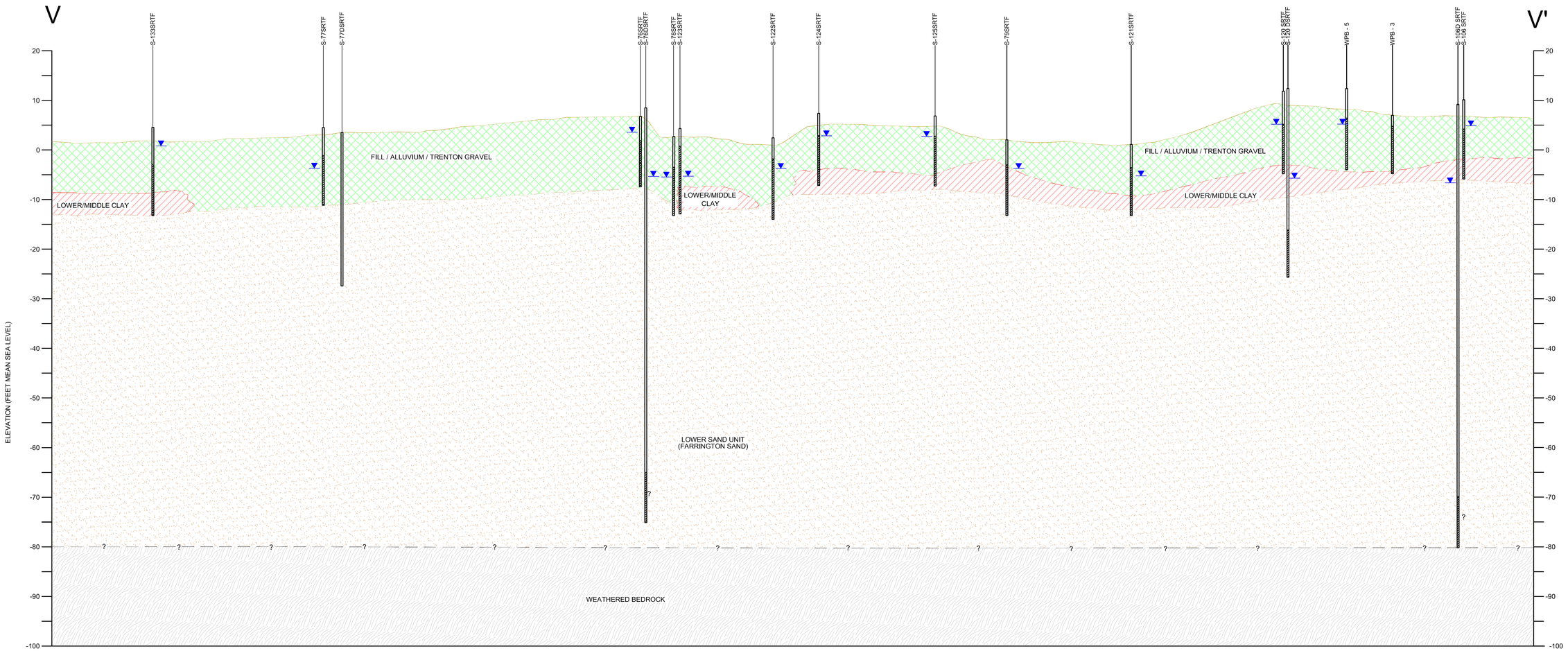
Q:\Data6\2574601\ArcGIS\MapDocuments\AOI 9 SCR\Figure 5A - Cross Section Location Plan 10-29-09.mxd

NOTES:

1. DEPTH OF SCHUYLKILL RIVER FROM SIMULATION OF GROUNDWATER FLOW IN THE POTOMIC-RARITAN-MAGOTHY AQUIFER SYSTEM NEAR THE DEFENSE SUPPLY CENTER PHILADELPHIA, AND THE POINT BREEZE REFINERY, SOUTHERN PHILADELPHIA COUNTY, PENNSYLVANIA BY CURTIS L. SCHREFFLER DATED 2001.
2. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
3. DEPTH TO WEATHERED BEDROCK WAS INTERPOLATED FROM NEW/HISTORIC WELL / SOIL BORING LOGS AND FROM FIGURE 3-11 GENERALIZED CROSS SECTION A_A-$A_{A'}$-$A_{A''}$, DATED 13 NOVEMBER 1992 FROM DAMES & MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVRON REFINERY, 1992. CROSS SECTION RENAMED N-C-J
4. WELL CONSTRUCTION INFORMATION IS NOT AVAILABLE FOR ALL WELLS SHOWN ON THIS CROSS SECTION.

LEGEND:

- FILL / ALLUVIUM / TRENTON GRAVEL (UNDIFFERENTIATED)
- CLAY
- SAND
- WEATHERED BEDROCK
- GROUNDWATER LEVEL
- S-120SRTF LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- INFERRED CONTACTS



VERTICAL SCALE IN FEET: 10 0 2 4 10

HORIZONTAL SCALE IN FEET: 200 0 100 200

Project: SUNOCO PHILADELPHIA REFINERY — PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION V-V'	Project No. 2574601	Figure No. 5b
		Date 8 September 2009	
		Scale 1"=200' HOR. 1"=10' VER.	
		Drn. By JEM/ KW	
		Last Revised 23 October 2009	Of

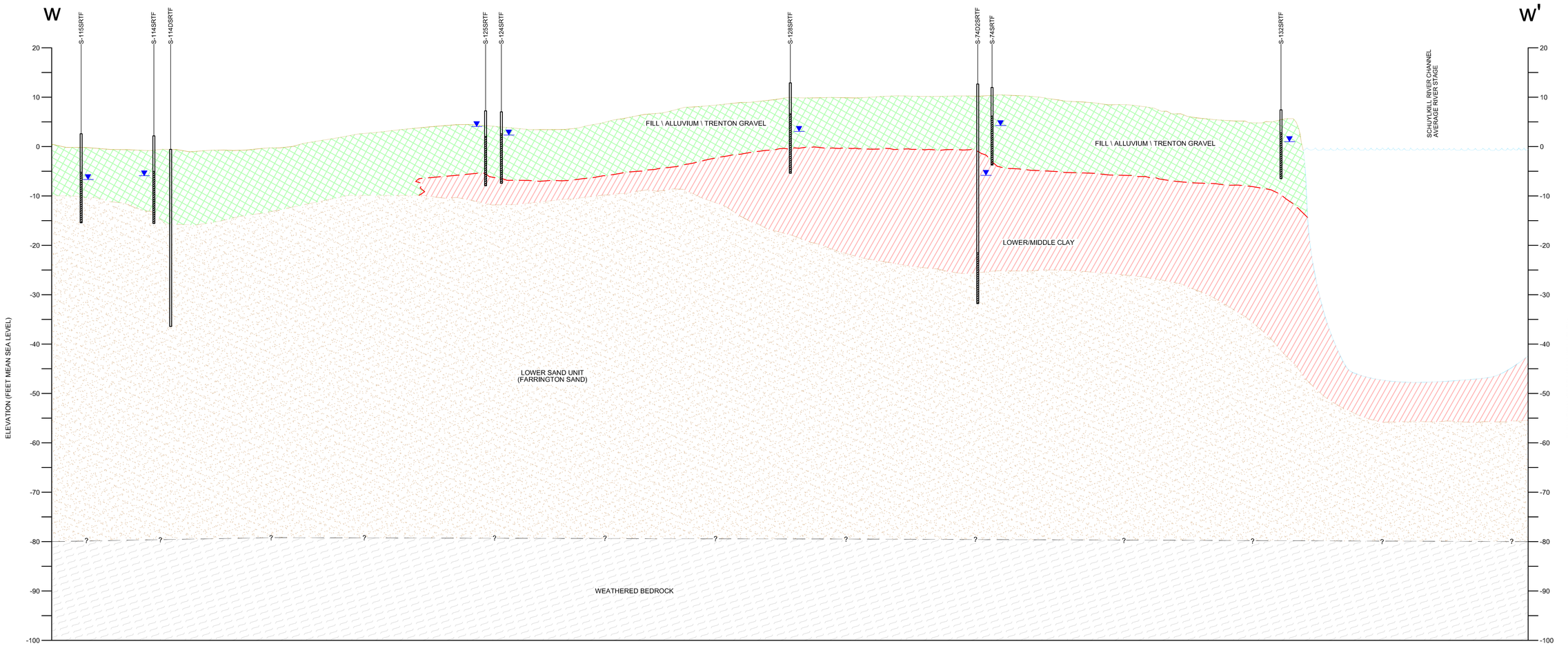
Filename: Q:\Data6\2574601\Cadd Data – 2574601\Dwg\Geologic Cross-Section V-V'.dwg Date: 10/30/2009 Time: 8:42 User: jmay Style Table: Langan.stb Layout: D Size Sheet (Bottom)

NOTES:

1. DEPTH OF SCHUYLKILL RIVER FROM SIMULATION OF GROUNDWATER FLOW IN THE POTOMIC-RARITAN-MAGOTHY AQUIFER SYSTEM NEAR THE DEFENSE SUPPLY CENTER PHILADELPHIA, AND THE POINT BREEZE REFINERY, SOUTHERN PHILADELPHIA COUNTY, PENNSYLVANIA BY CURTIS L. SCHREFFLER DATED 2001.
2. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
3. DEPTH TO WEATHERED BEDROCK AND CLAY BENEATH THE SCHUYKILL RIVER IS INTERPOLATED FROM NEW/HISTORIC WELL / SOIL BORING LOGS AND FROM FIGURE 3-11 GENERALIZED CROSS SECTION A_e-A_w-A_x , DATED 13 NOVEMBER 1992 FROM DAMES & MOORE, RCRA VERIFICATION INVESTIGATION REPORT, CHEVRON REFINERY, 1992. CROSS SECTION RENAMED N-C-J
4. WELL CONSTRUCTION INFORMATION IS NOT AVAILABLE FOR ALL WELLS SHOWN ON THIS CROSS SECTION.

LEGEND:

- FILL / ALLUVIUM / TRENTON GRAVEL (UNDIFFERENTIATED)
- CLAY
- SAND
- WEATHERED BEDROCK
- GROUNDWATER LEVEL
- S-120SRTF LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- ——?—— ——?—— INFERRED CONTACTS



10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

SUNOCO	Project: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION W-W'	Project No. 2574601 Date 8 September 2009 Scale 1"=200' HOR. 1"=10' VER. Drn. By JEM/ KW Last Revised 20 October 2009
			Figure No. 5c Of

Filename: Q:\Data6\2574601\Cadd Data – 2574601\Dwg\Geologic Cross-Section W-W'.dwg Date: 10/30/2009 Time: 8:43 User: jmay Style Table: Langan.stb Layout: D Size Sheet (Bottom)

AOI-10

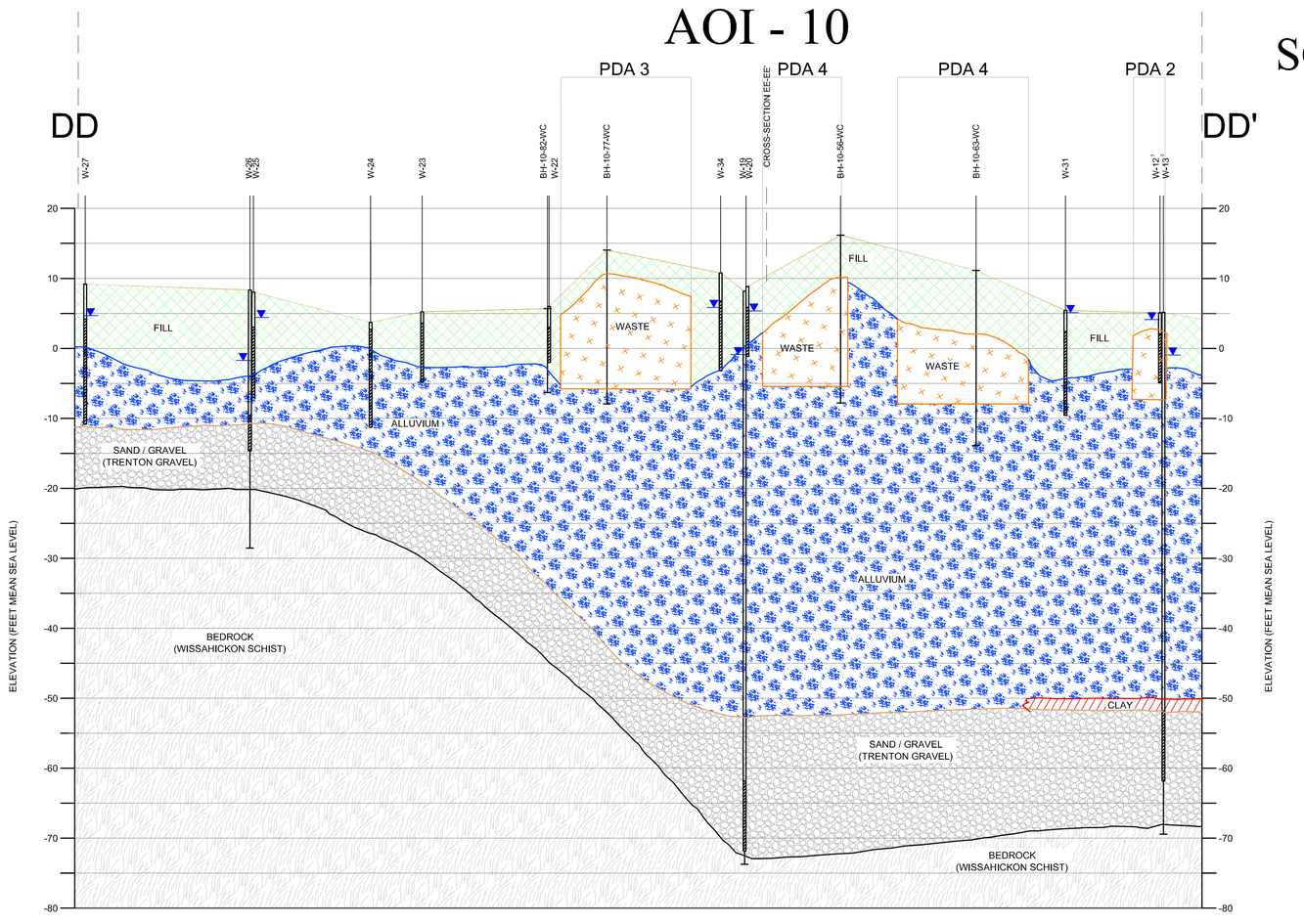
KEY MAP N.T.S.

NOTES:
1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
2. GROUNDWATER ELEVATIONS COLLECTED IN APRIL 2011.
3. WELLS W-12 AND W-13 ARE NOT LOCATED WITHIN PDA2. THESE WELLS WERE PROJECTED ONTO CROSS-SECTION FOR LITHOLOGY PURPOSES.
4. PAST DISPOSAL AREAS (PDA) WERE APPROXIMATED FROM FIELD DELINEATION SOIL BORINGS AND ENSR'S FIGURE 9 DEEP AQUIFER PIEZOMETRIC MAP DATED APRIL 17, 1992.

LEGEND:

- FILL
- WASTE
- ALLUVIUM
- SAND / GRAVEL (TRENTON GRAVEL)
- CLAY
- BEDROCK (WISSAHICKON SCHIST)
- W-7 LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- GROUNDWATER LEVEL
- SOIL BORING

AOI - 10



SCHUYLKILL RIVER

10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

SUNOCO

Project: SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title: GEOLOGIC CROSS SECTION DD-DD'

Project No. 2574601	Figure No. 4A
Date 6/1/2011	
Scale 1" = 200' HOR. 1" = 10' VER.	
Drn. By JEM	
Last Revised X	Of

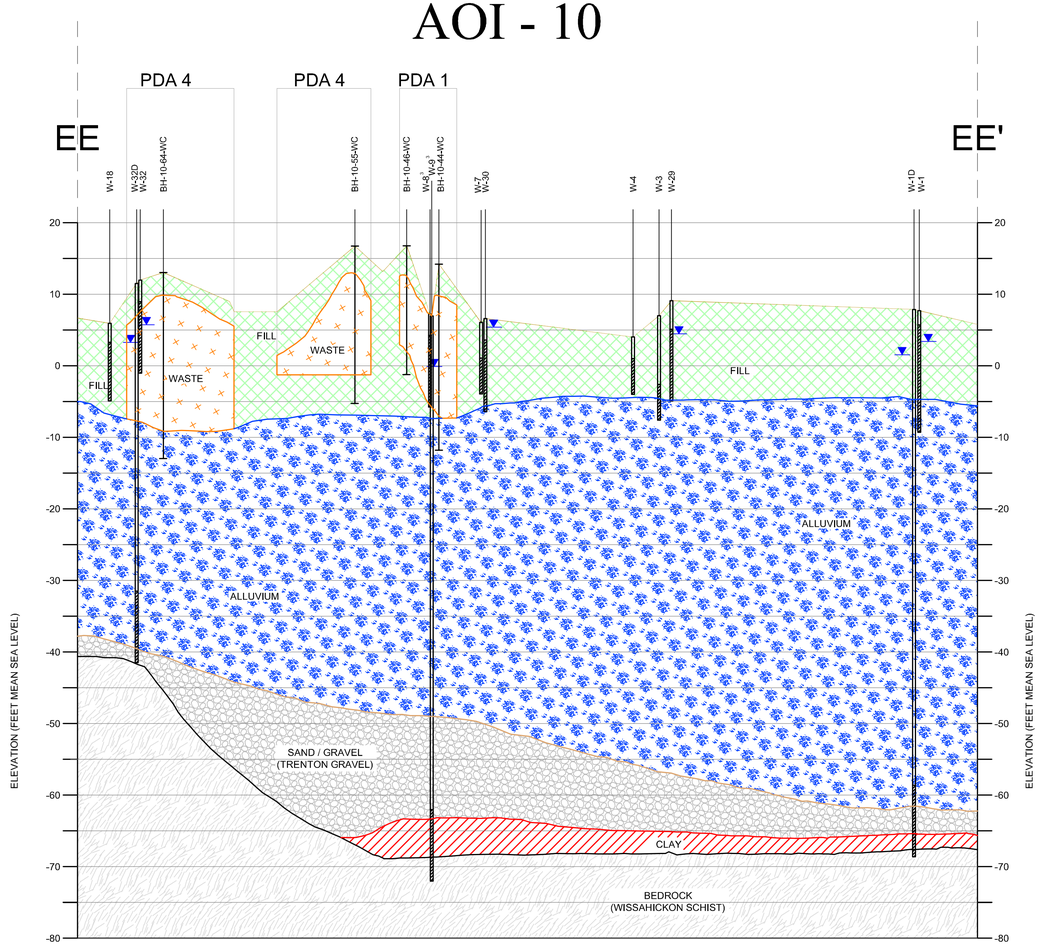
Filename: \\langan.com\data\DT\data6\2574601\Cadd Data - 2574601\Dwg\Geologic Cross-Sections\AOI 10\Cross-Section DD-DD'.dwg Date: 6/21/2011 Time: 16:25 User: tyates Style Table: Langan.stb Layout: 5A

KEY MAP N.T.S.

NOTES:
1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL / SOIL BORING LOGS.
2. GROUNDWATER ELEVATIONS COLLECTED IN APRIL 2011.
3. WELLS W-8 AND W-8 ARE NOT LOCATED WITHIN PDA1. THESE WELLS WERE PROJECTED ONTO CROSS-SECTION FOR LITHOLOGY PURPOSES.
4. PAST DISPOSAL AREAS (PDA) WERE APPROXIMATED FROM FIELD DELINEATION SOIL BORINGS AND ENSR'S FIGURE 9 DEEP AQUIFER PIEZOMETRIC MAP DATED APRIL 17, 1992.

LEGEND:
- FILL
- WASTE
- ALLUVIUM
- SAND / GRAVEL (TRENTON GRAVEL)
- CLAY
- BEDROCK (WISSAHICKON SCHIST)
- W-7 LOCATION ID
- WELL CASING/BOREHOLE
- WELL SCREEN
- BOTTOM OF BOREHOLE
- GROUNDWATER LEVEL
- SOIL BORING

AOI - 10



SCHUYLKILL RIVER

10 0 2 4 10
VERTICAL SCALE IN FEET

200 0 100 200
HORIZONTAL SCALE IN FEET

	Project: SUNOCO PHILADELPHIA REFINERY — PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title: GEOLOGIC CROSS SECTION EE-EE'	Project No. 2574601
			Date 6/1/2011
			Scale 1" = 200' HOR. 1" = 10' VER.
			Drn. By JEM
			Last Revised X
			Figure No. 4B
			Of

Filename: \\langan.com\data\DT\data6\2574601\Cadd Data - 2574601\Dwg\Geologic Cross-Sections\AOI 10\Cross-Section EE-EE".dwg Date: 6/21/2011 Time: 16:28 User: tyates Style Table: Langan.stb Layout: 5B

SITE WIDE

APPENDIX C

GEOLOGIC CROSS SECTIONS

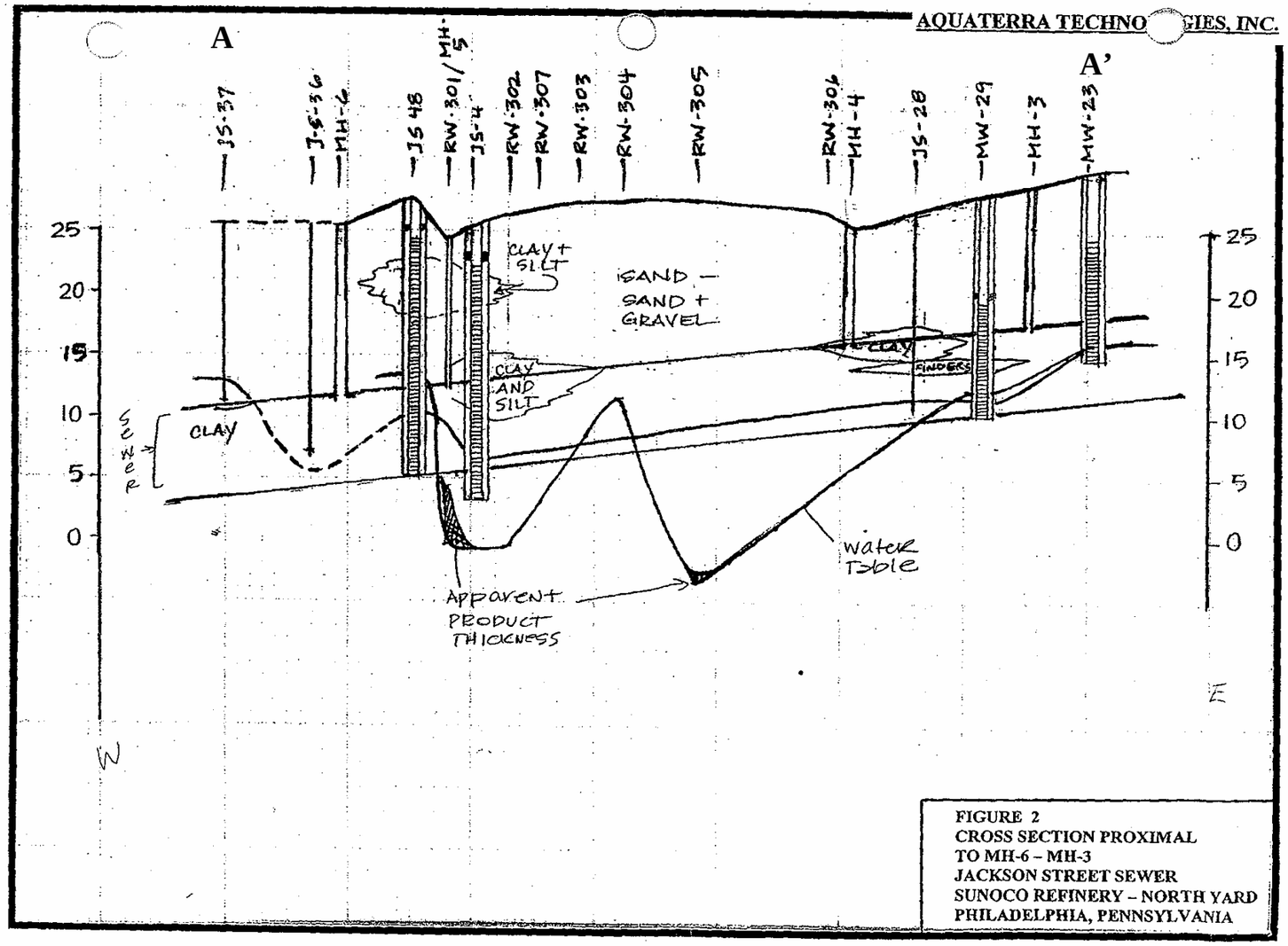


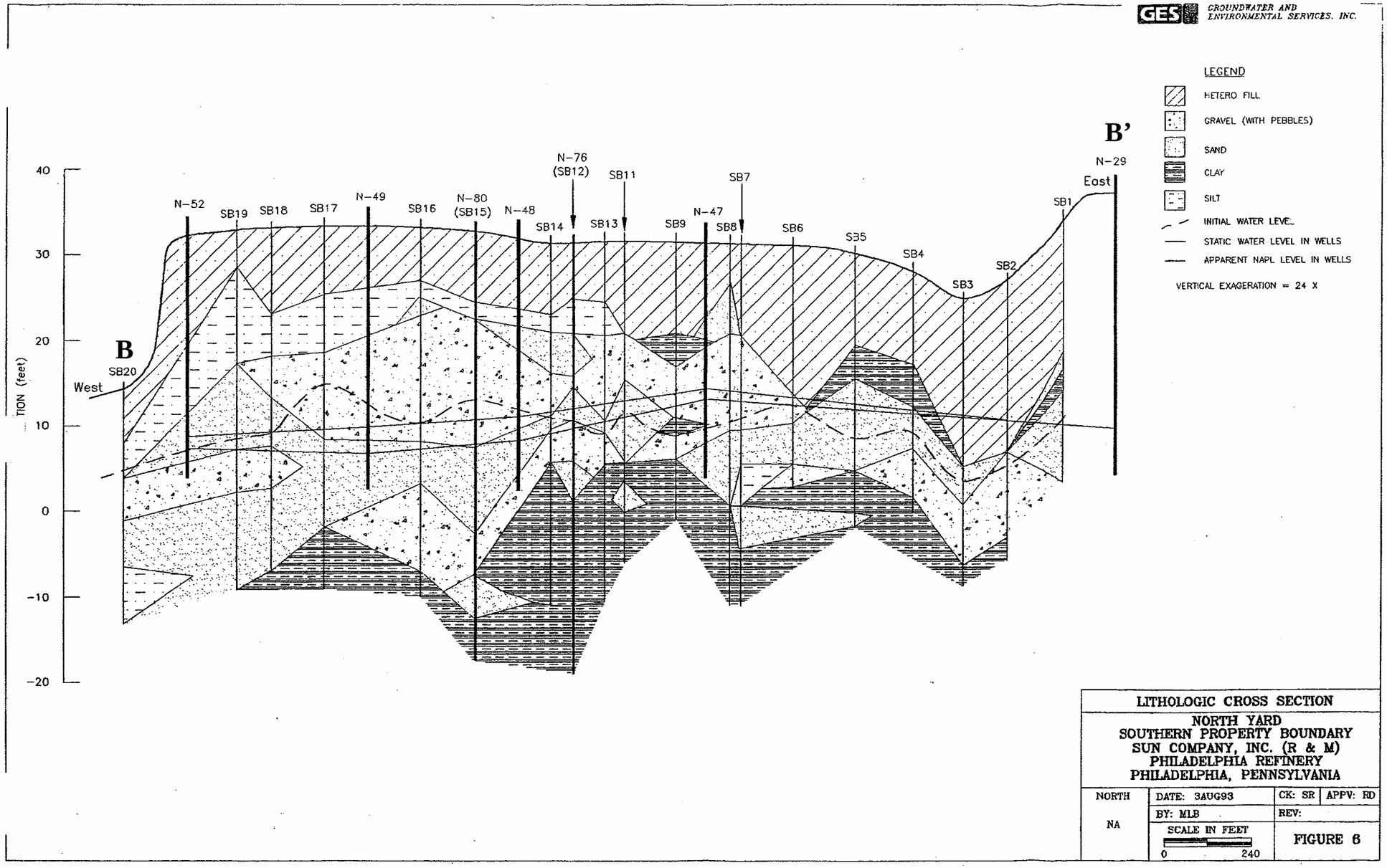
FIGURE 2
CROSS SECTION PROXIMAL
TO MH-6 – MH-3
JACKSON STREET SEWER
SUNOCO REFINERY – NORTH YARD
PHILADELPHIA, PENNSYLVANIA

LANGAN
ENGINEERING & ENVIRONMENTAL SERVICES

Elmwood Park ,NJ Doylestown, PA Philadelphia, PA
Miami, FL New Haven, CT New York, NY

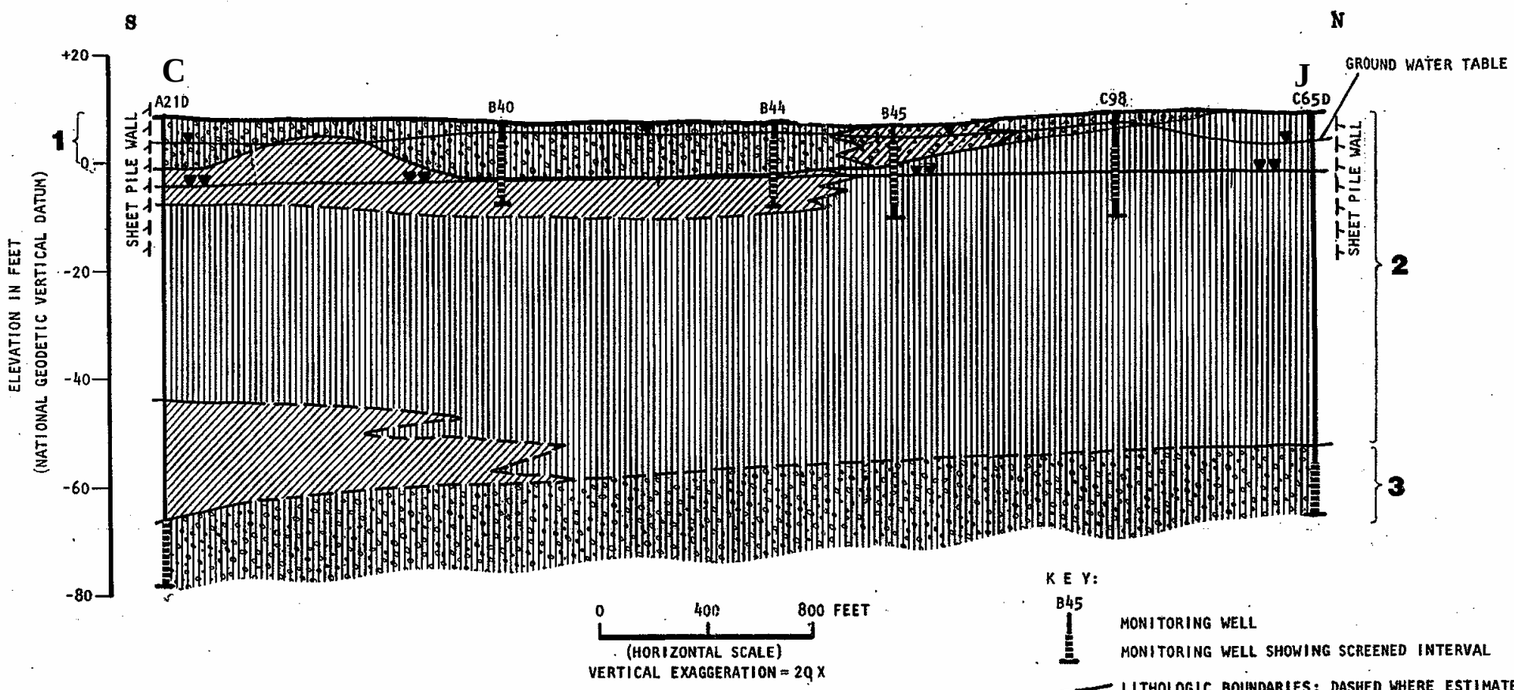
Appendix C – Cross Section A-A'

NOTE: Cross Section taken from Aquaterra Technologies, Supplemental Subsurface Evaluation: Jackson Street Sewer-North Yard, 2002. Renamed Cross Section A-A'.



Appendix C – Cross Section B-B'

NOTE: Cross Section taken from GES, Inc., Remedial Action Plan North Yard Southern Property Boundary (PGW Border), 1993. Renamed Cross Section B-B'.



KEY:

B45 — MONITORING WELL

MONITORING WELL SHOWING SCREENED INTERVAL

LITHOLOGIC BOUNDARIES; DASHED WHERE ESTIMATED

SILTY SANDS, SAND-SILT-GRAVEL MIXTURES

CLAYEY SANDS, SAND-CLAY MIXTURES

INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY

INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, SILTY CLAYS

WATER TABLE IN UPPER UNCONSOLIDATED AQUIFER (1986/87 SITE ASSESSMENT)

PIEZOMETRIC SURFACE IN LOWER UNCONSOLIDATED AQUIFER (1986/87 SITE ASSESSMENT)

1 FILL AND TRENTON GRAVEL, UNDIFFERENTIATED UPPER UNCONSOLIDATED AQUIFER

2 LOWER CLAY MEMBER RARITAN FORMATION

3 FARRINGTON SAND MEMBER RARITAN FORMATION LOWER UNCONSOLIDATED AQUIFER

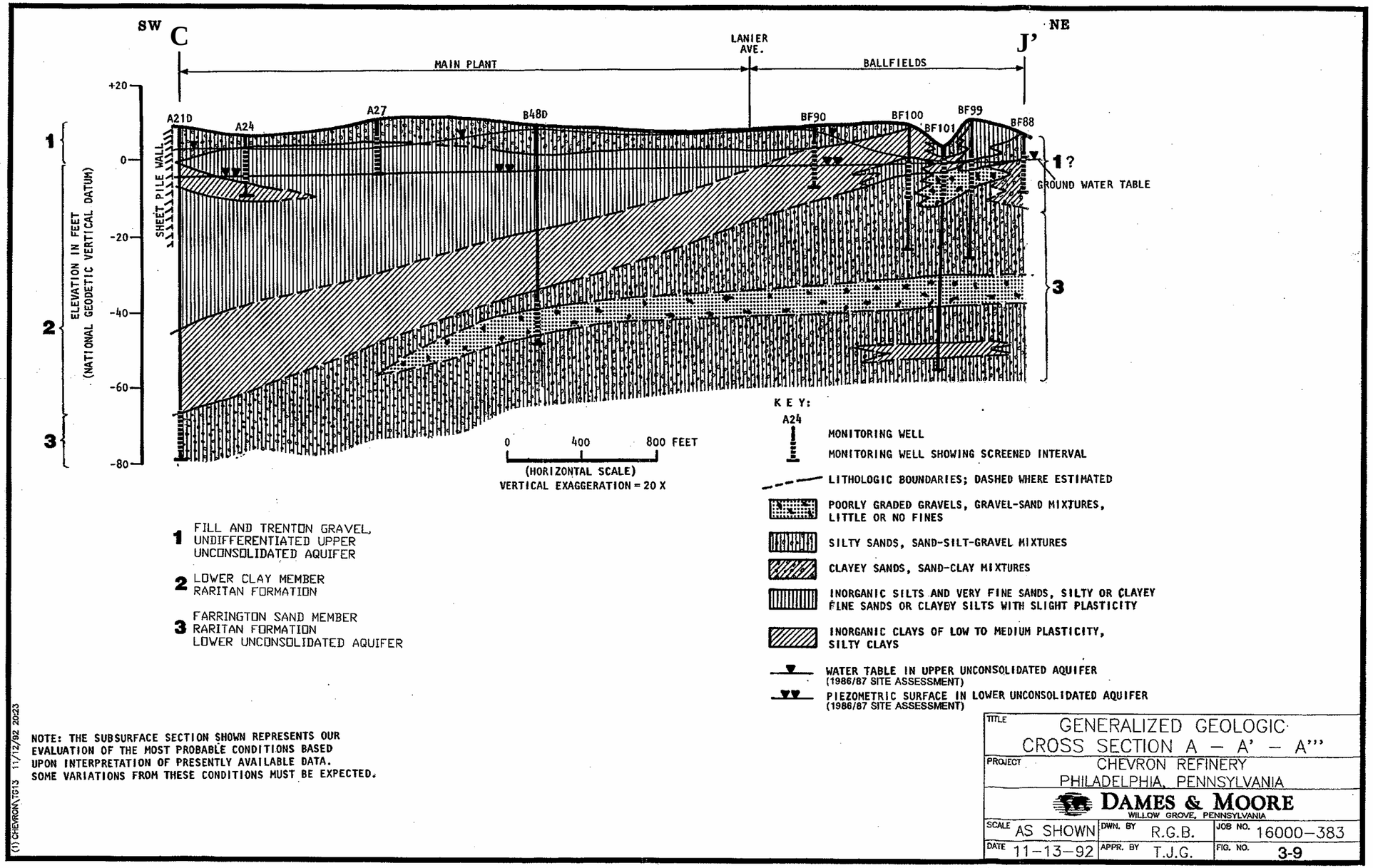
NOTE: THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

(1) CHEVRON\7814 11/12/92 20:24

TITLE: GENERALIZED GEOLOGIC CROSS SECTION A – C		
PROJECT: CHEVRON REFINERY, PHILADELPHIA, PENNSYLVANIA		
DAMES & MOORE, WILLOW GROVE, PENNSYLVANIA		
SCALE: AS SHOWN	DWN. BY: R.G.B.	JOB NO.: 16000-383
DATE: 11-13-92	APPR. BY: T.J.G.	FIG. NO.: 3-8

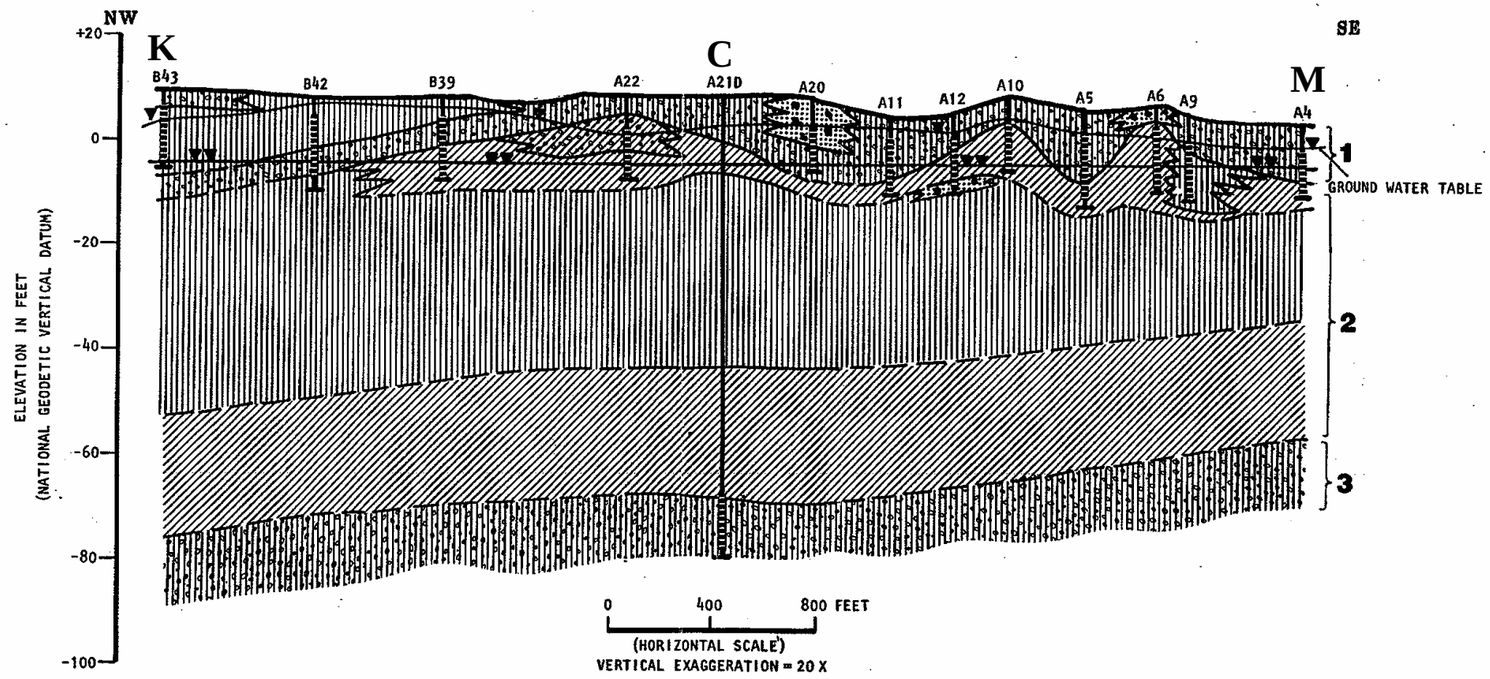
Appendix C – Cross Section C-J

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section C-J.



Appendix C – Cross Section C-J'

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section C-J'.



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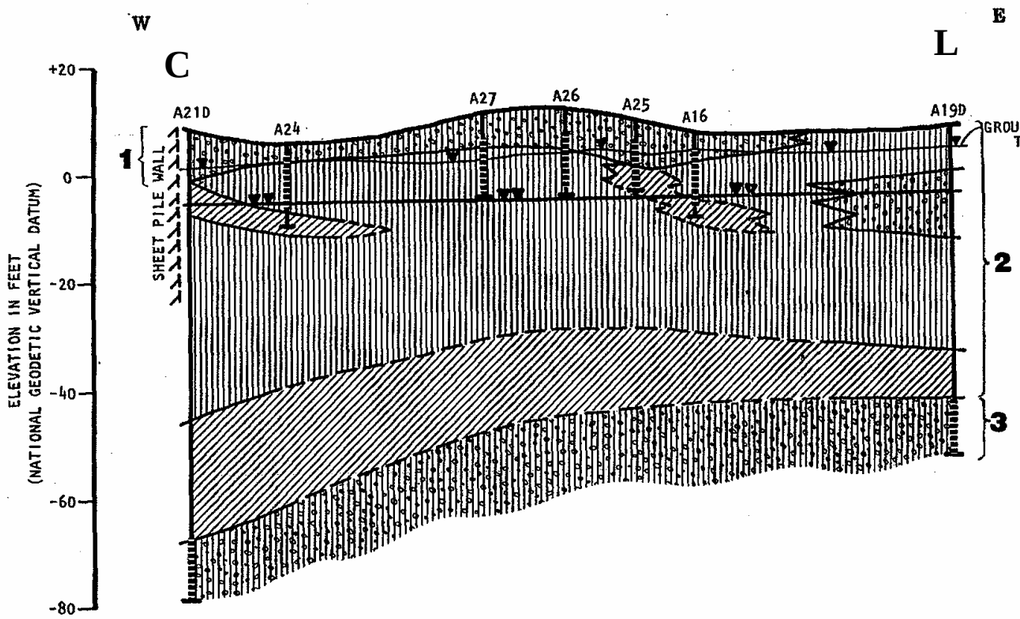
Appendix C – Cross Sections C-K and C-M

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section C-K and C-M.



0 400 800 FEET

(HORIZONTAL SCALE)

VERTICAL EXAGGERATION = 20 X

1 FILL AND TRENTON GRAVEL, UNDIFFERENTIATED UPPER UNCONSOLIDATED AQUIFER

2 LOWER CLAY MEMBER RARITAN FORMATION

3 FARRINGTON SAND MEMBER RARITAN FORMATION LOWER UNCONSOLIDATED AQUIFER

NOTE: THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

K E Y:

A24 — MONITORING WELL

MONITORING WELL SHOWING SCREENED INTERVAL

LITHOLOGIC BOUNDARIES; DASHED WHERE ESTIMATED

SILTY SANDS, SAND-SILT-GRAVEL MIXTURES

INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY

INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, SILTY CLAYS

WATER TABLE IN UPPER UNCONSOLIDATED AQUIFER(1986/87 SITE ASSESSMENT)

PIEZOMETRIC SURFACE IN LOWER UNCONSOLIDATED AQUIFER(1986/87 SITE ASSESSMENT)

(1) CHEVRON\TG16 11/12/92 20:26

TITLE	GENERALIZED GEOLOGIC CROSS SECTION A – A' – A''		
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA		
	DAMES & MOORE WILLOW GROVE, PENNSYLVANIA		
SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-383	
DATE 11-13-92	APPR. BY T.J.G.	FIG. NO. 3-6	

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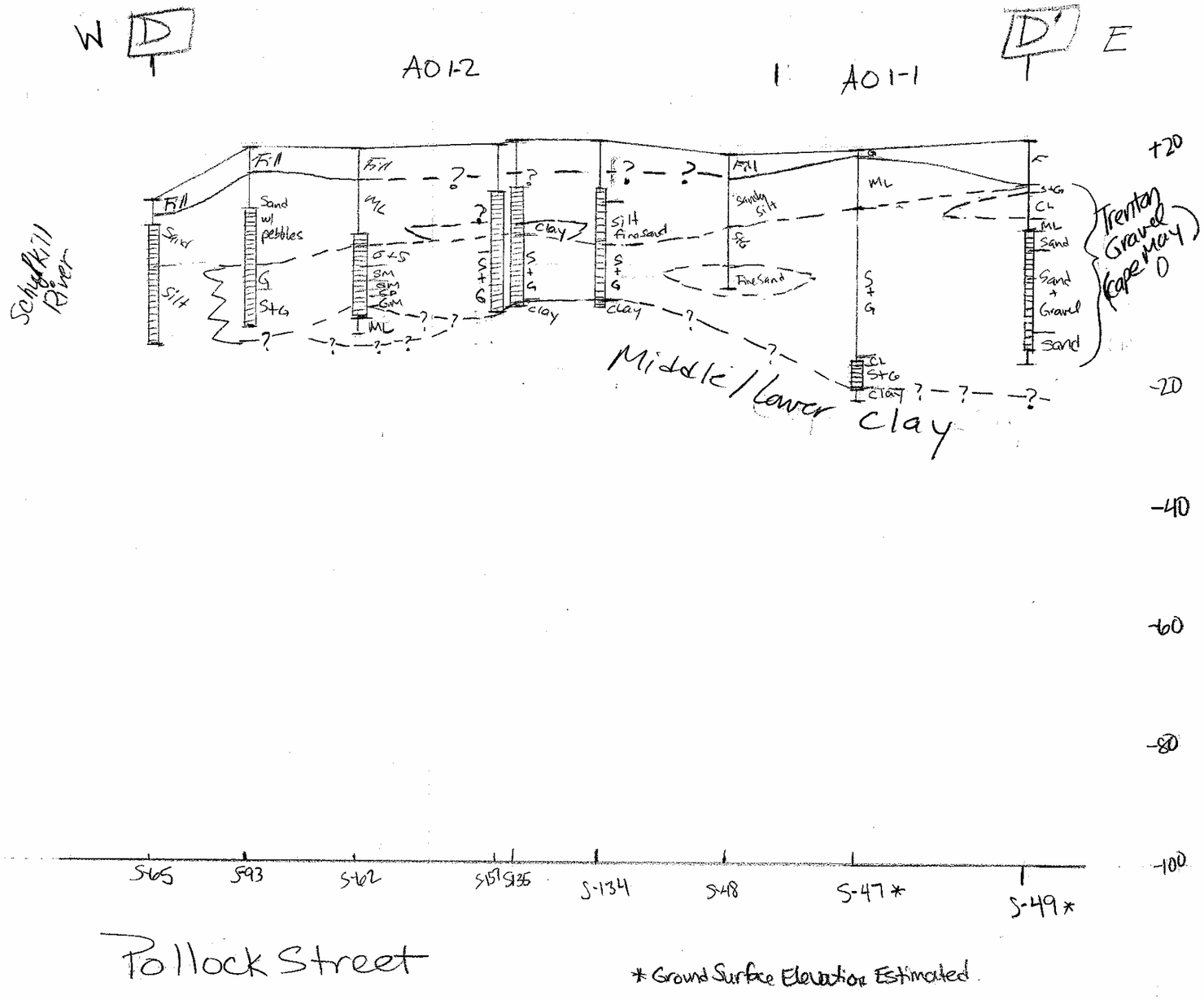
Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section C-L

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section C-L.



Appendix C – Cross Section D-D'

NOTE: Created by Langan 2004 from available boring logs.

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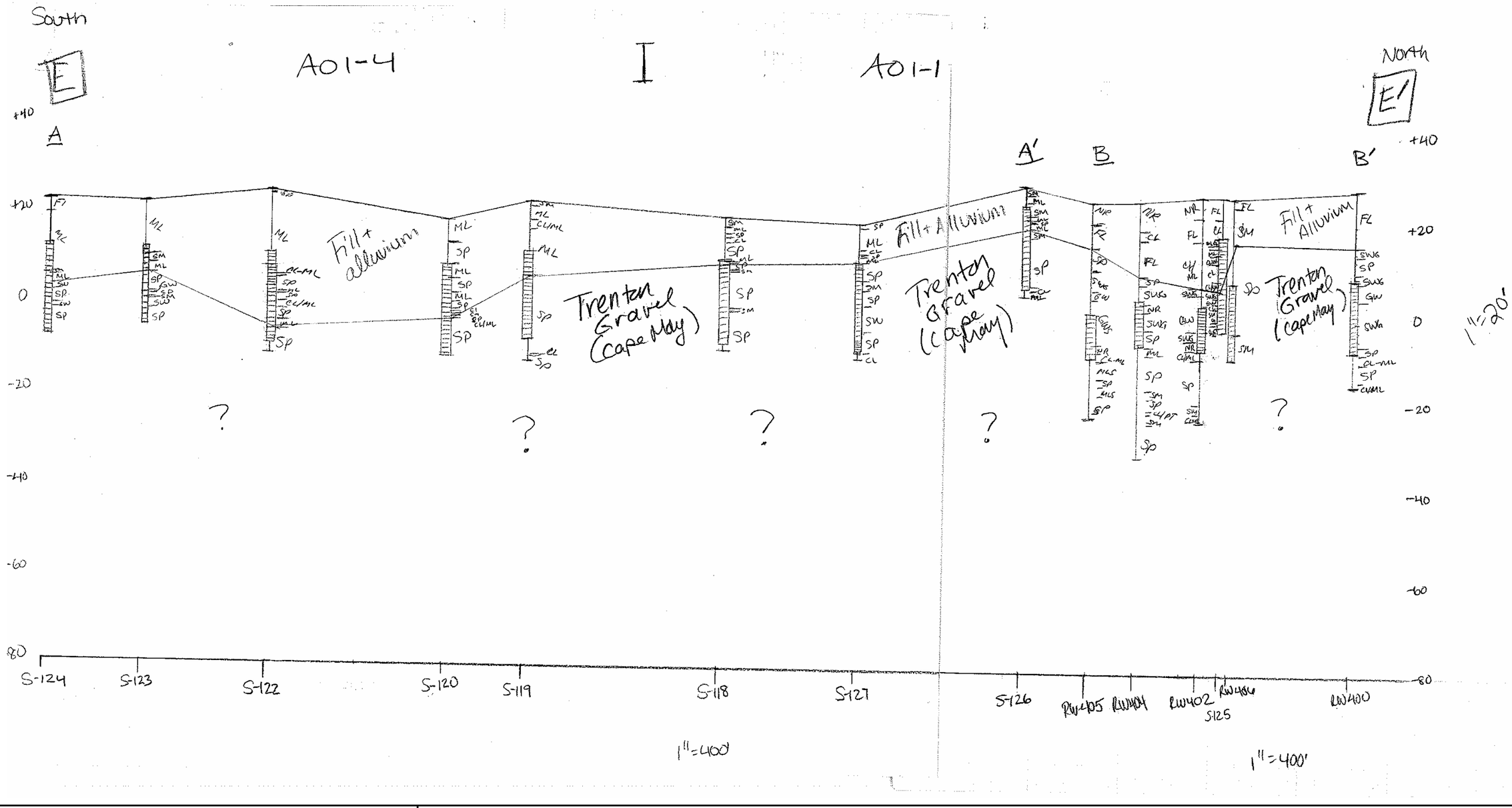
Miami, FL New Haven, CT New York, NY



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Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section E-E'

NOTE: Created by Langan 2004 from available boring logs.

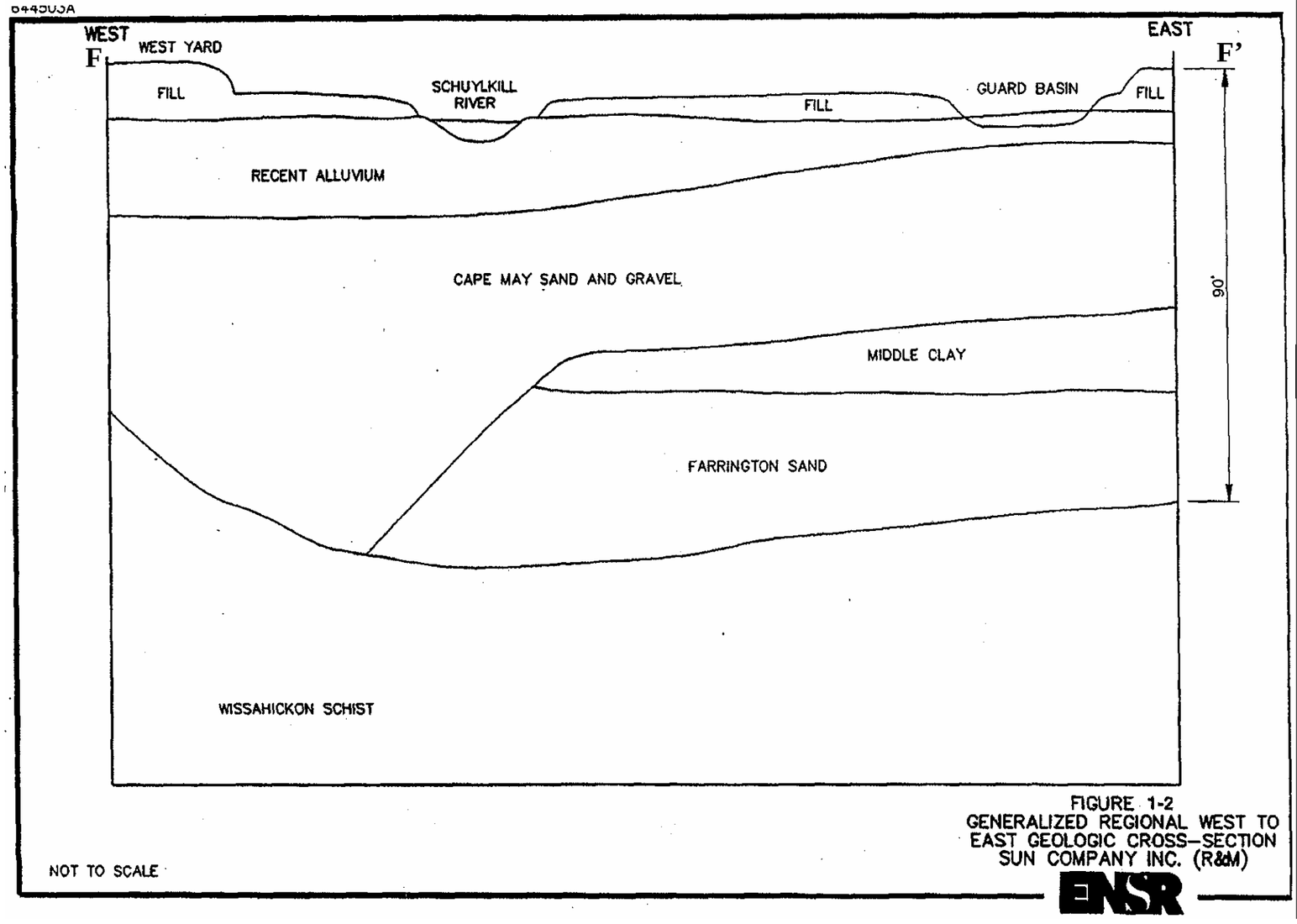

FIGURE 1-2
GENERALIZED REGIONAL WEST TO EAST GEOLOGIC CROSS-SECTION
SUN COMPANY INC. (R&M)

ENSR

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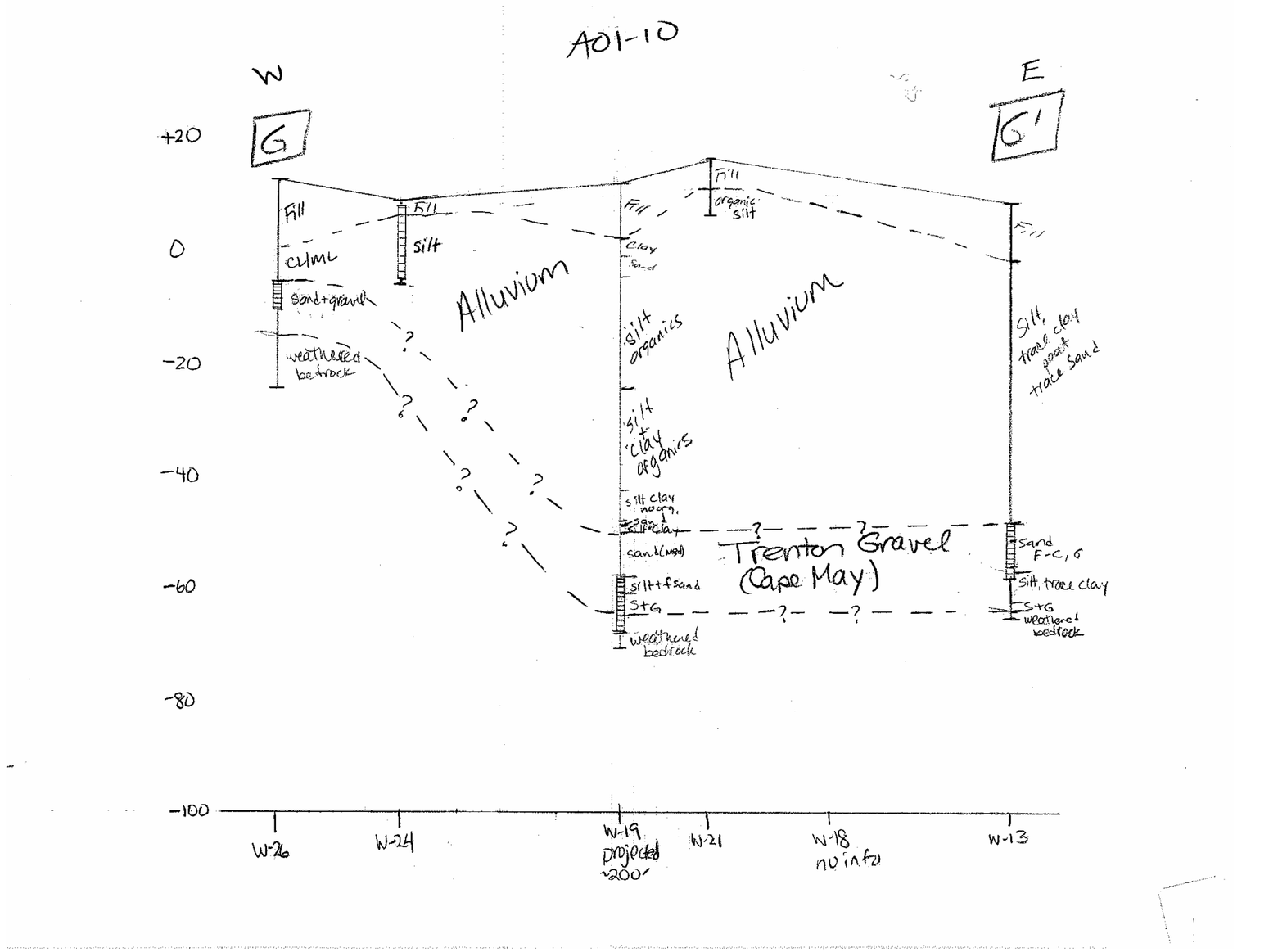
Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section F-F'

NOTE: Cross Section taken from ENSR, Investigation of Shallow and Deep Groundwater Quality, Philadelphia Refinery, 1994 (location is approximate). Renamed Cross Section F-F'.



Appendix C – Cross Section G-G'

NOTE: Created by Langan 2004 from available boring logs.

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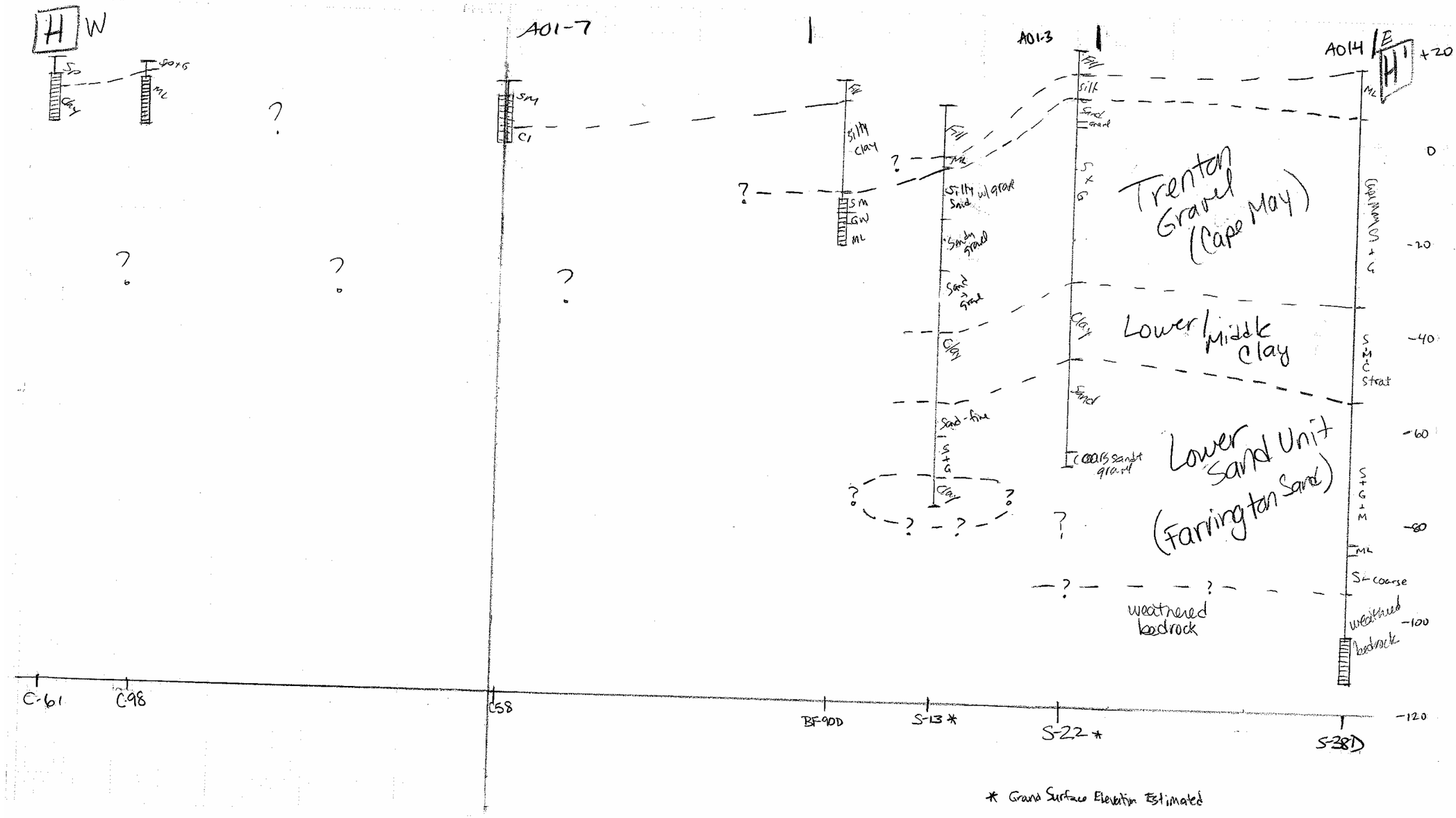
Miami, FL New Haven, CT New York, NY



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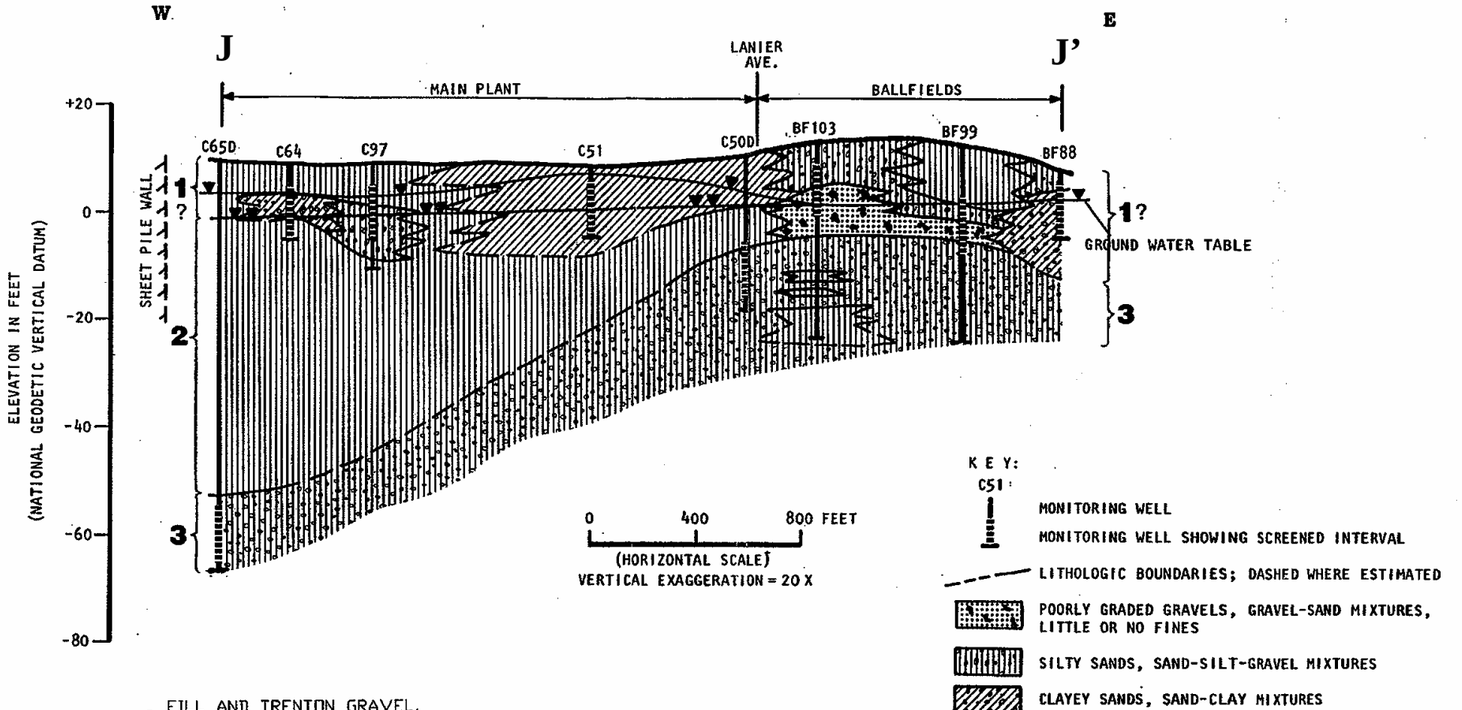
Elmwood Park ,NJ Doylestown, PA Philadelphia, PA
Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section H-H'

NOTE: Created by Langan 2004 from available boring logs.



NOTE: THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

(1) CHEVRON\TG7 11/13/92 08:08

TITLE	GENERALIZED GEOLOGIC CROSS SECTION C – A'''		
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA		
	DAMES & MOORE WILLOW GROVE, PENNSYLVANIA		
SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-383	
DATE 11-13-92	APPR. BY T.J.G.	FIG. NO. 3-10	

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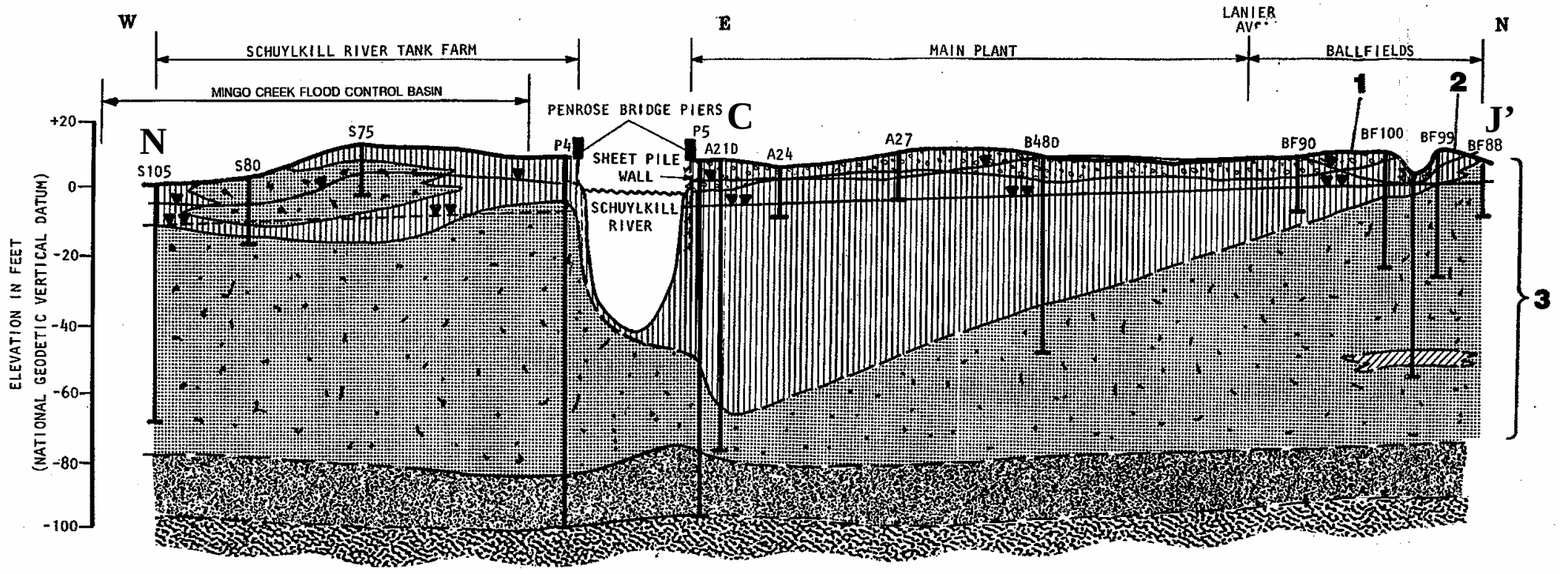
Appendix C – Cross Section J-J'

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section J-J'.



0 620 1240 FEET
(HORIZONTAL SCALE)
VERTICAL EXAGGERATION = 22 X

1 FILL AND TRENTON GRAVEL, UNDIFFERENTIATED UPPER UNCONSOLIDATED AQUIFER

2 LOWER CLAY MEMBER RARITAN FORMATION

3 FARRINGTON SAND MEMBER RARITAN FORMATION LOWER UNCONSOLIDATED AQUIFER

NOTE: THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

(1) CHEVRON\TG12 11/13/92 08:49

KEY:

A24 MONITORING WELL

MONITORING WELL SHOWING SCREENED INTERVAL

LITHOLOGIC BOUNDARIES; DASHED WHERE ESTIMATED

SAND AND GRAVEL, LITTLE OR NO FINES

SILTY SANDS, SAND-SILT-GRAVEL MIXTURES

SILT AND CLAY, LITTLE OR NO SAND

INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, SILTY CLAYS

WEATHERED MICA SCHIST

UNWEATHERED MICA SCHIST

WATER TABLE IN UPPER UNCONSOLIDATED AQUIFER (1986/87 SITE ASSESSMENT)

PIEZOMETRIC SURFACE IN LOWER UNCONSOLIDATED AQUIFER (1986/87 SITE ASSESSMENT)

TITLE	GENERALIZED GEOLOGIC CROSS SECTION $A_{SR} - A_{MP} - A'_{BF}$		
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA		
	DAMES & MOORE WILLOW GROVE, PENNSYLVANIA		
SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-383	
DATE 11-13-92	APPR. BY T.J.G.	FIG. NO. 3-11	

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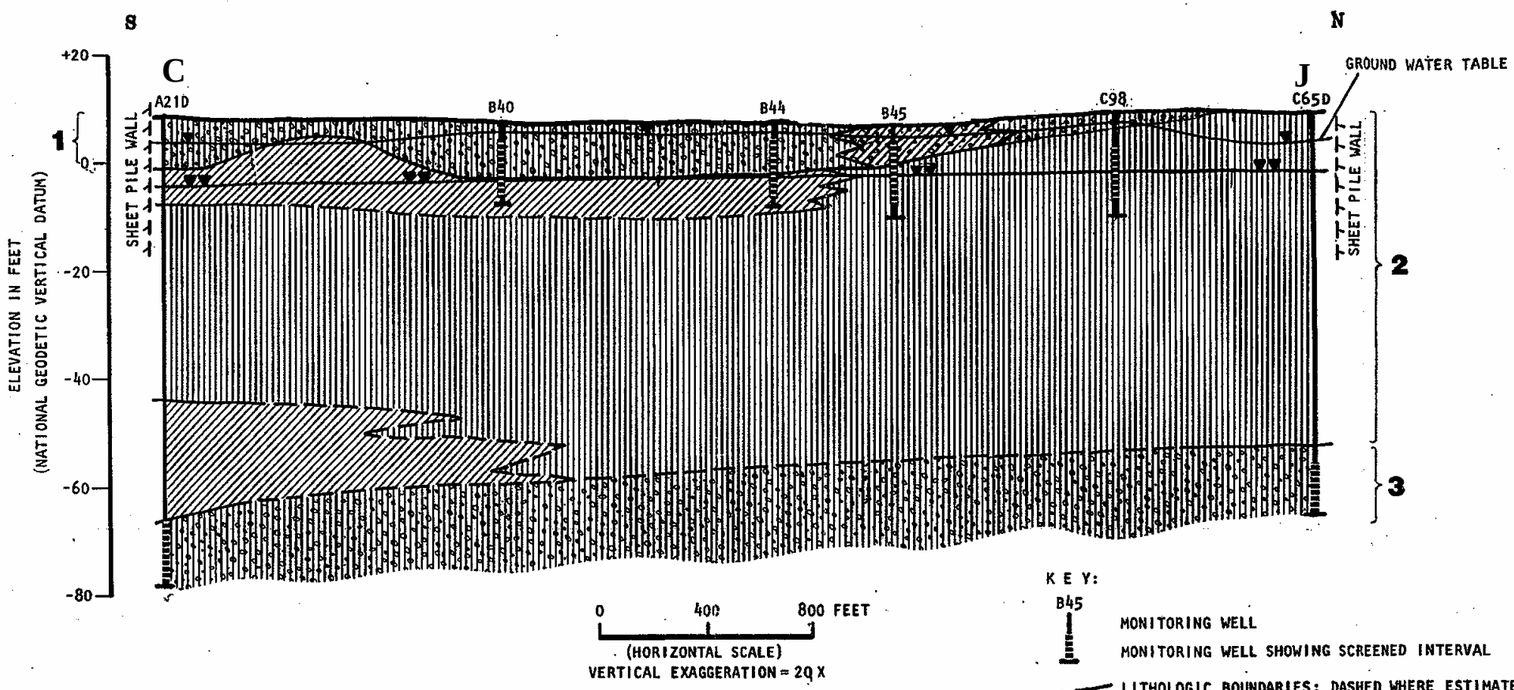
Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section N-C-J'

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section N-C-J'.



KEY:

B45 — MONITORING WELL

MONITORING WELL SHOWING SCREENED INTERVAL

LITHOLOGIC BOUNDARIES; DASHED WHERE ESTIMATED

SILTY SANDS, SAND-SILT-GRAVEL MIXTURES

CLAYEY SANDS, SAND-CLAY MIXTURES

INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY

INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, SILTY CLAYS

WATER TABLE IN UPPER UNCONSOLIDATED AQUIFER (1986/87 SITE ASSESSMENT)

PIEZOMETRIC SURFACE IN LOWER UNCONSOLIDATED AQUIFER (1986/87 SITE ASSESSMENT)

1 FILL AND TRENTON GRAVEL, UNDIFFERENTIATED UPPER UNCONSOLIDATED AQUIFER

2 LOWER CLAY MEMBER RARITAN FORMATION

3 FARRINGTON SAND MEMBER RARITAN FORMATION LOWER UNCONSOLIDATED AQUIFER

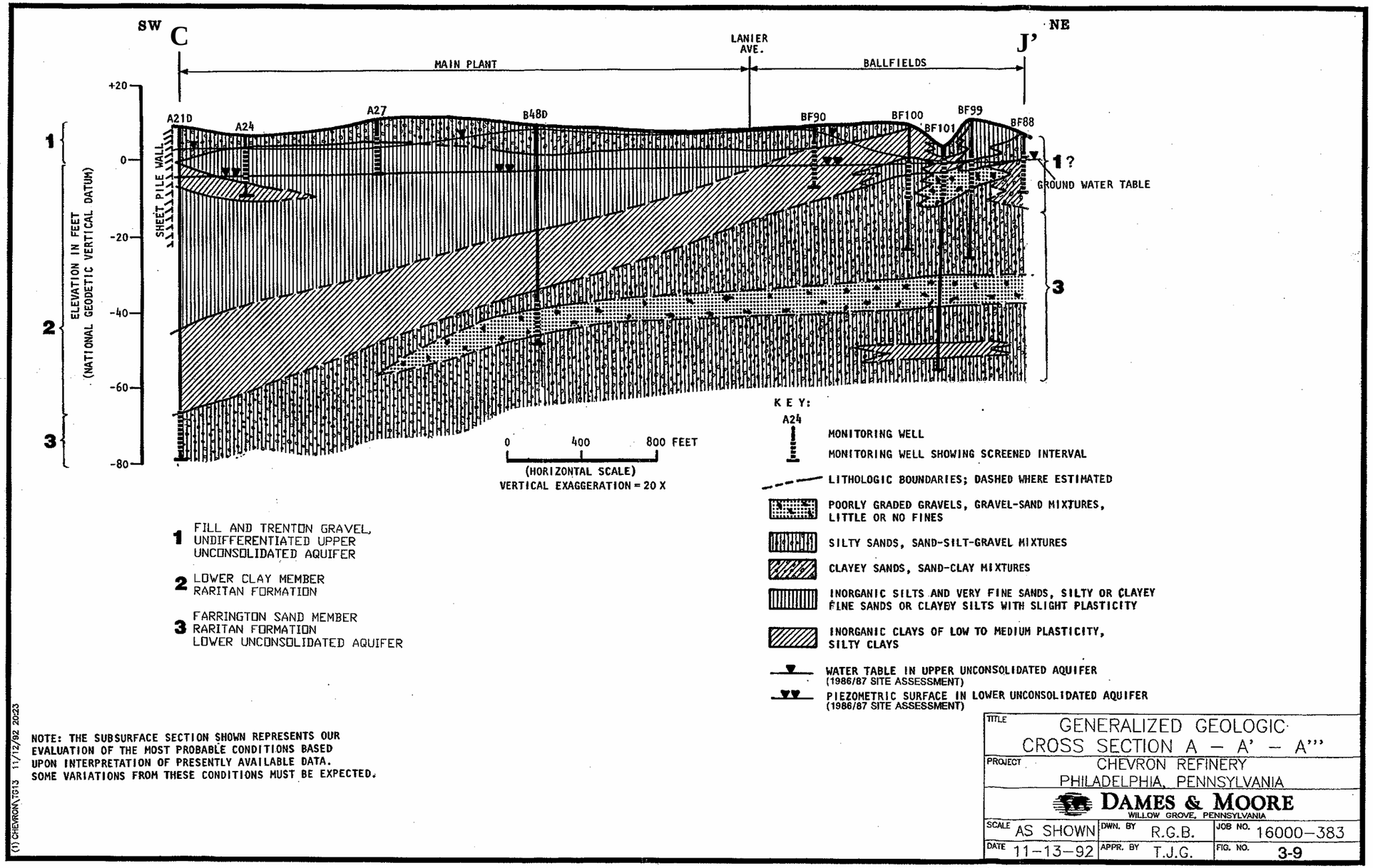
NOTE: THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

(1) CHEVRON\7814 11/12/92 20:24

TITLE: GENERALIZED GEOLOGIC CROSS SECTION A – C		
PROJECT: CHEVRON REFINERY, PHILADELPHIA, PENNSYLVANIA		
DAMES & MOORE, WILLOW GROVE, PENNSYLVANIA		
SCALE: AS SHOWN	DWN. BY: R.G.B.	JOB NO.: 16000-383
DATE: 11-13-92	APPR. BY: T.J.G.	FIG. NO.: 3-8

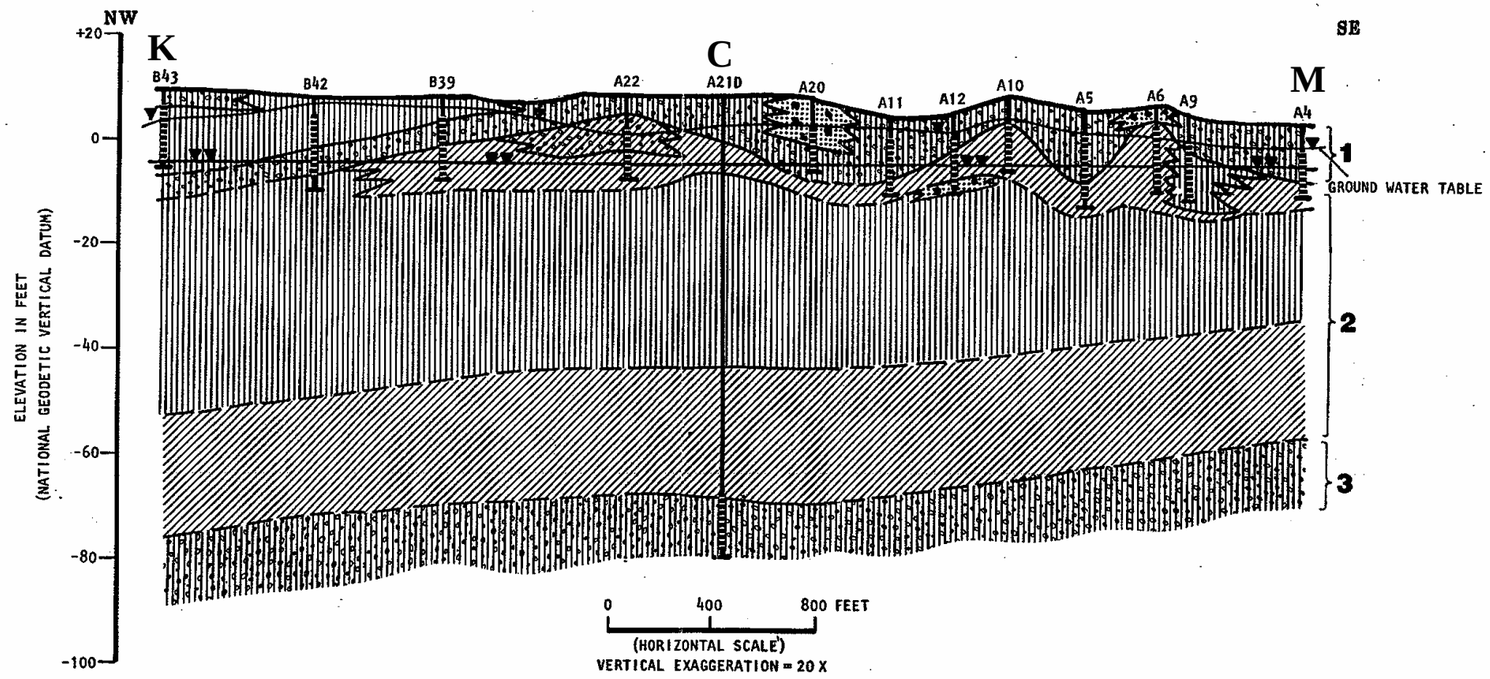
Appendix C – Cross Section C-J

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section C-J.



Appendix C – Cross Section C-J'

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section C-J'.



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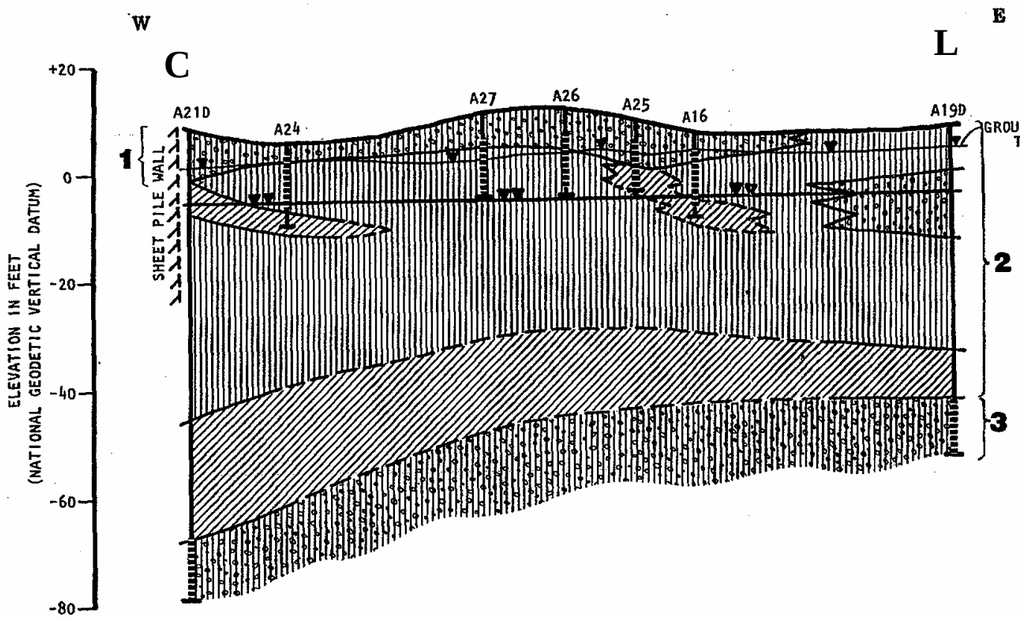
ENGINEERING & ENVIRONMENTAL SERVICES

Elmwood Park ,NJ Doylestown, PA Philadelphia, PA
Miami, FL New Haven, CT New York, NY

Appendix C – Cross Sections C-K and C-M

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section C-K and C-M.



0 400 800 FEET

(HORIZONTAL SCALE)

VERTICAL EXAGGERATION = 20 X

1 FILL AND TRENTON GRAVEL, UNDIFFERENTIATED UPPER UNCONSOLIDATED AQUIFER

2 LOWER CLAY MEMBER RARITAN FORMATION

3 FARRINGTON SAND MEMBER RARITAN FORMATION LOWER UNCONSOLIDATED AQUIFER

NOTE: THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

K E Y:

A24 — MONITORING WELL

MONITORING WELL SHOWING SCREENED INTERVAL

LITHOLOGIC BOUNDARIES; DASHED WHERE ESTIMATED

SILTY SANDS, SAND-SILT-GRAVEL MIXTURES

INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY

INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, SILTY CLAYS

WATER TABLE IN UPPER UNCONSOLIDATED AQUIFER(1986/87 SITE ASSESSMENT)

PIEZOMETRIC SURFACE IN LOWER UNCONSOLIDATED AQUIFER(1986/87 SITE ASSESSMENT)

(1) CHEVRON\TG16 11/12/92 20:26

TITLE	GENERALIZED GEOLOGIC CROSS SECTION A – A' – A''		
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA		
	DAMES & MOORE WILLOW GROVE, PENNSYLVANIA		
SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-383	
DATE 11-13-92	APPR. BY T.J.G.	FIG. NO. 3-6	

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Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section C-L

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section C-L.

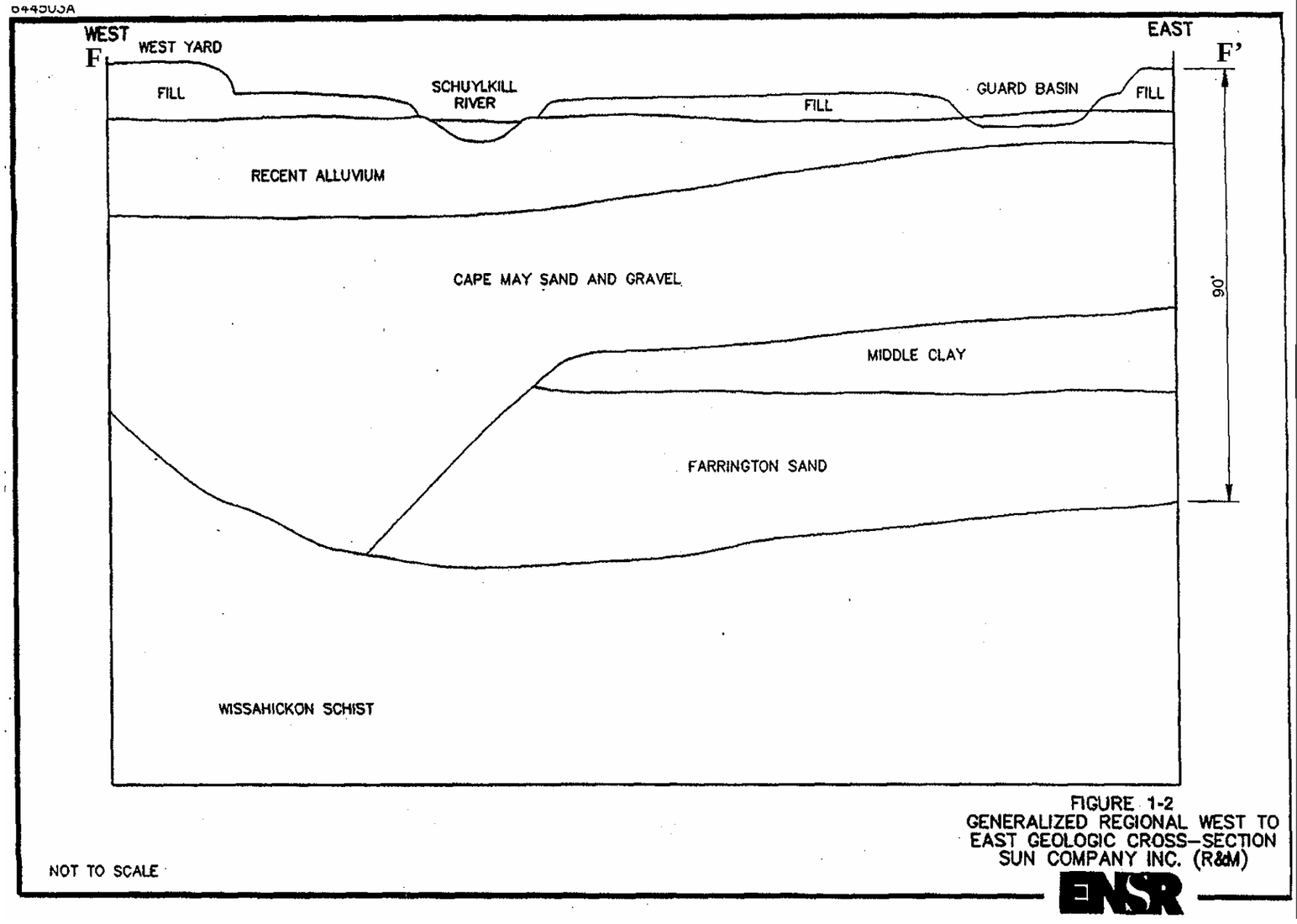

FIGURE 1-2
GENERALIZED REGIONAL WEST TO EAST GEOLOGIC CROSS-SECTION
SUN COMPANY INC. (R&M)

ENSR

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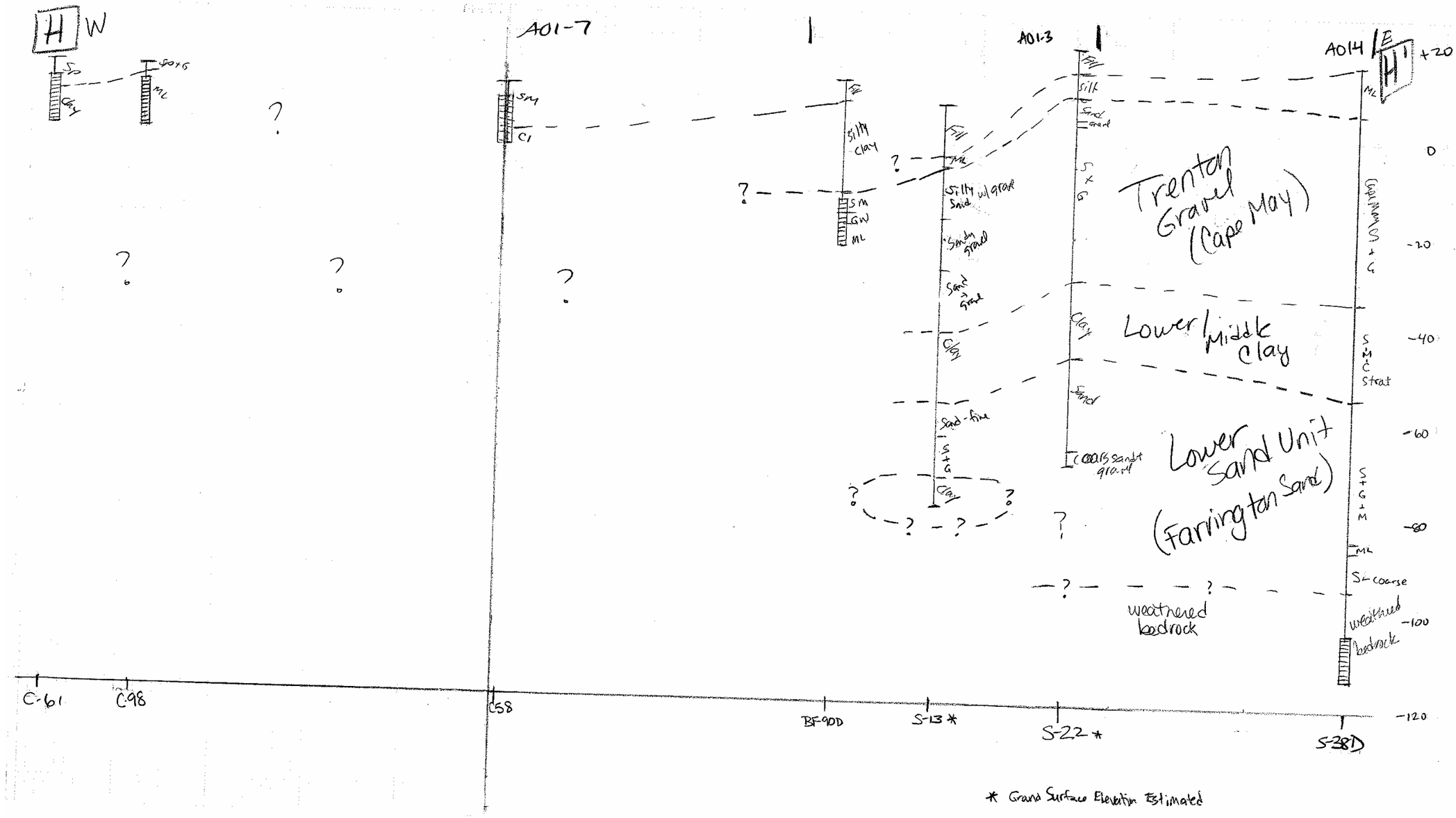
Elmwood Park ,NJ Doylestown, PA Philadelphia, PA
Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section F-F'

NOTE: Cross Section taken from ENSR, Investigation of Shallow and Deep Groundwater Quality, Philadelphia Refinery, 1994 (location is approximate). Renamed Cross Section F-F'.



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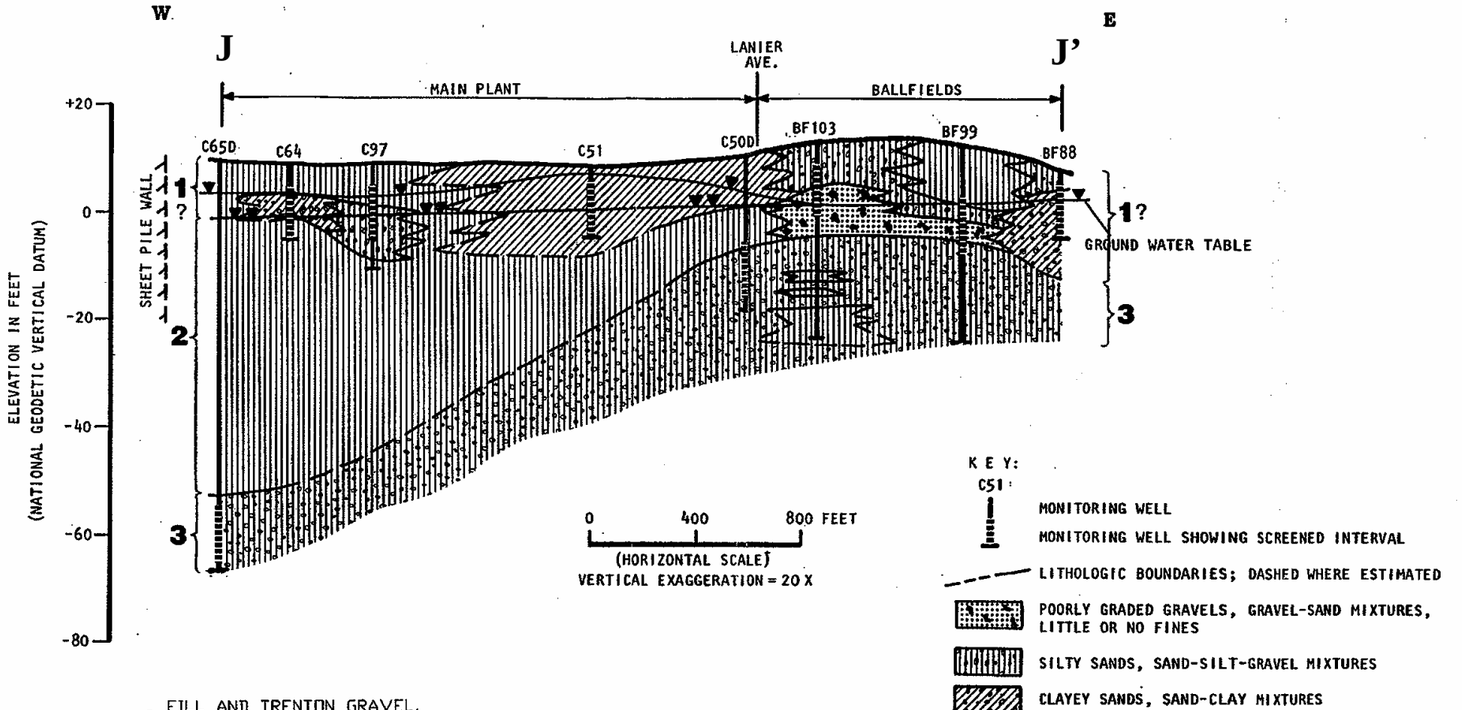
Elmwood Park ,NJ Doylestown, PA Philadelphia, PA
Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section H-H'

NOTE: Created by Langan 2004 from available boring logs.



NOTE: THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

(1) CHEVRON\TG7 11/13/92 08:08

TITLE	GENERALIZED GEOLOGIC CROSS SECTION C – A'''		
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA		
	DAMES & MOORE WILLOW GROVE, PENNSYLVANIA		
SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-383	
DATE 11-13-92	APPR. BY T.J.G.	FIG. NO. 3-10	

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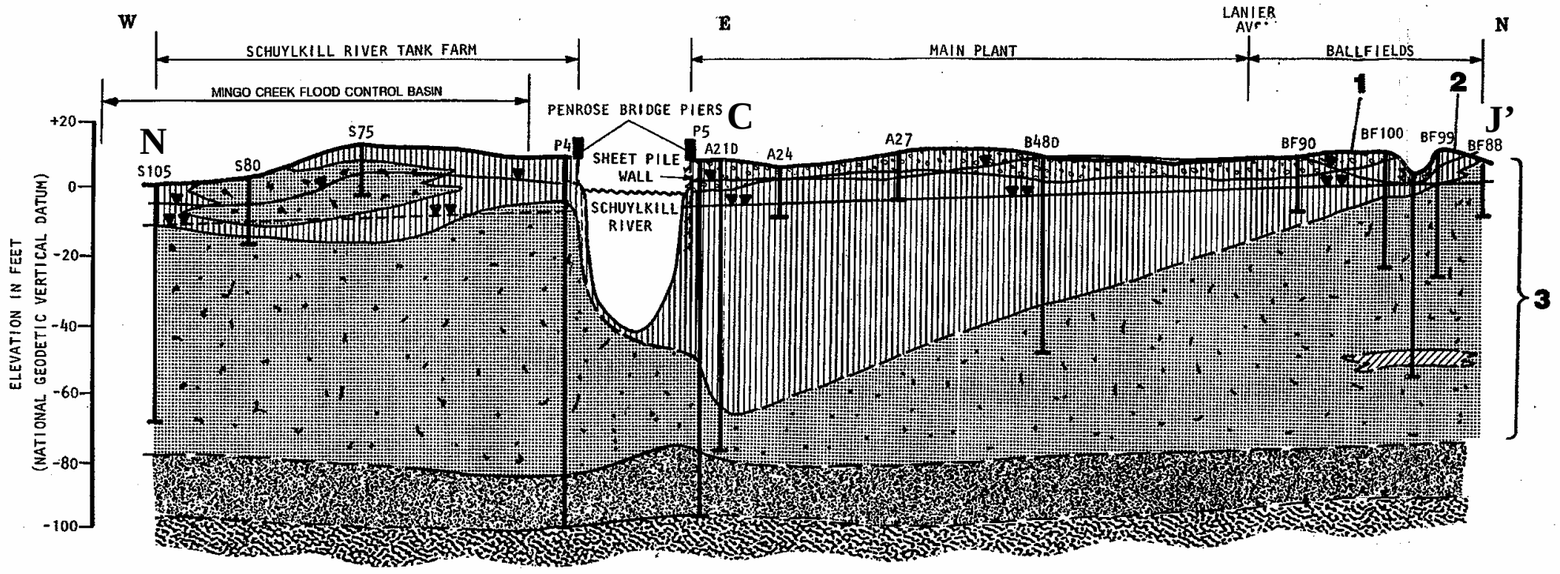
Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section J-J'

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section J-J'.



0 620 1240 FEET
(HORIZONTAL SCALE)
VERTICAL EXAGGERATION = 22 X

1 FILL AND TRENTON GRAVEL, UNDIFFERENTIATED UPPER UNCONSOLIDATED AQUIFER

2 LOWER CLAY MEMBER RARITAN FORMATION

3 FARRINGTON SAND MEMBER RARITAN FORMATION LOWER UNCONSOLIDATED AQUIFER

NOTE: THE SUBSURFACE SECTION SHOWN REPRESENTS OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

(1) CHEVRON\TG12 11/13/92 08:49

KEY:

A24 MONITORING WELL

MONITORING WELL SHOWING SCREENED INTERVAL

LITHOLOGIC BOUNDARIES; DASHED WHERE ESTIMATED

SAND AND GRAVEL, LITTLE OR NO FINES

SILTY SANDS, SAND-SILT-GRAVEL MIXTURES

SILT AND CLAY, LITTLE OR NO SAND

INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, SILTY CLAYS

WEATHERED MICA SCHIST

UNWEATHERED MICA SCHIST

WATER TABLE IN UPPER UNCONSOLIDATED AQUIFER (1986/87 SITE ASSESSMENT)

PIEZOMETRIC SURFACE IN LOWER UNCONSOLIDATED AQUIFER (1986/87 SITE ASSESSMENT)

TITLE	GENERALIZED GEOLOGIC CROSS SECTION $A_{SR} - A_{MP} - A'_{BF}$		
PROJECT	CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA		
	DAMES & MOORE WILLOW GROVE, PENNSYLVANIA		
SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 16000-383	
DATE 11-13-92	APPR. BY T.J.G.	FIG. NO. 3-11	

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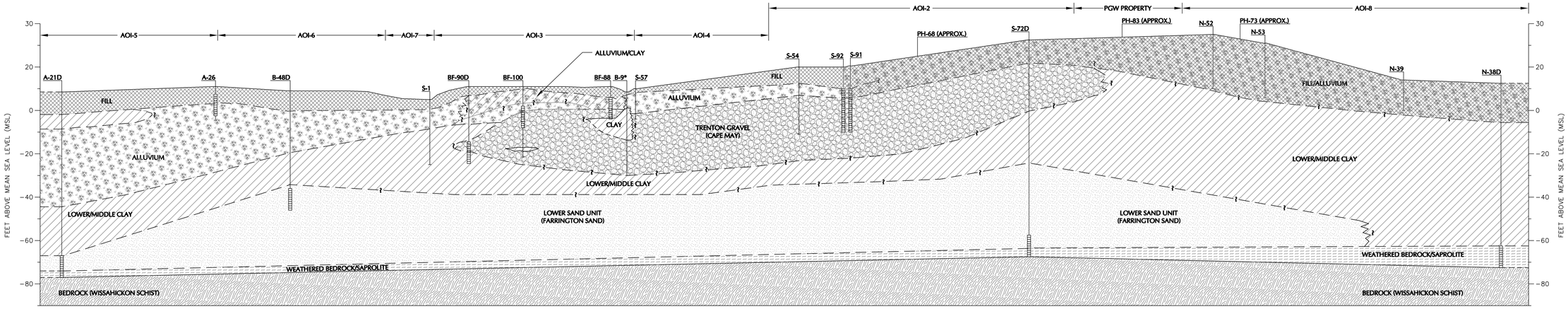
Miami, FL New Haven, CT New York, NY

Appendix C – Cross Section N-C-J'

NOTE: Cross Section taken from Dames and Moore, RCRA Verification Investigation Report, Chevron Refinery, 1992. Renamed Cross Section N-C-J'.

C
SOUTH

C′
NORTH



LEGEND

- FILL
- ALLUVIUM
- SAND AND GRAVEL
- CLAY
- SAND
- WEATHERED BEDROCK
- BEDROCK
- * APPROXIMATE LOCATION OF CONE PENETROMETER

20 0 10 20
VERTICAL SCALE IN FEET

400 0 200 400
HORIZONTAL SCALE IN FEET

SUNOCO

Project
SUNOCO, INC. (R & M)
PHILADELPHIA
PHILADELPHIA COUNTY PENNSYLVANIA

Drawing Title
GEOLOGIC CROSS SECTION C - C′
SUNOCO PHILADELPHIA REFINERY AND BELMONT TERMINAL

Project No. 2574601	Drawing No. 9
Date 06/07/04	
Scale AS SHOWN	
Drn. By TVL	
Last Revised 06/07/04	1 Of 1

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Filename: Q:\Data6\2574601\Cadd Data – 2574601\Dwg\Environmental\2574601.Cross Section C–C.060704.dwg Date: 6/30/2004 Time: 9:16 User: jherr Style Table: Langan.stb Layout: E Size Sheet (Bottom)

Plate 20 Cross sections showing probable directions of ground water movement in and between aquifers under natural conditions near the junction of the Delaware and Schuylkill Rivers in Pennsylvania.

APPENDIX E

Historic Deep Groundwater
Elevation Contour Plans (2001 to 2010)

AOI-8
AOI-10
AOI-1
AOI-2
AOI-4
AOI-3
AOI-7
AOI-6
AOI-5
AOI-9

N
W E
S

Legend

AOI Boundary

N-27
3.45
Lower Sand Wells and Groundwater Elevations
(Feet Above Mean Sea Level)

MW-2D
3.45
PGW Lower Sand Wells and Groundwater Elevations[3]

Groundwater Elevation Contour

Inferred Groundwater Elevation Contour

Notes:
1. All GW elevations provided by *Handex Well Gauge Report* dated November 2, 2003.
2. TIC and all other relevant elevation datum for wells within AOIs 5-10 were converted from the pre-existing elevations (in NVGD 29) to NAVD 88 (conversion factor is 1.05 ft).
3. PGW wells and data provided by Weston. Groundwater data is for November 2003.
4. Figure shows all known existing Lower Sand wells.
5. B-132D, B-133D, and B-134D well locations estimated based on the locations of wells B-132, B-133, and B-134 in Handex 2004 First Quarter Report.

Figure 4: Lower Sand Groundwater Elevations
Sunoco Philadelphia Refinery
and Belmont Terminal
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

SCALE: 1" = 400'
DATE: June 24, 2004
DRN. BY: JSC
CKD. BY: CC
JOB#: 2574601

C:\Data\2574601\ArcGIS\MapDocuments\Current Conditions Report\Figure 4- Deep Groundwater Elevation.mxd

N

W E

S

Legend

AOI Boundary

N-27
3.45

Lower Sand Wells and Groundwater Elevations (Feet Above Mean Sea Level)

Lower Sand Wells with No Groundwater Elevations

Inferred Groundwater Elevation Contour

Notes:
1. All GW elevations provided by Secor on October 24-30, 2005. Only accessible wells were gauged for this event.
2. TIC and all other relevant elevation datum for wells within AOIs 5-10 were converted from the pre-existing elevations (in NVGD 29) to NAVD 88 (conversion factor is 1.05 ft).
3. Figure shows all known existing Lower Sand wells.

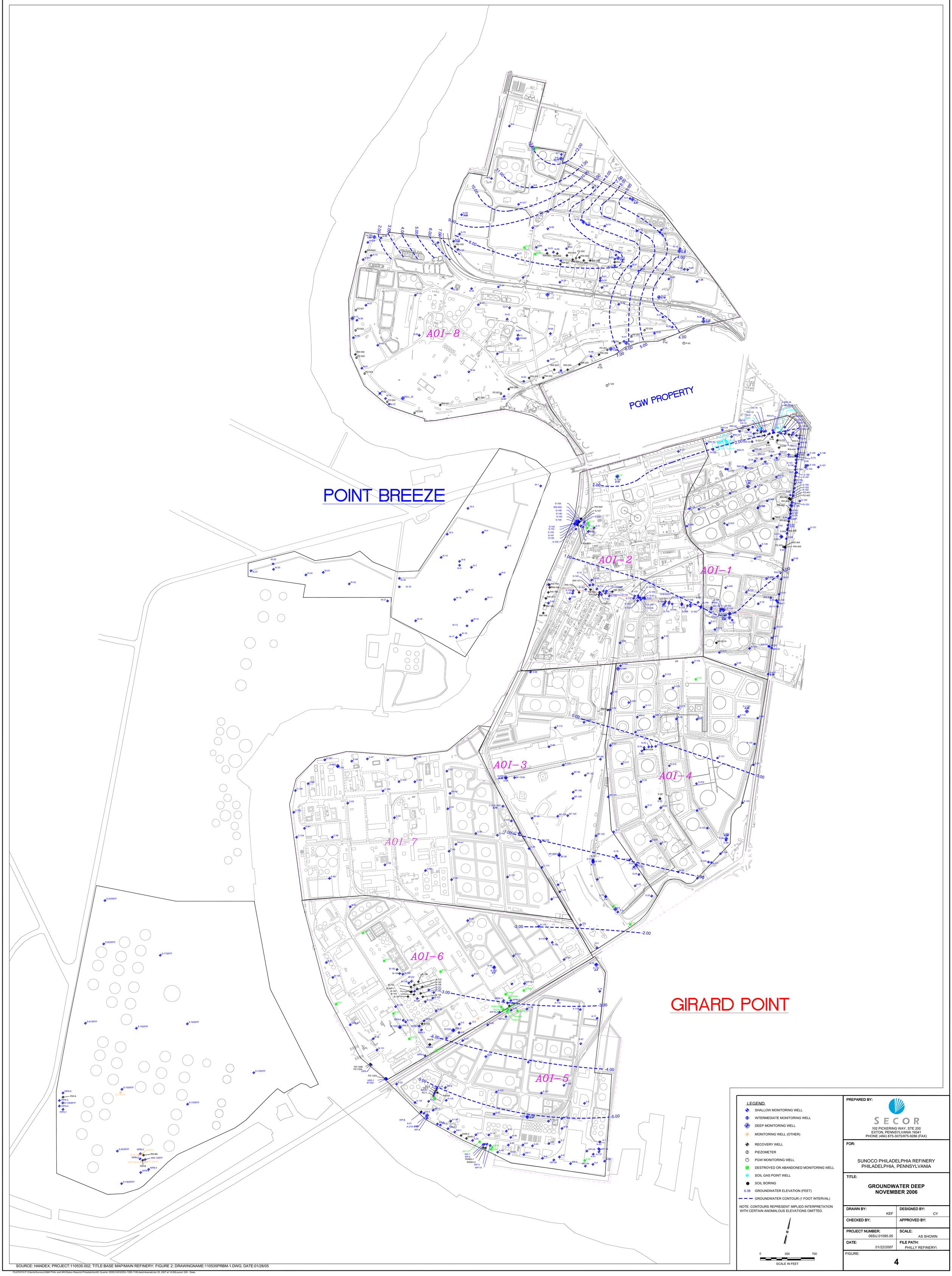
Figure 4: Lower Sand Groundwater Elevations
Fourth Quarter, 2005
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 425 850
Feet

SCALE: AS SHOWN BY: CKD. BY: JOB #:
January 13, 2005
AE
JSC
2574601

O:\Job\2574601\Arc\GIS\Mxd\Documents\Quarterly Report\4_Q2005\Figure 4 - Deep Groundwater Elevations_Lower.mxd



SOURCE: HANDEX; PROJECT:110535.002; TITLE:BASE MAP/MAIN REFINERY; FIGURE 2; DRAWINGNAME:110535PRBM-1.DWG; DATE:01/28/05

FILEPATH:P:\Clients\Sunoco\O&M Philly and MH\Status Reports\Philadelphia\4th Quarter 2006\CAD\62SU-1095-1106.dwg\mkascak\Jan 25, 2007 at 14:26\Layout: GW - Deep

Note: New Wells in AOI-1 and AOI-2 Well Classification Data Pending
Source: Base Map Provided by Langan Engineering & Environmental Services

Legend

N
W E
S

- Deep Monitoring Well
- Intermediate Monitoring Well
- Shallow Monitoring Well
- Other Monitoring Well
- Piezometer
- Deep Recovery Well
- Intermediate Recovery Well
- Shallow Recovery Well
- Other Recovery Well
- Damaged Well
- Abandoned
- Staff Gauge
- AOIs
- Groundwater Elevation Contour (Ft MSL)

Site Wide Monitoring Locations With Groundwater Elevation Contours for Deep Wells

Figure **4**

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 250 500 1,000 Ft
1 inch equals 500 feet

SCALE: 1" = 500' (when plotted at 24"x36")
DATE: January 29, 2008
DRN. BY: TB/RE
CKD. BY: CM
JOB#: 2574601

N-4 6.47
N-69 7.25
N-9 1.16
N-13 3.85
N-38D -0.23
N-83 5.67
N-21 3.61
N-19 2.17
N-27 1.79
N-30 2.00
N-43 10.18
N-76 4.77
N-46D
N-50D 3.41
S-72D 3.55
S-80D 0.55
S-46D 0.17
S-58D
S-264
S-119D -0.43
C-65D
S-69D -0.58
C-50D 0.3
S-38D -1.36
BF-90D 0.86
S-13 0.11
S-22 -1.24
S-8 0.6
S-6
A-19D -2.41
B-48D -2.15
B-134D -3.32
B133D
B132D
A-21D -4.66
A-13D -2.14

6 6 4 4 2 2 0 0 -2 -2 -4 -4

Note: New Wells in AOI-1 and AOI-2 Well Classification Data Pending
Source: Basemap Provided by Langan Engineering and Environmental Services

Note: Select groundwater elevation data are considered anomalous and are not used for contouring.

N
W E
S

Legend

- Deep Monitoring Well
- Intermediate Monitoring Well
- Shallow Monitoring Well
- Other Monitoring Well
- Piezometer
- Deep Recovery Well
- Intermediate Recovery Well
- Shallow Recovery Well
- Other Recovery Well
- Damaged Well
- Abandoned
- Staff Gauge
- AOIs
- Groundwater Elevation Contour (FT MSL)
- 3.85 Groundwater Elevation (FT MSL)

SITE WIDE MONITORING LOCATIONS
WITH GROUNDWATER ELEVATIONS
FOR DEEP WELLS
NOVEMBER 2008

FIGURE 4

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 250 500 1,000 Feet

SCALE: 1" = 500'
DATE: JANUARY 14, 2009
DRN. BY: TTB
CKD. BY: RTD
JOB#

Source: Basemap Provided by Langan Engineering and Environmental Services

Legend

- Deep Monitoring Well
- Intermediate Monitoring Well
- Shallow Monitoring Well
- Other Monitoring Well
- Piezometer
- Deep Recovery Well
- Intermediate Recovery Well
- Shallow Recovery Well
- Other Recovery Well
- Damaged Well
- Abandoned
- Staff Gauge
- AOIs
- GWE_DEEP_0709A Contour (FT MSL)
- 3.85 Groundwater Elevation (FT MSL)
- NR No Reference Elevation Available
- NM Not Measured

SITE WIDE MONITORING LOCATIONS WITH GROUNDWATER ELEVATIONS FOR DEEP WELLS
JUNE 2009

FIGURE 4

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 250 500 1,000 Feet

SCALE: 1" = 500'
DATE: JANUARY 14, 2009
DRN. BY: TFB
CHD. BY: RTD
JOB#

N
W
E
S

N-4
8.02

N-9
6.18

N-13
5.17

N-38D
0.93

N-21
5.76

N-19
3.61

N-27
3.04

N-30
3.82

N-44D
4.73

N-50D
6.31

N-46D

AOI-8

AOI -10

AOI-2

AOI-1

SCHUYLKILL RIVER

S-294D
2.35

S-72D
1.2

S-80D
2.37

S-302D
0.002

S-305D
0.82

S-46D
1.31

S-59D

S-280D
-0.03

S-264

S-119D
0.66

C-129D
3.94

S-284D
0.48

AOI-4

AOI-3

C-144D
-8.72

C-65D

S-69D
-0.23

BF-108
0.13

C-50D
-0.03

S-38D2
-0.25

S-38D
-1.21

AOI-7

BF-90D

S-13
-0.76

S-22
-0.54

S-8
6.05

S-6

C-134D
-1.1

A-19D
-1.73

B-48D
-1.28

AOI-6

S-76DSRTF
-6.08

B-134D
-2.76

B-133D
-1.42

AOI-9

S-74D2SRTF
-4.48

S-74D1SRTF
-6.34

B-132D
-4.52

AOI-5

A-21D
-4.41

A-13D
-2.11

S-120DSRTF
-6.61

S-106DSRTF
-5.8

1 2 3 4 5 6 7 8

-1 -2 -3 -4 -5 -6 0

Notes:
1. Bing Maps aerial imagery provided by © 2010 Microsoft Corporation and its data suppliers and obtained under the licensing agreement with ESRI.
2. Deep groundwater elevation provided by Stantec, August 2010.

PENNSYLVANIA

Approximate Site Location

Legend

S-119D 0.66 — Deep Groundwater Monitoring Well and Groundwater Elevation

N-46D — Damaged/Abandoned/Unable to Locate

Deep Groundwater Contour

Area of Interest (AOI)

C-192D 3.94 — Wells omitted from contouring

Figure X - Deep Groundwater Elevation Contour Plan (August 2010)
AOI-11 Site Characterizaton/ Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 250 500 1,000 Feet

SCALE: 1" = 500'
DATE: November 24, 2010
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\AOI 11\Workplan\Figure X - August 2010 Deep GW Contours_

APPENDIX F

2011 1.0 Mile Radius Well Search

N
W E
S

Legend

- Site Boundary
- **Well Search (1.5 Mile Radius)**
- **Use**
  - UNKNOWN
  - DEWATER
  - DOMESTIC
  - INDUSTRIAL
  - OTHER
  - PUBLIC SUPPLY
  - UNUSED
- MileBuffer_090711

Notes:
1. Bing Maps aerial imagery provided by © 2010 Microsoft Corporation and its data suppliers and obtained under the licensing agreement with ESRI.
2. Well search results provided by PaGWIS.

Figure F-1: 1 Mile Well Search
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 1,200 2,400 Feet

SCALE: 1" = 1200'
DATE: August 22, 2011
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

Path: \\langan.com\data\DT\data\2574601\ArcGIS\MapDocuments\AOI 11 SCR\Appendix Figure F-1 - Well Search_9-8-11.mxd

APPENDIX G

Field Procedures

APPENDIX G
FIELD PROCEDURES
AOI 11 SITE CHARACTERIZATION
SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA, PENNSYLVANIA

G.1. LIQUID LEVEL ACQUISITION

Responsible Personnel: Technicians and Geologists

Training Qualifications:

All field personnel involved in liquid level acquisition shall have, as a minimum, completed OSHA 40 HOUR HAZWOPER training and completed the 3-day minimum field training requirements as specified within the Corporate Health and Safety Plan. Prior to solo performance of liquid levels, all field personnel will have performed a minimum of three site visits under the direct supervision of experienced personnel.

Health and Safety Requirements:

Personal Protective Equipment (PPE) Required:

Level D attire including steel toe/steel shank boots are required to be worn. Based on site conditions, Level C attire may be required. The PPE required to upgrade to Level C may include: nitrile gloves, disposable outerboots, Tyvek coveralls, and a respirator. Safety glasses or hard hats may also be required in certain areas.

Site Controls:

Safety cones and or caution tape should be used in high traffic areas. The "Buddy System" may also be employed in high traffic areas.

Potential Hazards:

Traffic, pinch and trip, chemical (airborne and physical contact) and biological are all likely hazards to be encountered on-site. Additional hazards are mentioned in the site-specific HASP.

Materials and Equipment Necessary for Task Completion:

Electronic oil/water interface probe or conductivity water line, decontamination supplies (liquinox, deionized-distilled water, appropriate containers, scrub brush, and sorbent pads or paper towels), and air monitoring instruments (optional, based on previous site visits).

Methodology:

The task involves the deployment of a liquid sensing probe into a well (in most cases), recording the reading, and decontaminating the probe. The recorded field readings can then be utilized for one of several applications including: well sampling, water table gradient mapping, separate-phase hydrocarbon occurrence, thickness, and or gradient mapping, and various testing procedures.

The proper procedure for liquid level acquisition from a well is as follows:

1) The wells should be gauged in order of least to most contaminated based on existing sampling data or separate-phase hydrocarbon occurrence.
2) The gauging instrument is decontaminated prior to initial deployment and after each well to prevent cross contamination between wells.
3) Decontamination procedures include the following steps:
    a) Remove gross contaminants with sorbent pad or towel.
    b) Rinse/scrub equipment with water.
    c) Scrub equipment in Liquinox®/deionized-distilled water solution.
    d) Double rinse with deionized-distilled water.
    e) Air dry.
4) The well(s) to be gauged may need to be marked off with safety cones and or caution tape in order to protect personnel from auto traffic; the "Buddy System" may also be employed.
5) The manhole cover is then lifted off of the well head. A pry bar may be needed to prevent personal injury in the case of large manhole covers.
6) The probe is lowered into the well until the instrument signals contact with liquid.
7) The corresponding reading is recorded when the instrument signals either water or product. A clear bailer may be used to verify the existence or approximate amount and appearance of product.
8) The probe is then retracted from the well and decontaminated accordingly.

9) The well is then secured appropriately.

10) Note the start and stop time for gauging round in the field book.

G.2. GROUNDWATER MONITORING/SAMPLING PROCEDURES

Responsible Personnel: Technicians and Geologists

Health and Safety Requirements:

Site specific HASP must be completed and reviewed by field personnel. Ambient air monitoring will be performed quarterly at all treatment areas to determine the necessity of PPE upgrade. As a minimum, level "D" attire will be worn.

Training Qualifications:

All field personnel involved in groundwater monitoring shall have, as a minimum completed OSHA 40 HOUR HAZWOPER training and completed the 3 day minimum field training requirements. Prior to groundwater monitoring, all field personnel will have sampled a minimum of three sites under the direct supervision of experienced personnel. Field personnel will also have experience in vapor monitoring techniques and sampling equipment decontamination.

Materials and Equipment Necessary for Task Completion:

A list of equipment required to access, gauge, purge, and sample site monitoring wells is presented below. Also listed are materials necessary to store, label, preserve, and transport groundwater samples.

- Current site map detailing well locations;
- Field data book for recording site data;
- Liquid level gauging device (graduated, optical interface probe);
- Keys and tools to provide well access;
- Appropriate sample containers and labels: volatile samples will be collected in laboratory provided 40 milliliter (ml) glass vials with plastic caps fitted with Teflon ® lined septa; all sample bottles will be laboratory sterilized and will contain the appropriate preservative, if applicable;

- Appropriate well purging apparatus as determined by volume of groundwater to be purged and compounds to be analyzed;
- Teflon ® (or equivalent) bottom-loading bailer to extract groundwater sample;
- Clean nylon or polypropylene bailer cord;
- Disposable nitrile sampling gloves;
- Decontamination supplies;
- Calibrated five-gallon bucket and watch or stopwatch to determine discharge rate during purging;
- Blank chain-of-custody forms; and
- Cooler and ice for sample preservation.

Methodology for Three Well Volume Sampling:

Prior to actual site visitation for the groundwater sampling event, the following data will be reviewed to ensure proper preparation for field activities:

- Most recent liquid level data from all wells;
- Most recent analytical data from all wells to determine gauging and sampling sequence; and
- Well construction characteristics.

Each monitoring well to be sampled will be gauged to obtain liquid level data immediately prior to initiation of the sampling process. Refer to Liquid Level Gauging SOP for appropriate well gauging procedures. Liquid level data will be recorded in a field book. Should free-phase petroleum product be detected by the gauging process and verified through inspection in a pre-cleaned acrylic bailer, groundwater sampling will not be conducted at that location.

The sampling procedure will be initiated by purging from the well a minimum of three well volumes, except in cases where the well is pumped dry, as referenced below. Well purging is performed to remove stagnant water and to draw representative water from the aquifer into the well for subsequent sampling and analysis for the established parameters. In extreme cases where a well is pumped dry and/or shows little recharge capacity, the well will be evacuated once prior to sample procurement. Well volume calculations will be based on total

well depth as determined during well installation and depth-to-water measurements obtained immediately prior to sampling.

Down-hole pre-purge, post-purge, and sampling water quality readings will be collected. The parameters to be monitored and recorded will include dissolved oxygen, turbidity, pH, specific conductance, redox potential, and temperature.

Well purging can be performed with various equipment including: a dedicated bailer for hand bailing low volumes of water; a surface mounted electric centrifugal pump with dedicated polyethylene tubing; and/or submersible pump (when the depth to water is greater than 20 feet) with dedicated polyethylene tubing. During pumping, the intake will be placed directly below the static water surface and slowly lowered during the purging process. This procedure may not prove necessary in low-yielding wells but is important in high-yielding, permeable strata where an intake initially placed deep in a well may draw laterally and have little influence in exchanging water from shallower depths within the well bore.

Flow rate during well purging will be approximated by the bucket and stop watch method. The duration of pumping required to remove three well volumes will be calculated directly from this flow rate. All fluids removed during purging will be treated on-site with activated carbon.

The sequence of obtaining site groundwater samples will be based upon available historical site data for existing wells and soil organic vapor analyzer (OVA) readings for newly installed wells. Site wells will be sampled in order from the lowest to highest concentration of water quality indicator parameters based upon the most recent available set of laboratory analyses to reduce the potential for sample cross-contamination. Groundwater samples will not be obtained for analysis from any well containing measurable free product.

The following sequence of procedures will be implemented for the collection of groundwater samples from monitoring wells.

1) Establish a clean work area where sampling equipment will not come in contact with the ground or any potentially contaminated surfaces.
2) Use a laboratory, pre-cleaned Teflon® sampling bailer for each well.
3) Use a clean pair of nitrile gloves.

4) Attach an appropriate length of unused, clean nylon or polypropylene cord to the designated sampling bailer.

5) Select appropriate laboratory-sterilized sample containers.

6) Slowly lower sampling bailer into well until water surface is encountered; continue to lower the sampling bailer into the standing water column to one foot below the water surface.

7) Retrieve bailer at a steady rate to avoid excess agitation.

8) Visually inspect bailed sample to ensure that no free product or organic detritus has been collected.

9) Uncap first designated sample vial and fill from bailer as rapidly as possible but minimizing agitation; secure septum and lid.

10) Inspect sealed sample for entrapped air; if air is present within sample vial. Remove lid and repeat vial filling, sealing and inspection process until no air is present.

11) Repeat Steps 9 and 10 for the second designated vial; all volatile parameter samples will be collected in duplicate.

12) Complete and attach labels to sample containers noting sample collector, date, time, and location of sample; record same data in field book.

13) Place samples in ice-filled cooler in such a manner as to avoid breakage. Samples collected for VOC analysis will be maintained at a temperature of 4°C.

Discard gloves and bailer cord and move to next sample location.

Methodology for Low-Flow Purging and Sampling:

For wells that will be Low-Flow purged and sampled, the USEPA Region III Bulletin QAD023: *Procedure for Low-Flow Purging and Sampling of Groundwater Monitoring Wells* will be followed. The following data will be reviewed for each well in order to set the pump intake for the low flow sampling:

- Soil boring (lithologic) log and continuous soil sample PID;
- Well construction log showing the screened interval;
- Identification of the most permeable zone screened by the well;
- Approximate depth to static water;
- Proposed pump intake setting; and

- Technical rationale for the pump intake setting, preferably across from the most impacted/contaminated subsurface interval.

Equipment

Adjustable rate, submersible, bladder pumps in conjunction with Teflon® or Teflon-lined polyethylene tubing for purging and sampling will be used. The tubing diameter will be between 3/16-inch to ½-inch inner diameter and the length of the tubing extended outside the well will be minimized. Flow through cells will be used to evaluate parameters during sampling. Monitoring well information, equipment specifications, water level measurements, parameter readings, and other pertinent information will be recorded during monitoring well purging and sampling.

Sampling Procedure

The following protocol details the low-flow sampling procedure that will be used for sampling the monitoring wells.

1. PID Screening of Well. A PID measurement will be collected at the rim of the well immediately after the well cap will be removed and recorded on the sampling form.
2. Depth to Water Measurement. A depth to water measurement will be collected and recorded. To avoid disturbing accumulated sediment and to prevent the inadvertent mixing of stagnant water, measuring the total depth of the well will be done at the completion of sampling on an annual basis.
3. Low Stress Purging Startup. Water pumping will commence at a rate of 100 to 400 milliliters per minute (mL/min). This pumping should cause very little drawdown in the well (less than 0.2-0.3 feet) and the water level should stabilize. Water level measurements are made continuously and will be recorded in milliliters per minute on the sampling form.
4. Low Stress Purging and Sampling. The water level and pumping rate will be monitored and recorded every five minutes during purging, and any pumping rate adjustments will be recorded. During the early phase of purging, emphasis will be placed on minimizing and stabilizing pumping stress, and recording any necessary adjustments. Adjustments, when necessary, will be made in the first 15 minutes of purging. If necessary, pumping rates will be reduced to the minimum capabilities of the pump to avoid well dewatering. If the minimal drawdown exceeds 0.3 feet, but the water level stabilizes above the pump intake setting, purging will continue until indicator field parameters stabilized, as detailed in Step 5 below. If the water level drops below the pump intake setting at the absolute minimum

purge rate, the pump will remain in place and the water level will be allowed to recover repeatedly until there will be sufficient water volume in the well to permit the collection of samples.

5. Indicator Field Parameters Monitoring. During well purging, indicator field parameters (DO, turbidity, pH, specific conductance, and redox potential) will be monitored every five minutes (or less frequently, if appropriate). Purging will be considered complete and sampling began when all the aforementioned indicator field parameters had stabilized. Stabilization will be achieved when three consecutive readings, taken at five (5) minute intervals (or less frequently, if appropriate), are within the following limits:

    - DO (±10 percent);
    - turbidity (±10 percent);
    - specific conductance (±3 percent);
    - pH (± 0.1 unit); and
    - redox potential [Eh] ±10 mv).

    Temperature and depth to water will be also monitored during purging. Should any of the parameter-reading components of the flow-through meter fail during sampling; the sampling team will attempt to locate a replacement flow-through meter. If none is available, the sampling team will measure that parameter with an individual criteria meter. Any other field observations relating to sample quality, such as odor, foaming, effervescence, and sheens, will also be recorded on the sampling form.

6. Collection of Ground Water Samples. Water samples for laboratory analyses will be collected before the groundwater had passed through the flow-through cell by either using a by-pass assembly or by temporarily disconnecting the flow-through cell. All sample containers will be filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. During purging and sampling, the tubing remains filled with water in order to minimize possible changes in water chemistry upon contact with the atmosphere. Methods employed to ensure that the outlet tubing will be filled include (i) adjusting the tubing angle upward to completely fill the tubing and (ii) restricting the diameter of the tubing near the outlet of the tubing.

    The order in which samples will be collected is as follows:

- Volatile organics;
- Gas sensitive (e.g., Fe^{+2}, CH_4, H_2S/HS);
- Base/Neutrals or PAHs;
- Total Petroleum Hydrocarbons;
- Total metals;
- Dissolved metals;
- Cyanide;
- Sulfate and chloride;
- Nitrate and ammonia;
- Preserved inorganic;
- Non-preserved inorganic; and
- Bacteria.

Decontamination Requirements:

Numerous practices are employed throughout the processes of site investigation and sampling to assure the integrity of the resulting data. Of particular significance to the procedures of groundwater measurement and sampling is the limitation, whenever possible, of materials inserted into a well bore and, even more importantly, of materials transferred from well to well.

Many items can be discarded between well sampling and/or gauging locations without significantly impacting project costs. Dedicated sampling equipment which can be discarded between well sampling locations without significantly impacting project costs, will be used whenever possible to preclude decontamination requirements. Sampling equipment included in this category are Teflon ® bailers, nitrile gloves, and bailer cord. However, other investigative and sampling equipment, including such items as liquid level probes, must be reused from well to well.

The danger in multi-well equipment applications lies in the potential of cross-contamination. While the threat of cross-contamination is always present, it can be minimized through the implementation of a consistent decontamination program during sensitive site measurement and data collection activities. The decontamination procedure is outlined below:

All site equipment used in a multi-well capacity will be decontaminated immediately prior to initial use and between each well. Standard site decontamination procedures for the optical interface probes between wells will be performed according to the following schedule:

- Initial rinse with clean tap water to remove excess residuals;
- Scrub equipment with sponge or clean, soft cloth in a distilled water/Liquinox@ (or equivalent) solution; and
- Double rinse with deionized/distilled water.

Rinse water generated during decontamination procedures will be treated on-site by passing the water through a bucket filled with activated carbon prior to disposal.

G.3. SOIL SAMPLING & WELL INSTALLATION

Responsible Personnel: Geologist

Training Qualifications: All field personnel supervising drilling activities shall have completed OSHA 40-Hour training, and three days of field training. Personnel supervising the well installation shall have observed drilling procedures for a minimum of three under the direct supervision of experienced personnel. Field personnel will have experience in operating the following field equipment: interface probe and photo-ionization detector (PID). Personnel should be able to describe soils encountered during drilling for generation of well logs.

Health and Safety Requirements:

A site specific HASP must be completed and reviewed by all field personnel. Prior to deploying a rig to the site, a utility call must be made (i.e. Pennsylvania One-Call) to allow mark-out of known subsurface utilities and associated laterals proximal to the site. Site plans, if available, should be reviewed to document and avoid the location of on-site utilities. No drilling should occur on retails sites within the exclusion zone. This zone is defined as the area between the pumps, the tank field and the station building. The area is excluded from drilling activities due to the likely occurrence of subsurface petroleum distribution lines. After review of all known mapped and marked utilities, a site reconnaissance will be performed to document the location of utility meters and storm sewer drains. In addition, the location of overhead utilities must be documented. After completing the subsurface and overhead utility review, the area to drill may be observed as clear or the location may be adjusted to a "clear" location.

Once the drilling location is established, the area must be marked with cones to alert area traffic of the work area. Other health and safety concerns include slip/trip hazards, working with heavy equipment and overhead work hazards. During drilling activities, a minimum of protective work gloves, steel toed boots, hard hats, and safety goggles must be worn.

A final health and safety requirement includes hand clearing the borehole, prior to advancing the borehole with the drill rig. To ensure the safety of workers, the borehole will be cleared by hand or air knife, to depth of 5 feet below ground surface. This will serve to clear the area of utilities, prior to drilling.

Decontamination Requirements:

All down-hole equipment must be steam cleaned prior to drilling at each boring/well location. All soil sampling equipment must be cleaned with detergent and rinsed with distilled water prior to deployment into the borehole. All well construction materials (i.e. PVC well casing, PVC well screen, sand pack, bentonite seal) should be clean and dedicated to each hole.

Methodology:

1) Borehole Advancement

During soil sampling or well installation activities, a borehole is advanced into the unconsolidated subsurface materials or bedrock via a drill rig (or similar). Various types of drilling methods could be deployed to advance the hole. A description of each drilling method is included below:

a) Hollow Stem Auger

A spiral tool form is used to move material from the subsurface to the surface. A bit at the bottom cuts into the subsurface material. Spiral augers on outside convey the material to the surface while spinning. The center of the auger is hollow like a straw when the inner drive rods and plug are removed. During drilling or formation cutting, the center is filled with rods connected to a plug at the bottom bit. Once the desired drilling depth is reached, the center plug and rods can be pulled out, leaving the hollow augers in place. The hollow augers hold the borehole to remain open for sediment sampling and well installation.

b) Air Rotary

A drill bit at the bottom of rods is used to cut into the subsurface material. Air injected into the drill rods escapes through small holes in the drill bit and conveys the drill cuttings to the surface.

c) Geoprobe®

The geoprobe® sampling allows collection of soil by directly pushing (through hydraulic hammering) a sampling device lined with a plastic macrocore into the soil column.

d) Hand Auger

A stainless steel or aluminum hand auger will be physically advanced to the desired soil sampling depth.

e) Sonic Drilling

This method provides a continuous soil sample collecting in a wide range of soil types, including soils with large particles that often preclude sampling by other drilling methods. The drill stem and sampler barrel are mechanically vibrated vertically at frequencies between 50 and 180 Hz (sonic) such that the sampler barrel advances by slicing through the soil. A core barrel is advanced ahead of the outer casing from one to thirty foot runs. The outer casing is advanced down over the inner barrel, to collect a relatively undisturbed core sample. The outer casing can be advanced completely dry in most situations depending upon the formations being drilled.

2) Soil Sampling

Soil samples will be obtained for lithologic logging and laboratory analysis for chemical contaminants with different sampling devices: split barrel spoon sampler, hand auger or Geoprobe® soil sampler. For either methods mentioned above, the sampling devices are lowered through the hollow-stem augers or open borehole to allow sampling of the undisturbed soils below the auger bit. Soil samples will be collected at intervals which appear to be visually impacted or from intervals which exhibit the highest deflections on the screening device (PID or similar). One shallow soil sample (0-2 ft bgs) will be collected from each shallow soil boring and analyzed only for site COCs.

a) Split barrel spoon sampler (split spoon)

The split spoon sampler will be driven into the soil column in accordance with ASTM Standard Method D1586 (Reference A6, Appendix E). Soil sampling by split barrel spoon will entail drilling a borehole with a hollow-stem auger to the desired sampling depth (standard five foot intervals). After augering to the desired depth, slowly and carefully lower the split barrel spoon sampler attached to the drill rod extension into the borehole. Drive the sampler into the soil by repeated blows from a 140 Lb. hammer with 30 inch travel. Record the blow counts required to drive the split spoon sampler each successive six inch interval. Remove sampler for borehole, split barrel open, remove soil sample utilizing a stainless steel knife to trim the top and edges of the sample and containerize sample in appropriate sample jar.

b) Geoprobe®

The geoprobe® liner is dedicated to each soil sampling interval. After retrieval of the sample, the liner may be sliced open and the soil sample can be logged and containerized in the appropriate sample jar. During shallow soil sampling from fine-grained sediments, the geoprobe® can advance the sampler directly into the ground, without the advance of an augered borehole.

c) Hand Auger

The hand auger allows for soil from the desired interval to be collected directly by removing the soil column that is contained in the auger portion of the device.

d) Sonic Drilling

An outer casing is advanced down over an inner barrel, to collect a relatively undisturbed core sample. Samples are extracted from the inner barrel and are contained within a poly bag. The bag is cut open and then the soil can be logged and soil samples collected.

Methodology for Well Installations:

1) Well Construction

After drilling to the desired depth or the desired interval, permanent monitoring wells can be installed to allow groundwater sampling. In general, wells are constructed with slotted screen, which allows groundwater to flow into the well at the desired monitored interval and well casing, which restricts groundwater flow into the well from undesired interval. In most cases the well materials are constructed of PVC. In conditions where the shallowest groundwater interval is monitored, a single case construction monitoring well is installed. In conditions

where multiple water bearing units occur and deep groundwater conditions are selected for monitoring, a double cased well is installed.

a) Single Casing Construction

The construction details of a monitoring well are determined by soil type, depth to groundwater and relative fluctuation of groundwater level. After drilling to the desired depth, a monitoring well is constructed for installation into the evacuated borehole. The well consists of a bottom cap, a length of screen and length of well casing. To determine the length of screen used, seasonal groundwater table or tidal fluctuations should be considered to allow the water table to intercept the well screen throughout the year. The assembled well is then inserted into the borehole.

The annular space between the well screen and subsurface is filled with a sand pack, which consists of clean, sorted sand. The sand pack allows water flow into the well but acts as a filter to prevent subsurface sediments from silting in the well. The sand pack extends one to two feet above the top of well screen. Above the sand pack, a seal is installed in the annular space between the well casing and the subsurface. The seal is comprised of hydrated bentonite and prevents surface water from infiltrating the well screen. Above the well seal, the annular space is backfilled with drill cuttings or cement. A cap is placed on the top of the well to further prevent infiltration of the surface water. The top of the well is protected with either a stand-up pipe or a locking, flush mount box.

b) Double Casing Construction

In cases where multiple water bearing zones occur, a double case well is installed to allow monitoring of the deeper water bearing zones. Construction of a double cased well is similar to that of a single case well; however, to prevent groundwater infiltration from shallower water bearing zones, a second casing is installed. This type of construction requires drilling two different diameter boreholes.

During drilling through the shallower groundwater zones, large diameter augers/bits are used to create a large diameter borehole. The borehole is advanced through the shallower water bearing area which will not be monitored. An outer casing is installed to seal the deeper monitoring well from infiltration from the shallow water bearing zones. After the outer casing is installed, the borehole is advanced deeper with smaller diameter auger/bit. The outside diameter of second augers fit within the inside diameter of the outer casing. The borehole is advanced to allow monitoring of the deeper water bearing zone. Once the

desired depth is obtained, a monitoring well is installed within the outer casing, using similar methods as described in the single casing construction (3a, above). The outside casing prevents shallow groundwater infiltration into the well. The inside casing prevents surface water infiltration into the well.

2) Soil Cutting Handling

Cuttings generated from drilling will be containerized or stock-piled, undercover, until appropriate disposal is determined. In the case the soils are not impacted, the cuttings may remain on-site. Impacted soils will be removed using appropriate hazardous waste handling procedures and disposed of with an approved hazardous waste handler.

3) Well Development

After installation, monitoring wells are developed to remove residual sediments within the well and annular space. Water is pumped from the well until groundwater flowing from the well appears relatively free of sediments.

Documentation:

All site activities should be detailed in the site investigators fieldbook. The entry shall include the date, time, weather, address, and persons present on-site. In addition, data required to create well construction logs or boring logs (if no well is constructed) should be collected. This data includes soil type, relative moisture content, depth of water table, observed impact, soil screening measurements (if PID is used), blow counts (if split spoon samples are collected), sample recovery, depth of borehole, length of well screen, length of well casing(s), sand pack interval, well seal interval. The site investigator should identify the relative location and number.

G.4. SURFACE WATER SAMPLING

Responsible Personnel: Technicians and Geologists

Health and Safety Requirements:

Site specific HASP must be completed and reviewed by field personnel. Health and safety concerns include biological, chemical, slip/trip hazards, and drowning. During surface water sampling activities, a minimum of protective nitrile and work gloves, steel toe knee-high rubber boots or hip waders, nomex suit, hard hats, and safety goggles must be worn.

Training Qualifications:

All field personnel involved in surface water monitoring shall have, as a minimum completed OSHA 40 HOUR HAZWOPER training and completed the 3 day minimum field training requirements. Prior to surface water monitoring, all field personnel will have sampled a minimum of three sites under the direct supervision of experienced personnel. Field personnel will also have experience in vapor monitoring techniques and sampling equipment decontamination.

Materials and Equipment Necessary for Task Completion:

- Health and Safety Equipment.
- Dip Cup Sampler or similar.
- Multi-Parameter Water Quality Meter (Horiba U-22 or YSI 650).
- Decontamination Equipment.
- Steel toe knee-high rubber boots or hip waders.
- Nitrile gloves.
- Sample bottles.
- Field Logbook and Field Sheets.
- Waterproof Markers.
- Cooler and Ice.

Sampling Procedure

Dip Sampler Method

A dip sampler is useful in situations where a sample is to be recovered from an outfall pipe or along a lagoon bank where direct access is limited. The long handle on such a device allows access from a discrete location. Sampling procedures are as follows:

1. Assemble the device in accordance with the manufacturer's instructions.
2. Extend the device to the sample location and collect the sample by dipping the sampler into the water.
3. Retrieve the sampler and transfer the sample to the appropriate sample container(s).
4. Decontaminate the sampler.

Direct Sampling Method

Surface water samples will be obtained by direct filling of bottles to avoid cross-contamination.

With proper PPE and sampling equipment, grab samples will be taken by slowly submerging the sample bottles or sampler with minimal surface water disturbance. Sample collection will be continued until the bottle is almost completely filled. To avoid loss of preservative added by the laboratory, bottles will not be over-filled. The sample bottles or sampler will be retrieved from the surface water with minimal disturbance.

Bottles for volatile organic compound (VOC) analysis will be filled first, followed by semi-volatile organic compounds (SVOCs), total metals, dissolved metals, and other field parameters. The VOC bottles must be filled very slowly and completely to avoid trapping any air. Alter the VOC vials are capped, they are inverted and tapped lightly to see if any air is trapped. If so, the bottle will be refilled and recapped.

All the sample bottles will be placed in a cooler on ice until sample bottles can be properly decontaminated and packed for transport to the laboratory. Samples will be shipped to the laboratory on ice within 48 hours of collection.

Documentation

Each field activity must be properly documented to allow a timely and accurate reconstruction of events in the field to provide verification of the proper acquisition of samples, and to provide a permanent record of field activities. Field activities will be documented in a bound field notebook. A field sampling sheet will be completed for all groundwater samples submitted for chemical analysis. Water quality data obtained during sampling will be recorded in the field notebook and on the field sampling sheet. The parameters to be monitored and recorded will include dissolved oxygen, turbidity, pH, specific conductance, redox potential, and temperature.

Decontamination

All site equipment used during surface water sampling will be decontaminated immediately prior to initial use and between each sample location. Standard site decontamination procedures will be performed according to the following schedule:

- Initial rinse with clean tap water to remove excess residuals;
- Scrub equipment with sponge or clean, soft cloth in a distilled water/Liquinox@ (or equivalent) solution; and
- Double rinse with deionized/distilled water.

Rinse water generated during decontamination procedures will be treated on-site by passing the water through a bucket filled with activated carbon prior to disposal.

G.5. NON-AQUEOUS PHASE LIQUID (NAPL) SAMPLING PROCEDURES

Responsible Personnel: Technicians and Geologists

Training Qualifications:

All field personnel involved must have completed OSHA 40 HOUR HAZWOPER training. Prior to NAPL sampling, all field personnel will have worked a minimum of three sites under the direct supervision of experienced personnel. Field personnel will also have experience in sampling and vapor monitoring techniques and sampling equipment decontamination.

Materials and Equipment Necessary for Task Completion:

A list of equipment required to sample NAPL from a monitoring well is presented below:

- Current site map detailing well locations;
- Field data book for recording site data;
- Liquid level gauging device (graduated, optical interface probe);
- Keys and tools to provide well access;
- Appropriate sample containers and labels. NAPL samples will be collected in laboratory provided 40 milliliter (ml) glass vials with plastic caps fitted with Teflon ® lined septa; all sample bottles will be laboratory sterilized and will contain the appropriate preservative, if applicable. A minimum of 10 ml is required for laboratory analysis. In the case that sufficient volume is not obtained, a swabbing technique (described below) will be used;
- Sorbent pads (required for swabbing technique);
- Teflon ® (or equivalent) bottom-loading bailer to obtain NAPL sample;

- Clean nylon or polypropylene bailer cord;
- Decontamination supplies;
- H&S supplies (tyvek, nitrile gloves, safety goggles);
- Blank chain-of-custody forms; and
- Cooler and ice for sample preservation.

Health and Safety Requirements:

Site specific HASP must be completed and reviewed by field personnel. As a minimum, modified Level "D" attire will be worn. Individuals performing NAPL sampling are required to wear safety goggles, tyvek suit, and nitrile sampling gloves.

Decontamination Requirements:

During NAPL sampling activities, dedicated sampling equipment (i.e. Teflon ® bailers, nitrile gloves, and bailer cord) are utilized; thereby, eliminating decontamination requirements. The interface probe, used to record the presence of NAPL and relative thickness prior to sampling, does require decontamination between sampling locations.
All site equipment used in a multi-well capacity will be decontaminated immediately prior to initial use and between each well. Standard site decontamination procedures for the optical interface probes between wells will be performed according to the following schedule:

- Initial rinse with clean tap water to remove excess residuals;
- Scrub equipment with sponge or clean, soft cloth in a distilled water/Liquinox® (or equivalent) solution; and
- Double rinse with deionized/distilled water.

Methodology:

Each monitoring well to be sampled will be gauged to obtain liquid level and relative NAPL thickness immediately prior to initiation of the sampling process. Refer to SOP No. 1 for appropriate well gauging procedures. Liquid level data will be recorded in a field book.

Sampling of the NAPL will occur via two different methods: direct sample or swabbing.

The following sequence of procedures will be implemented for the collection of groundwater samples from monitoring wells.

1) Establish a clean work area where sampling equipment will not come in contact with the ground or any potentially contaminated surfaces.
2) Use a laboratory, pre-cleaned Teflon® sampling bailer for each well.
3) Don an unused, clean pair of nitrile gloves.
4) Attach an appropriate length of unused, clean nylon or polypropylene cord to the designated sampling bailer.
5) Select appropriate laboratory-sterilized sample containers.
6) Slowly lower sampling bailer into well until water surface is encountered; continue to lower the sampling bailer into the standing water column to one foot below the water surface.
7) Retrieve bailer at a steady rate to avoid excess agitation.
8) Visually inspect bailed sample to ensure for relative thickness of NAPL. If sufficient volume is present (>10 ml) place a direct sample of the NAPL into the laboratory vial. If less than 10 ml of NAPL is present, use a sorbent pad to absorb the NAPL from the surface of the groundwater sample. Place is swab sample into the laboratory vial.
9) Complete and attach labels to sample containers noting sample collector and date, time, and location of sample; record same data in field book.
10) Place samples in ice-filled cooler in such a manner as to avoid breakage. Samples collected for VOC analysis will be maintained at a temperature of 4°C.
11) Discard gloves and bailer cord and move to next sample location.

Documentation:

All site activities should be detailed in the site investigators fieldbook. The entry shall include the date, time, weather, address, persons present on-site, and the aforementioned parameters. Only relevant observations should be recorded. The nature of the work being performed is also appropriate.

APPENDIX H

Groundwater Sampling Summary Sheets

Appendix H1
Groundwater Sampling Summary April 2011
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Well Information						FIELD READINGS (pre-purge)					FIELD READINGS (during purge)					FIELD READINGS (post purge)					FIELD READINGS (sampling)				
Location ID	Depth to Bottom (ft bgs)	Well Diameter (in)	Depth to Water (ft btic)	Depth to Product (ft btic)	Product Thickness (feet)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Purge Start	Purge Complete (sample time)	Approx. Purge Rate (gpm)	Volume Purged (gal)	Date Sampled
AOI 1																								
S-264	81	4	26.40	-	-	15.3	0.60	-23.9	6.4	0.674	15.0	0.77	-19.8	6.2	0.958	15.0	1.19	8	6.0	1.018	1250	1340	2.5	104	4/6/11
S-46D	69	2	15.15	-	-	15.7	3.01	38.4	6.3	0.798	15.7	0.42	-42.6	6.3	1.107	15.7	0.35	-52.4	6.3	1.104	1325	1340	2.5	26	4/6/11
S-80D	80	2	30.63	-	-	15.6	0.81	36.2	6.8	1.224	15.6	1.20	39.6	5.8	1.278	15.6	1.02	40.6	5.6	1.277	1140	1155	2.5	24	4/6/11
AOI 2																								
S-72D	100	2	32.97	-	-	17.8	6.34	-52.5	6.3	0.980	17.3	0.61	-97.3	6.4	0.979	17.3	0.49	-99.4	6.4	0.979	0825	0845	2.5	32	4/7/11
S-294D	99	4	33.23	-	-	16.5	6.16	-293.6	6.7	1.084	16.5	0.33	-175.4	6.5	1.079	16.5	0.27	-152.9	6.5	1.083	1140	1205	5.0	128	4/6/11
S-302D	92	4	24.94	-	-	12.3	1.13	-127.6	6.4	1.164	15.4	0.50	-121.8	6.4	1.206	13.5	0.45	-106.5	6.3	1.270	1300	1330	5.0	130	4/7/11
S-305D	82	4	20.21	-	-	17.6	3.03	-216.1	12.4	2.853	17.6	0.22	-190.1	6.8	1.519	17.6	0.21	-175.3	6.7	1.513	1430	1455	5.0	120	4/6/11
AOI 3																								
BF-108	--	2	11.21	-	-	13.5	2.77	79.6	6.5	0.490	13.5	0.42	104.7	6.3	0.474	13.5	0.43	115.2	6.3	0.473	1010	1035	2.5	62.5	4/7/11
S-13	85	2	Not sampled - is now a shallow well ~22' deep (collapse? Debris?)																					
S-22	85	2	19.56	-	-	14.2	0.75	30.3	6.9	0.479	14.5	0.21	-57.3	6.6	0.577	14.5	0.15	-83	6.5	0.583	1030	1045	2.5	31	4/7/11
S-69D	64	2	14.01	-	-	16.7	2.81	21.2	8.1	0.881	16.6	0.95	63.9	6.8	0.884	16.6	0.96	64.8	6.6	0.883	1430	1440	2.5	24	4/7/11
S-8	91	2	Sample collected, but well seemed to collapse during sampling - TD now shallow. May be able to air lift or may need replaced.																					
S-280D	61	4	25.57	-	-	16.8	4.25	-34.2	6.3	0.351	16.9	0.30	-65.1	6.2	0.349	16.7	0.27	-68.5	6.2	0.350	1410	1440	2.5	69	4/7/11
S-284D	78	4	12.10	-	-	15.7	1.18	-143.8	7.8	1.173	15.5	0.47	-76.3	6.7	1.070	15.5	0.71	-5.1	6.2	1.021	1215	1305	2.5	125	4/7/11
S-6	72	4	Destroyed																					
BF-90D	40	4	3.89	-	-	13.5	3.52	-76.5	6.7	0.511	13.5	3.97	-46.2	6.6	0.481	13.5	12.60	-23.3	6.6	0.467	1140	1210	2.5	70	4/7/11
AOI 4																								
S-119D	72	2	25.01	-	-	14.7	1.08	81.8	6.0	0.495	14.6	1.38	76.7	5.4	0.806	14.6	1.23	74.1	5.3	0.807	1400	1410	2.5	23	4/6/11
S-38D	130	2	18.41	-	-	15.5	8.56	51.3	6.4	0.256	15.2	1.08	43.5	6.8	0.255	15.1	0.89	44.7	6.8	0.254	1445	1510	2.5	53	4/6/11
S-38D2	80	2	19.02	-	-	15.5	4.92	75.7	7.4	0.598	15.0	0.32	63.1	6.4	0.607	14.9	0.66	47.1	6.2	0.624	825	840	2.5	29	4/7/11
S-59D	56	2	16.83	-	-	17.5	1.28	21.6	6.5	1.318	17.3	0.82	6.5	6.5	1.300	17.3	0.84	-1.4	6.3	1.288	1140	1150	2.5	19	4/7/11
AOI 5																								
A-13D	69	4	11.13	-	-	15.4	4.06	-30.6	6.6	0.421	15.2	0.59	-25.8	6.1	0.873	15.2	0.90	-48.5	6.0	0.905	1110	1155	2.5	110	4/11/11
A-19D	60	4	12.22	-	-	15.2	1.28	59.3	6.2	0.608	14.8	0.60	-3.1	6.1	0.575	14.8	0.51	-20.1	6.1	0.575	1235	1305	2.5	91	4/11/11
A-21D	85	4	15.95	-	-	15.3	0.82	-3.2	6.3	0.553	15.4	0.74	-27.7	5.9	0.807	15.4	1.11	-40.1	6.0	0.808	950	1045	2.5	131	4/11/11
AOI 6																								
B-132D	85	2	14.61	-	-	15.9	8.22	14.9	7.5	0.594	15.3	0.82	5.2	6.3	0.846	15.3	0.80	-42.4	6.1	0.843	915	930	2.5	34	4/11/11
B-133D	65	2	10.32	-	-	16.3	6.28	-89.3	6.4	0.751	15.7	0.52	-96.3	6.3	0.687	15.3	0.21	-111.2	6.3	0.672	1250	1305	2.5	26	4/8/11
B-134D	79	2	11.08	-	-	15.0	6.07	-88.3	6.6	0.731	14.9	0.32	-98.3	6.5	0.697	14.9	0.24	-103.3	6.5	0.695	1145	1215	2.5	68	4/8/11
B-48D	55	4	10.88	-	-	15.7	0.99	-97.5	6.5	0.704	15.8	0.29	-95.1	6.4	0.704	15.8	0.29	-95	6.4	0.701	1020	1040	5.0	86	4/8/11
AOI 7																								
C-50D	26	4	11.54	-	-	14.7	9.26	-58.0	6.9	0.829	14.8	1.03	-113.2	6.8	0.900	14.8	0.61	-130.4	6.8	1.115	835	850	2.5	28	4/8/11
C-129D	66	4	9.77	-	-	15.1	1.85	-241.5	11.5	0.633	15.1	0.66	-202.1	7.3	0.844	15.1	0.28	-190.8	7.2	0.840	925	950	5.0	109	4/8/11
C-134D	70	4	10.96	-	-	16.7	3.85	-301.0	12.4	1.888	16.7	0.19	-379.6	12.2	1.732	16.7	0.20	-391.2	12.1	1.412	1355	1425	5.0	115	4/8/11
C-144D	78	4	Destroyed - found casing laying in debris pile near well.																					
C-65D	75	4	Destroyed																					
AOI 8																								
N-13	50	--	22.34	-	-	15.9	3.00	-19.9	6.6	0.687	16.0	0.42	-56	6.6	0.701	16.0	0.40	-70.8	6.6	0.702	920	930	2.5	13	4/6/11
N-19	60	--	29.82	-	-	16.0	1.19	-25.2	6.1	0.549	16.0	0.52	-37.5	6.0	0.549	16.0	0.35	-44.8	5.9	0.561	1345	1355	2.5	14	4/5/11
N-21	51.5	--	22.50	-	-	15.2	12.20	54.8	6.0	0.810	15.3	0.90	136.8	4.5	1.022	15.3	0.60	143.6	4.4	1.094	820	830	2.5	14	4/6/11
N-27	60.5	--	20.76	-	-	15.2	2.21	141.2	5.1	0.820	15.2	0.54	106.2	5.6	0.840	15.2	0.35	84.6	5.8	0.845	1250	1300	2.5	19	4/5/11
N-30	60	2	37.09	-	-	15.0	2.04	53.4	5.2	0.792	15.0	1.53	52.2	5.1	0.816	15.0	1.35	49.2	5.1	0.818	1325	1330	2.5	11	4/5/11
N-38D	85	2	10.46	-	-	16.1	1.90	-123.5	6.6	1.771	15.8	1.79	-87.9	6.1	2.069	15.7	2.53	-85.6	6.1	2.068	900	920	2.5	36	4/6/11
N-4	44.5	--	19.26	-	-	15.7	4.56	22.6	6.8	0.619	15.4	0.47	-58.3	7.0	1.351	15.4	0.35	-87.3	7.0	1.366	1010	1020	2.5	12	4/6/11
N-44D	58	2	26.15	-	-	16.5	1.22	65.2	6.6	0.322	16.7	0.50	-13.5	5.3	0.036	16.7	0.69	-15	5.2	0.423	1200	1210	2.5	15	4/5/11
N-50D	60	2	26.12	-	-	16.6	7.15	24.3	6.6	0.262	17.1	0.33	-72.2	6.1	0.820	17.2	0.22	-81	6.2	0.840	1435	1445	2.5	16	4/5/11
N-9	78	--	34.88	-	-	16.7	3.71	60.4	6.6	0.563	16.7	1.09	42.7	6.6	0.615	16.7	0.51	28	6.6	0.857	1440	1450	2.5	20	4/5/11
N-46D	55	--	Destroyed																					
AOI 9																								
S-74D2 SRTF	42	4	17.85	-	-	15.7	1.17	34.9	6.6	1.110	16.0	3.34	64.2	6.8	1.401	15.8	1.04	-13	6.7	1.114	1210	1230	2.5	47	4/8/11
S-74D1 SRTF	82	4	18.95	-	-	17.7	1.04	-51.0	7.0	0.580	17.9	4.53	-10.3	6.9	0.593	17.7	1.56	26.3	7.0	0.604	1300	1320	2.5	30	4/8/11
S-76D SRTF	85	2	14.77	-	-	14.1	17.26	-17.0	7.2	0.401	14.4	83.00	95.7	7.2	0.408	14.4	67.80	88	7.0	0.404	1050	110	2.5	34	4/8/11
S-106D SRTF	93	2	16.28	-	-	15.8	7.81	46.2	8.0	0.772	16.0	15.35	102.8	7.8	0.791	16.0	5.84	7.59	54.2	0.789	845	900	2.5	37	4/8/11
S-120D SRTF	35	4	19.06	-	-	16.6	5.53	43.0	7.3	0.704	16.8	2.33	11.6	7.1	0.800	16.8	0.73	-65.1	7.0	0.804	955	1010	2.5	35	4/8/11

NOTES:
-- No Data Available
AOI - Area of Interest
ft. - feet
bgs - below ground surface
in. - inches
msl - elevation relative to mean sea level
g/cc - grams per cubic centimeter
NA - Data not available

Appendix H2
Groundwater Sampling Summary June-July 2011
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Well Information						FIELD READINGS (pre-purge)					FIELD READINGS (during purge)					FIELD READINGS (post purge)					FIELD READINGS (sampling)				
Location ID	Depth to Bottom (ft bgs)	Well Diameter (in)	Depth to Water (ft btic)	Depth to Product (ft btic)	Product Thickness (feet)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Purge Start	Purge Complete (sample time)	Approx. Purge Rate (gpm)	Volume Purged (gal)	Date Sampled
AOI 1																									
S-264	81	4	26.10	-	-	15.28	0.98	-19.7	7.63	1.052	15.04	0.52	-32.5	8.33	1.052	14.97	0.54	-37.5	8.33	1.056	1300	1400	2	104	6/28/11
S-46D	69	2	14.65	-	-	15.78	2.73	95.2	6.28	0.918	15.67	0.74	-4.8	7.39	1.245	15.66	0.68	-32.4	7.88	1.275	1210	1230	2	26	6/28/11
S-80D	80	2	29.92	-	-	15.67	1.59	22.7	6.51	1.275	15.58	1.27	62.6	7.02	1.301	15.58	1.02	77.7	7.04	1.302	1130	1145	2	24	6/28/11
AOI 2																									
S-72D	100	2	32.13	-	-	18.06	0.52	-53.7	6.35	0.920	-	-	-	-	-	17.59	0.53	-36.6	6.60	0.925	1330	13.50	2	32.5	6/28/11
S-294D	99	4	32.27	-	-	16.68	0.41	-77.4	7.16	1.044	15.96	0.52	-94.9	6.33	1.057	15.98	0.37	-99.7	6.11	1.055	1140	1230	2	130	6/28/11
S-302D	92	4	22.90	-	-	17.59	1.09	-38.4	7.86	0.780	18.13	0.32	-88.6	6.20	1.217	18.12	0.29	-97.1	6.24	1.220	1240	1330	2	135	6/28/11
S-305D	82	4	20.01	-	-	17.33	1.13	537.9	2.96	2.917	17.46	1.02	487.0	3.32	1.658	17.29	1.10	388.1	2.76	1.644	1030	1130	2	118	6/29/11
AOI 3																									
BF-108	–	2	NR	-	-	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	7/5/11
S-13	85	2	location dry (blockage in well)			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
S-22	85	2	19.39	-	-	14.59	1.61	-14.6	6.31	0.545	14.66	0.35	-102.6	8.72	0.547	14.80	0.90	-73.2	8.19	0.555	1250	1310	2	31	6/29/11
S-69D	64	2	13.79	-	-	16.55	0.53	-76.1	10.35	0.750	-	-	-	-	-	16.61	0.56	-30.6	8.27	0.747	1055	1110	2	24	6/29/11
S-8	91	2	7.77	-	-	14.61	1.12	-27.1	7.37	0.198	14.60	0.43	-100.4	8.74	0.322	14.63	0.38	-89.2	8.63	0.348	1345	1410	2	40	6/29/11
S-280D	61	4	25.37	-	-	17.13	0.37	-47.9	6.60	0.446	17.04	0.35	-111.9	7.26	0.579	17.03	0.30	-105.5	7.41	0.580	1420	1455	2	69.5	6/28/11
S-284D	78	4	11.75	-	-	15.68	0.49	-120.1	8.55	1.027	15.46	0.94	-92.9	10.04	0.850	15.44	0.70	-119	11.21	0.832	955	1030	2	129	6/29/11
S-6	72	4	Destroyed																						
BF-90D	40	4	9.76	-	-	14.24	1.18	-107.3	7.50	0.521	14.44	1.42	-113	7.80	0.542	14.49	1.96	-124.2	7.01	0.498	1225	1300	2	59	7/5/11
AOI 4																									
S-119D	72	2	24.69	-	-	14.71	1.44	53.2	6.85	0.572	14.51	0.82	31.4	7.54	0.809	14.50	0.59	12.4	7.65	0.812	1415	1430	2	23	6/28/11
S-38D	130	2	18.22	-	-	14.72	2.21	1145.2	5.10	0.258	14.82	1.44	1184.1	6.71	0.260	14.69	1.33	1196.2	5.62	0.261	850	920	2	53	6/29/11
S-38D2	80	2	18.89	-	-	14.80	1.85	1086.1	5.73	0.645	14.50	1.50	1196.3	4.79	0.666	14.48	1.47	1213.8	4.31	0.623	935	955	2	29	6/29/11
S-59D	56	2	16.23	-	-	17.20	1.11	46.8	6.98	1.331	17.24	0.54	22.4	7.25	1.331	17.17	0.53	7.9	7.31	1.322	1155	1210	2	19	6/29/11
AOI 5																									
A-13D	69	4	11.54	-	-	15.28	1.45	-67.4	7.85	0.708	15.16	1.47	-76.1	8.31	0.944	15.16	1.06	-86.6	8.36	0.942	1030	1130	2	109	7/1/11
A-19D	60	4	12.53	-	-	14.84	1.84	-36.3	7.82	0.590	14.77	0.67	-79.3	8.23	0.595	14.77	0.66	-85.6	8.27	0.596	1145	1230	2	90	7/1/11
A-21D	85	4	16.56	-	-	15.29	1.74	-37.2	7.46	0.826	15.27	0.76	-67.1	7.93	0.836	15.24	1.06	-76.5	8.05	0.831	915	1020	2	130	7/1/11
AOI 6																									
B-132D	85	2	15.27	-	-	15.44	2.38	-86.4	7.25	0.870	15.20	1.22	-74.0	7.93	0.868	15.20	0.95	-81.5	8.03	0.869	840	900	2	33	7/1/11
B-133D	65	2	10.19	-	-	15.66	0.79	-117.8	6.50	0.683	-	-	-	-	-	15.71	0.43	-106.5	7.20	0.689	1130	1150	2	26.5	7/1/11
B-134D	79	2	11.03	-	-	15.04	1.19	-144.8	6.71	0.666	-	-	-	-	-	15.11	0.50	-113.1	7.25	0.671	1040	1100	2	33	7/1/11
B-48D	55	4	11.06	-	-	15.85	0.63	-172.2	8.36	0.680	15.87	1.44	-162.8	6.87	0.668	15.87	1.50	-160.1	6.66	0.646	950	1030	2	86	7/1/11
AOI 7																									
C-50D	26	4	11.65	-	-	14.54	1.79	-157.9	8.19	1.073	14.37	1.51	-142.9	7.23	1.056	14.42	1.32	-137.1	6.84	1.084	1135	1200	2	28	7/5/11
C-129D	66	4	9.06	-	-	15.11	0.39	-203.2	11.93	0.924	14.97	0.36	-233.7	13.14	0.955	15.00	0.38	-250.6	13.66	0.918	1335	1410	2	111	6/29/11
C-134D	70	4	10.83	-	-	16.78	18.74	-259.2	11.32	1.303	16.75	1.15	-273.8	11.36	1.244	16.73	0.43	-275.6	11.19	0.839	840	915	2	115	7/1/11
C-144D	78	4	12.83	-	-	15.74	20.12	-110.9	7.19	0.824	15.49	5.35	-130.9	5.99	0.800	15.48	3.27	-132.1	5.93	0.802	1015	1100	2	127	7/5/11
C-65D	75	4	Destroyed																						
AOI 8																									
N-13	50	--	21.89	-	-	15.32	4.32	-72.2	7.00	0.658	-	-	-	-	-	16.49	3.05	-47.6	7.14	0.646	1150	1200	2	13.5	6/27/11
N-19	60	--	29.60	-	-	16.30	1.73	-21.5	6.63	0.473	-	-	-	-	-	16.84	1.61	-0.4	7.07	0.459	1350	1400	2	13	6/27/11
N-21	51.5	--	24.29	-	-	15.45	2.02	62.1	5.25	3.723	-	-	-	-	-	15.43	0.93	19.4	7.96	3.646	1230	1240	2	13	6/29/11
N-27	60.5	--	20.75	-	-	14.80	7.29	30.3	5.79	0.306	-	-	-	-	-	15.32	5.20	2.4	6.66	0.344	855	905	2	19	6/28/11
N-30	60	2	36.38	-	-	15.23	0.82	-48.8	5.79	0.646	-	-	-	-	-	15.15	0.55	-73.2	6.55	0.665	940	950	2	11.5	6/28/11
N-38D	85	2	9.58	-	-	16.04	3.55	2.1	7.10	2.058	15.76	1.84	-23.4	7.91	2.061	15.72	1.61	-12.6	7.80	2.115	935	955	2	36	6/28/11
N-4	44.5	--	19.21	-	-	15.89	7.44	37.8	7.13	0.665	-	-	-	-	-	16.01	3.70	0.1	7.70	0.732	1055	1105	2	12	6/27/11
N-44D	58	2	26.55	-	-	16.41	3.08	-42.7	5.22	0.473	16.50	1.37	-31.1	7.27	0.476	16.50	1.13	-52.3	8.09	0.474	830	840	2	15	6/28/11
N-50D	60	2	28.06	-	-	17.04	9.62	-78.1	6.51	0.676	-	-	-	-	-	17.74	0.59	-72.2	6.73	0.640	900	910	2	15.5	6/29/11
N-9	78	--	32.53	-	-	17.17	10.26	-22.9	6.67	0.956	-	-	-	-	-	17.24	2.80	-46.3	7.03	0.967	1250	1305	2	22	6/27/11
N-46D	55	--	Destroyed																						
AOI 9																									
S-74D2 SRTF	42	4	18.31	-	-	15.48	0.77	-98.2	7.90	1.161	15.45	0.52	-128.3	7.97	1.157	15.45	0.56	-137.2	8.00	1.157	1325	1350	2	45	6/30/11
S-74D1 SRTF	82	2	19.18	-	-	18.37	1.78	-69.2	5.36	0.815	17.93	1.12	-49.1	7.11	0.820	17.94	0.68	-80.7	7.49	0.827	1250	1310	2	30	6/30/11
S-76D SRTF	85	2	15.03	-	-	14.48	0.54	-58.9	7.49	-57.700	-	-	-	-	-	14.79	0.48	-78.6	9.54	0.402	1420	1440	2	33.5	6/30/11
S-106D SRTF	93	2	16.63	-	-	15.88	0.35	-133.1	6.99	0.861	-	-	-	-	-	15.94	0.40	-125.3	7.66	0.874	1310	1330	2	37	6/30/11
S-120D SRTF	35	4	19.37	-	-	16.32	0.33	-131.2	7.30	0.681	-	-	-	-	-	17.00	0.54	-133.5	7.40	0.661	1350	1405	2	31	6/30/11

NOTES:
-- No Data Available
AOI - Area of Interest
ft. - feet
bgs - below ground surface
in. - inches
msl - elevation relative to mean sea level
g/cc - grams per cubic centimeter
NA - Data not available

APPENDIX I

Groundwater Analytical Reports (on CD)

Appendix I: Data Usability Assessment

Data usability is the process of evaluating the laboratory data results and determining the confidence with which any data point may be used. Data usability is evaluated to ensure that the opportunity for incorporating unacceptable and unmanageable error into the decision-making process is minimized to the extent possible. Usability is determined by evaluating the data qualifiers applied and the laboratory QC results. The concentration values may be considered to have a high degree of confidence because the method performance criteria were achieved. The concentration values considered estimates, flagged with "J" qualifiers, are evaluated with respect to the bias contributed to the value by the QC result.

For the purposes of this investigation, sample results were summarized in sixteen sample delivery groups, provided by Lancaster Laboratories, and are evaluated in the sections below for usability. Copies of the laboratory reports are provided in this appendix for your reference. Any analytical data, data qualifiers, and QC results provided in these reports were evaluated to determine the confidence with which this groundwater data could be used in the decision-making process. The criteria used in the data usability summary are presented in the following sections.

Data Quality Indicators

Data quality indicators (DQIs) are qualitative and quantitative measures of data quality "attributes," which are descriptors used to express various properties of analytical data. Thus, DQIs are the various measures of the individual data characteristics that collectively comprise the general, all encompassing term "data quality." Quality attributes used to assess the data usability include:

- Method selectivity/specificity
- Accuracy (bias)
- Precision
- Representativeness
- Comparability
- Completeness

<u>Method Selectivity/Specificity</u>
Method selectivity/specificity is defined as the compound type or class that can be detected by the instrument or detector. Instruments that are used to detect a compound class (i.e., hydrocarbons) are said to be selective. Instruments that are used to detect a specific element group (e.g., halogens) are said to be specific. Groundwater samples, as well as field QC blanks, were analyzed for the following parameters using the listed selective and specified methods:

- GC/MS Volatiles via EPA Method SW-846 8260B,
- GC/MS Semi-Volatiles via EPA Method SW-846 8270C,
- Ethylene Dibromide via EPA Method SW-846 8011,

- Metals via EPA Method SW-846 6010B and SW-846 6020,
- Wet Chemistry via via EPA Method 300.0, SM20 5310C, SM20 2320B, SM20 2540C, SM20 4500 S2D, and SM20 4500NH3 B/C modified.

Accuracy (Bias)

Accuracy is defined as the amount of agreement between the laboratory's reported concentration and the true concentration of an analyte in an environmental sample. An evaluation of accuracy provides an estimate of bias. Bias is considered to be high or low, which means that the concentration result is likely lower or higher than the actual laboratory result indicates. Bias direction can be estimated for data quality impacts due to surrogate recoveries, matrix spike recoveries, and laboratory control sample recoveries; however, the degree to which bias impacts the concentration result cannot be estimated.

Indicators of accuracy include surrogate spikes, laboratory control spike, matrix spike, and matrix spike duplicate samples. The estimated ranges of accuracy for each measurement parameter are defined within the analytical test methods. For the purposes of this project, accuracy [or bias] was evaluated as follows:

- *Sample hold times* to ensure all samples were analyzed within method specific timeframes. If hold times are exceeded, reported concentrations may be negatively biased.

- *Lab and field blank samples* to ensure no analytes were detected: if analytes were detected in blank samples, the concentrations of these analytes in the normal environmental samples may be positively biased.

- *Percent recovery of surrogate spikes* (synthetic compounds injected into each sample) to ensure that these compounds were recovered within the range deemed acceptable by the analytic method. If surrogates are recovered below this range then concentrations reported for the target analytes may be negatively biased: likewise, if surrogates are recovered above this range then concentrations reported for the target analytes may be positively biased.

- *Percent recovery of each compound analyzed in the lab QC samples [Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (LCSD)] and field QC samples [Matrix Spike (MS) and Matrix Spike Duplicate (MSD)]*.

  LCS and LCSD samples are samples of DI water spiked with known concentrations of the target analytes. LCS and LCSD samples are run at a rate of one per sample batch (approximately 20 samples) and are indicators of method performance. If compounds within the LCS or LCSD are recovered above or below the acceptable ranges than concentrations of these compounds may be biased in each of the samples within the corresponding batch.

MS and MSD samples are normal environmental samples collected at the project site and spiked with known concentrations of the target analytes. MS and MSD samples are typically run at the same frequency as LCS and LCSD samples but are indicators of potential bias based on the sampling matrix.

Each laboratory sample delivery group was evaluated for accuracy based on the components listed above. Below is a summary of findings:

Sample Delivery Group 1253797:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the limit of quantitation (LOQ) in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits. Recoveries were less than the lower limits for
    - Lead (Pb) in the MSD for batch 111806050002A (corresponding to samples 6330638 – 6330645). Lead in the MS for this batch was between acceptable limits.
    - Fluoride and Nitrite Nitrogen in the MS for batch 11180196901B (corresponding to samples 6330638, 6330640, 6330642, and 6330644).
- With the exception noted below, surrogate recoveries were between acceptable recovery control limits.
    - SVOA surrogate recoveries in sample 6330644 were greater than the upper control limit.

Sample Delivery Group 1254489:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were greater than the upper control limit for nitrate nitrogen in the MS for batch 11183373601B (corresponding to samples 6334730, 6334732, 6334734, and 6334736).
- With the exception noted below, surrogate recoveries were between acceptable recovery control limits.
    - Surrogate recoveries in analysis of ethylene dibromide in sample 6334736 were less than the lower control limit.

Sample Delivery Group 1254858:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits. Recoveries were less than the lower limits for
    - Fluoride and Nitrite Nitrogen in the MS for batch 11188196901A (corresponding to samples 6336541, 6336543, 6336545, and 6336547).
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1254047:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were less than the lower limits for Fluoride, Nitrate Nitrogen, and Nitrite Nitrogen in the MS for batch 11180196902B (corresponding to samples 6331894 and 6331896).
    - Recoveries were less than the lower limits for Fluoride, Nitrate Nitrogen, and Nitrite Nitrogen in the MS for batch 11180196903A (corresponding to samples 6331898, 6331900, 6331902, and 6331904). In the same sample, recovery was greater than the upper limit for sulfate.
- With the exception noted below, surrogate recoveries were between acceptable recovery control limits.
    - Surrogate recovery in analysis of ethylene dibromide in sample 6331904 was greater than the upper control limit.

Sample Delivery Group 1254048:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were less than the lower limits for Ethylene Dibromide in the MS for batch 111830011A (corresponding to sample 6331916).

    - Recoveries were less than the lower limits for Fluoride, Nitrate Nitrogen, and Nitrite Nitrogen in the MS for batch 11180196903A (corresponding to samples 6331906, 6331908, 6331910, 6331912, 6331914, and 6331916). In the same sample, recovery was greater than the upper limit for sulfate.
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1254227:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were less than the lower limits for Ethylene Dibromide in the MS for batch 111830011A (corresponding to samples 6332969, 6332971, 6332973, 6332975, 6332977, and 6332979).
    - Recoveries were less than the lower limits for Fluoride, Nitrate Nitrogen, and Nitrite Nitrogen in the MS for batch 11181196902A (corresponding to samples 6332969, 6332971, 6332973, 6332975, 6332977, and 6332979). In the same sample, recoveries were greater than the upper limits for chloride and sulfate.
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1254228:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were less than the lower limits for Ethylene Dibromide in the MS for batch 111830011A (corresponding to samples 6332981, 6332983, 6332985, 6332987, and 6332989).
    - Recoveries were less than the lower limits for Cobalt in the MS for batch 111871848003 (corresponding to samples 6332987-6332988).
    - Recoveries were less than the lower limits for Sulfate in the MS for batch 11181196902B (corresponding to sample 6332989).
    - Recoveries were less than the lower limits for Fluoride, Nitrate Nitrogen, and Nitrite Nitrogen in the MS for batch 11181196902A (corresponding to samples 6332981, 6332983, 6332985, and 6332987). In the same sample, recoveries were greater than the upper limits for chloride and sulfate.

- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1254287:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were greater than the upper limits for Nitrate Nitrogen and Sulfate in the MS for batch 11183373601A (corresponding to samples 6334708, 6334710, 6334712, 6334714, and 6334716).
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1254288:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were greater than the upper limits for Nitrate Nitrogen and Sulfate in the MS for batch 11183373601A (corresponding to samples 6334720, 6334722, 6334724, 6334726, and 6334728).
    - Recovery was greater than the upper limit for Nitrate Nitrogen in the MS for batch 11183373601B (corresponding to sample 6334718).
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1254290:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recovery was greater than the upper limit for Nitrate Nitrogen in the MS for batch 11183373601B (corresponding to samples 6334738, 6334740, 6334742, and 6334744).
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1240831:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were greater than the upper limits for Chloride, Nitrate Nitrogen, and Sulfate in the MS for batch 11096130902B (corresponding to samples 6250842, 6250844, 6250846, 6250848, 6250850, and 6250852).
    - Recovery was less than the lower limit for Total Organic Carbon in the MS for batch 11102049501A (corresponding to samples 6250542, 6250844, 6250846, 6250848, 6250850, and 6250852).
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1241118:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were greater than the upper limits for Fluoride, Nitrate Nitrogen, and Nitrite Nitrogen in the MS for batch 11097130601B (corresponding to samples 6252781, 6252783, and 6252785).
    - Recoveries were greater than the upper limits for Chloride and Sulfate in the MS for batch 11097130602A (corresponding to samples 6252787, 6252789, 6252791, 6252793, 6252795, 6252797, 6252799, and 6252801). In the same sample, recovery was less than the lower limit for nitrite nitrogen.
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1241306:

- Samples were analyzed within sample hold times.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.

    - Recoveries were greater than the upper limits for Arsenic and Lead in the MS for batch 111016050003A (corresponding to samples 6253801-6253820).
    - Recoveries were less than the lower limits for Fluoride and Nitrite Nitrogen in the MS for batch 11098130602A (corresponding to samples 6253801, 6253803, 6253805, 6253807, 6253809, 6253811, 6253813, 6253815, 6253817, and 6253819). In the same sample, recovery was greater than the upper limit for sulfate.
    - Recoveries were less than the lower limits for Fluoride, Nitrate Nitrogen, Nitrite Nitrogen, and Sulfate in the MS for batch 11098130602B (corresponding to sample 6253821).
    - Recovery was less than the lower limits for Sulfide in the MS for batch 11104023001A (corresponding to samples 6253801, 6253803, 6253805, 6253807, 6253809, 6253811, 6253813, 6253815, 6253819, and 6253821).
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1241584:

- Hold times were exceeded for analysis of Nitrate Nitrogen and Nitrite Nitrogen in Samples 6255412, 6255414, 6255416, 6255418, and 6255420.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recovery was greater than the upper limit for Chloride in the MS for batch 11103196601A (corresponding to samples 6255412, 6255414, 6255416, 6255418, and 6255420).
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1241585:

- Hold times were exceeded for analysis of Nitrate Nitrogen and Nitrite Nitrogen in Samples 6255422, 6255424, 6255426, 6255428, 6255430, and 6255432.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recovery was greater than the upper limit for Chloride in the MS for batch 11103196601A (corresponding to samples 6255422, 6255424, 6255426, 6255428, and 6255430).

    - Recoveries were less than the lower limit for Fluoride and Nitrite Nitrogen in the MS for batch 11103196601B (corresponding to sample 6255432).
- Surrogate recoveries were between acceptable recovery control limits.

Sample Delivery Group 1241791:

- Hold times were exceeded by two-minutes for analysis of Nitrate Nitrogen and Nitrite Nitrogen in Sample 6256335.
- No trip or field blanks were submitted for analysis.
- Target compounds weren't detected above the LOQ in the lab blank.
- Recoveries in LCS/LCSD samples, analyzed for target analytes, were between acceptable recovery control limits.
- With the exceptions noted below, recoveries in MS/MSD samples, analyzed for ethylene dibromide, metals, and wet chemistry parameters, were between acceptable recovery control limits.
    - Recoveries were less than the lower limits for Fluoride and Sulfate in the MS for batch 11103196901A (corresponding to samples 6256325, 6256327, 6256329, 6256331, 6256333, 6256335, 6256337, and 6256339).
- Surrogate recoveries were between acceptable recovery control limits.

Based on the summary above, accuracy acceptance criteria were met with exception for select percent recovery values. Where the MS/MSD recoveries were less than the lower recovery control limit the reported values should be considered as estimated low. Where the MS/MSD recoveries were greater than the upper recovery control limit the reported values should be considered as estimated high. The corresponding data are considered usable but should be considered slightly higher or lower in concentration than groundwater representative of the site and time collected.

Three groundwater samples should be considered estimated based on surrogate recoveries. Surrogate recovery in one sample was less than the lower control limits and surrogate recoveries in the other two samples were greater than the upper control limit.

<u>Precision</u>

Precision is defined as the ability to reproduce analytical results and is the measure of variability between individual sample measurements under prescribed conditions. Precision is assessed by the analysis of duplicate samples and expressed in terms of relative percent difference (RPD). For this project, analytical variability was measured as the relative percent difference (RPD) between 1) analytical laboratory duplicates (LCS and LCSD), and 2) the matrix spike (MS) and matrix spike duplicate (MSD). Field duplicate samples are not required under the sampling guidelines and were not collected.

Each laboratory sample delivery group was evaluated for precision based on the components listed above. Below is a summary of findings:

Sample Delivery Group 1253797:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method, with the following exception.
    - Pb in batch 111806050002A (corresponding to samples 6330638 – 6330645).

Sample Delivery Group 1254489:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1254858:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1254047:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1254048:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1254227:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1254228:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1254487:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1254488:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1254490:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1240831:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method, with the exceptions noted below.
    - Sulfide in batch 11101023001A (corresponding to samples 6250842, 6250844, 6250846, 6250848, 6250850, and 6250852).

Sample Delivery Group 1241118:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method, with the exceptions noted below.
    - Sulfide in batch 11103023001A (corresponding to samples 6252781, 6252783, 6252785, 6252787, 6252789, 6252791, 6252793, 6252795, 6252797, 6252799, and 6252801).

Sample Delivery Group 1241306:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method, with the exceptions noted below.
    - Arsenic and Lead in batch 111016050003A (corresponding to samples 6253801-6253820).

- Sulfide in batch 11104023001A (corresponding to samples 6253801, 6253803, 6253805, 6253807, 6253809, 6253811, 6253813, 6253815, 6253819, and 6253821)

Sample Delivery Group 1241584:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1241585:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

Sample Delivery Group 1241791:

- The RPDs calculated and reported by the lab between the LCS/LCSD are below the maximum RPD allowable by the analytical method.
- The RPDs calculated and reported by the lab between the MS/MSD are below the maximum RPD allowable by the analytical method.

One hundred ninety four groundwater samples were collected and analyzed for VOA, SVOA, metals, and wet chemistry parameters. The RPDs calculated for one hundred percent of the LCS/LCSDs and ninety-four percent the MS/MSDs are within the limits allowable by the analytical method; therefore, the analytical results reported can be assumed to be reproducible.

Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter most concerned with the proper design of the sampling program. The representativeness criteria may be satisfied by making certain the sampling locations are selected properly and that a sufficient number of samples are collected to fulfill program objectives.

Groundwater samples were collected from the existing network of monitoring wells which were installed at locations biased to potential source areas and sensitive receptors (surface water bodies, occupied buildings, residential properties). The compounds analyzed in groundwater samples include the compounds currently identified in the Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E of PADEP's Closure Requirements for Underground Storage Tank Systems (with exception for the waste oil parameters since waste oil is only stored in small tanks within the facility maintenance garages). These compounds are the same as those listed for groundwater in the Current Conditions Report (Langan, 2004). In May 2009, two additional compounds, 1,2,4-trimethylbenze and 1,3,5-trimethylbenzene, were added to the list of parameters

at PADEP's request based on the PADEP's revisions to the petroleum short list of compounds. Four additional metals (arsenic, cobalt, iron and manganese) and wet chemistry parameters including ammonia, chloride, fluoride, nitrate, nitrite, sulfate, alkalinity, total organic carbon (TOC), and total dissolved solids (TDS) were also added to the compound list to further characterize deep groundwater at the site in accordance with the CO&A.

The data collected during this investigation is considered representative of groundwater in AOI 11 based on the distribution of the monitoring wells within the sampling program, the frequency of sample collection, and the suite of parameters analyzed.

Comparability

Comparability is the degree to which data from one study can be compared with data from other similar studies, reference values (such as background), reference materials, and screening values. This goal was achieved by using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. The sample collection methods used were based on PADEP's guidelines summarized in the Groundwater Monitoring Guidance Manual dated December 1, 2001 and the Groundwater Sampling and Analysis Plan, dated January 17, 2008. The analytical methods used are EPA solid waste methods or Standard Methods.

Based on this data quality analysis all data are considered comparable to other groundwater data collected as part of other groundwater sampling programs.

Completeness

Completeness is defined as the percentage of usable data in the total data population generated. One hundred percent of the data is considered usable, with few concentrations considered biased and therefore estimated. The number of samples planned was expected to provide sufficient data to satisfy the objective defined in the Current Conditions Report (Langan, 2004). Had the initial results not met QC requirements the volume of samples collected was sufficient to reanalyze samples as necessary.

Summary and Conclusions

For the purposes of this investigation, sample results were summarized in sixteen sample delivery groups, provided by Lancaster Laboratories, and are evaluated in the sections below for usability. Copies of the laboratory reports are provided in this appendix for your reference.

The laboratory performed quality assurance and quality control (QA/QC) analyses, including laboratory control spikes and laboratory control spike duplicates, matrix spikes and matrix spike duplicates, surrogate spikes, method blanks and QA/QC checks such as GC/MS instrument tuning and mass calibration, as appropriate. Laboratory QA/QC summaries were completed by the laboratory and provided in each data package, attached. The analytical data, data qualifiers, and QC results provided in these reports

were evaluated to determine the confidence with which this groundwater data could be used in the decision-making process.

Data quality indicators (DQIs) are qualitative and quantitative measures of data quality "attributes," which are descriptors used to express various properties of analytical data. Thus, DQIs are the various measures of the individual data characteristics that collectively comprise the general, all encompassing term "data quality." Quality attributes used to assess the data usability include:

- Method selectivity/specificity
- Accuracy (bias)
- Precision
- Representativeness
- Comparability
- Completeness

Based on evaluation of these indicators the groundwater data collected during this investigation is considered usable. As detailed in the sections above, few concentrations should be considered as biased because MS/MSD and surrogate recoveries were beyond acceptable control limits. The analytes most affected were the wet chemistry analytes: these analytes aren't pervasive and aren't considered compounds of concern at the Site. The data for these biased samples are considered usable but should be considered slightly higher or lower in concentration than groundwater representative of the site and time collected.

Lancaster Laboratories

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 08, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 06/28/2011
Group Number: 1253797
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
N-13_06272011 Grab Water	6330638
N-13_06272011 Filtered Grab Water	6330639
N-19_06272011 Grab Water	6330640
N-19_06272011 Filtered Grab Water	6330641
N-4_06272011 Grab Water	6330642
N-4_06272011 Filtered Grab Water	6330643
N-9_06272011 Grab Water	6330644
N-9_06272011 Filtered Grab Water	6330645

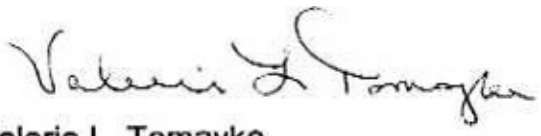
The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,



Valerie L. Tomayko
Group Leader

Lancaster Laboratories

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Analysis Report

Sample Description: N-13_06272011 Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-13

LLI Sample # WW 6330638
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 12:00 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N13

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0051	0.0050	0.00062	1
01754	Iron	7439-89-6	22.8	0.200	0.0141	1
07058	Manganese	7439-96-5	1.44	0.0050	0.00044	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0098	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0063	0.0010	0.000080	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	67.7	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	8.2	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	11.9	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	271	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	271	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	414	30.0	9.7	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: N-13_06272011 Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-13

LLI Sample # WW 6330638
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 12:00 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N13

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	0.76	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	P111822AA	07/01/2011 16:14	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P111822AA	07/01/2011 16:14	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11180WAC026	07/01/2011 07:35	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11180WAC026	06/29/2011 18:00	Nicholas W Shroyer	1
07879	EDB in Wastewater	SW-846 8011	1	111800012A	06/30/2011 23:07	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111800012A	06/30/2011 04:30	David V Hershey Jr	1
07052	Cobalt	SW-846 6010B	1	111801848006	07/01/2011 16:51	John P Hook	1
01754	Iron	SW-846 6010B	1	111801848006	07/01/2011 16:51	John P Hook	1
07058	Manganese	SW-846 6010B	1	111801848006	07/01/2011 16:51	John P Hook	1
06025	Arsenic	SW-846 6020	1	111806050002A	07/05/2011 09:48	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111806050002A	07/05/2011 09:48	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111801848006	06/30/2011 08:33	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111806050002	06/30/2011 08:28	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196901B	07/01/2011 16:30	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11180196901B	06/29/2011 10:23	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196901B	06/29/2011 10:23	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196901B	06/29/2011 10:23	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196901B	06/29/2011 10:23	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11182049502B	07/01/2011 06:38	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11181021201A	06/30/2011 09:58	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **N-13_06272011 Grab Water**
Philadelphia Refinery AOI-11
COC: 266186 N-13

LLI Sample # WW 6330638
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 12:00 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N13

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11181022101A	06/30/2011 15:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-13_06272011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-13

LLI Sample # WW 6330639
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 12:00 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	10.1	0.200	0.0141	1
07058	Manganese	7439-96-5	1.37	0.0050	0.00044	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0039	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111801848006	07/01/2011 16:55	John P Hook	1
01754	Iron	SW-846 6010B	1	111801848006	07/01/2011 16:55	John P Hook	1
07058	Manganese	SW-846 6010B	1	111801848006	07/01/2011 16:55	John P Hook	1
06025	Arsenic	SW-846 6020	1	111806050002A	07/05/2011 09:51	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111806050002A	07/05/2011 09:51	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111801848006	06/30/2011 08:33	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111806050002	06/30/2011 08:28	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-19_06272011 Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-19

LLI Sample # WW 6330640
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 14:00 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N19

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	27.6	0.200	0.0141	1
07058	Manganese	7439-96-5	0.276	0.0050	0.00044	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0028	0.0010	0.000080	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	87.8	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	23.8	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	4.1	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	172	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	172	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	386	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-19_06272011 Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-19

LLI Sample # WW 6330640
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 14:00 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N19

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	P111822AA	07/01/2011 16:42	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P111822AA	07/01/2011 16:42	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11180WAC026	07/01/2011 08:01	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11180WAC026	06/29/2011 18:00	Nicholas W Shroyer	1
07879	EDB in Wastewater	SW-846 8011	1	111800012A	07/01/2011 09:14	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111800012A	06/30/2011 04:30	David V Hershey Jr	1
07052	Cobalt	SW-846 6010B	1	111801848006	07/01/2011 17:06	John P Hook	1
01754	Iron	SW-846 6010B	1	111801848006	07/01/2011 17:06	John P Hook	1
07058	Manganese	SW-846 6010B	1	111801848006	07/01/2011 17:06	John P Hook	1
06025	Arsenic	SW-846 6020	1	111806050002A	07/05/2011 09:53	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111806050002A	07/05/2011 09:53	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111801848006	06/30/2011 08:33	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111806050002	06/30/2011 08:28	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196901B	07/01/2011 17:29	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11180196901B	06/29/2011 11:54	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196901B	06/29/2011 11:54	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196901B	06/29/2011 11:54	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196901B	06/29/2011 11:54	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11182049502B	07/01/2011 06:45	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11181021201A	06/30/2011 09:58	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **N-19_06272011 Grab Water**
Philadelphia Refinery AOI-11
COC: 266186 N-19

LLI Sample # WW 6330640
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 14:00 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N19

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11181022101A	06/30/2011 15:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-19_06272011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-19

LLI Sample # WW 6330641
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 14:00 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	23.5	0.200	0.0141	1
07058	Manganese	7439-96-5	0.251	0.0050	0.00044	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111801848006	07/01/2011 17:10	John P Hook	1
01754	Iron	SW-846 6010B	1	111801848006	07/01/2011 17:10	John P Hook	1
07058	Manganese	SW-846 6010B	1	111801848006	07/01/2011 17:10	John P Hook	1
06025	Arsenic	SW-846 6020	1	111806050002A	07/05/2011 09:55	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111806050002A	07/05/2011 09:55	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111801848006	06/30/2011 08:33	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111806050002	06/30/2011 08:28	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-4_06272011 Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-4

LLI Sample # WW 6330642
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 11:05 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	9.31	0.200	0.0141	1
07058	Manganese	7439-96-5	2.89	0.0050	0.00044	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0013	0.0010	0.000080	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	62.6	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	85.3	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	7.8	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	573	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	573	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	801	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-4_06272011 Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-4

LLI Sample # WW 6330642
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 11:05 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N04

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	P111822AA	07/01/2011 17:10	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P111822AA	07/01/2011 17:10	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11180WAC026	07/01/2011 08:28	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11180WAC026	06/29/2011 18:00	Nicholas W Shroyer	1
07879	EDB in Wastewater	SW-846 8011	1	111800012A	07/01/2011 09:44	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111800012A	06/30/2011 04:30	David V Hershey Jr	1
07052	Cobalt	SW-846 6010B	1	111801848006	07/01/2011 17:14	John P Hook	1
01754	Iron	SW-846 6010B	1	111801848006	07/01/2011 17:14	John P Hook	1
07058	Manganese	SW-846 6010B	1	111801848006	07/01/2011 17:14	John P Hook	1
06025	Arsenic	SW-846 6020	1	111806050002A	07/05/2011 09:58	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111806050002A	07/05/2011 09:58	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111801848006	06/30/2011 08:33	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111806050002	06/30/2011 08:28	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196901B	07/01/2011 16:01	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11180196901B	06/29/2011 09:52	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196901B	06/29/2011 09:52	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196901B	06/29/2011 09:52	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196901B	06/29/2011 09:52	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11182049502B	07/01/2011 06:53	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11181021201A	06/30/2011 09:58	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **N-4_06272011 Grab Water**
Philadelphia Refinery AOI-11
COC: 266186 N-4

LLI Sample # WW 6330642
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 11:05 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N04

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11181022101A	06/30/2011 15:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-4_06272011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-4

LLI Sample # WW 6330643
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 11:05 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	0.361	0.200	0.0141	1
07058	Manganese	7439-96-5	2.75	0.0050	0.00044	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111801848006	07/01/2011 17:18	John P Hook	1
01754	Iron	SW-846 6010B	1	111801848006	07/01/2011 17:18	John P Hook	1
07058	Manganese	SW-846 6010B	1	111801848006	07/01/2011 17:18	John P Hook	1
06025	Arsenic	SW-846 6020	1	111806050002A	07/05/2011 10:00	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111806050002A	07/05/2011 10:00	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111801848006	06/30/2011 08:33	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111806050002	06/30/2011 08:28	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-9_06272011 Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-9

LLI Sample # WW 6330644
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 13:05 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N09

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0083	0.0050	0.00062	1
01754	Iron	7439-89-6	11.9	0.200	0.0141	1
07058	Manganese	7439-96-5	1.90	0.0050	0.00044	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0022	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0077	0.0010	0.000080	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	67.8	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	99.4	20.0	6.0	20
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	3.0	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	451	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	451	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	639	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-9_06272011 Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-9

LLI Sample # WW 6330644
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 13:05 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N09

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	1.5	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	P111822AA	07/01/2011 17:37	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P111822AA	07/01/2011 17:37	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11180WAC026	07/01/2011 08:54	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11180WAC026	06/29/2011 18:00	Nicholas W Shroyer	1
07879	EDB in Wastewater	SW-846 8011	1	111800012A	07/01/2011 10:14	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111800012A	06/30/2011 04:30	David V Hershey Jr	1
07052	Cobalt	SW-846 6010B	1	111801848006	07/01/2011 17:22	John P Hook	1
01754	Iron	SW-846 6010B	1	111801848006	07/01/2011 17:22	John P Hook	1
07058	Manganese	SW-846 6010B	1	111801848006	07/01/2011 17:22	John P Hook	1
06025	Arsenic	SW-846 6020	1	111806050002A	07/05/2011 10:09	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111806050002A	07/05/2011 10:09	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111801848006	06/30/2011 08:33	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111806050002	06/30/2011 08:28	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196901B	07/01/2011 16:59	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11180196901B	06/29/2011 10:53	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196901B	06/29/2011 10:53	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196901B	06/29/2011 10:53	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196901B	07/01/2011 16:59	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11182049502B	07/01/2011 07:00	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11183020202B	07/02/2011 10:36	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11181021201A	06/30/2011 09:58	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **N-9_06272011 Grab Water**
Philadelphia Refinery AOI-11
COC: 266186 N-9

LLI Sample # WW 6330644
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 13:05 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11N09

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11181022101A	06/30/2011 15:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: N-9_06272011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266186 N-9

LLI Sample # WW 6330645
LLI Group # 1253797
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/27/2011 13:05 by SS

Submitted: 06/28/2011 15:35
Reported: 07/08/2011 16:24

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	4.17	0.200	0.0141	1
07058	Manganese	7439-96-5	1.81	0.0050	0.00044	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111801848006	07/01/2011 17:26	John P Hook	1
01754	Iron	SW-846 6010B	1	111801848006	07/01/2011 17:26	John P Hook	1
07058	Manganese	SW-846 6010B	1	111801848006	07/01/2011 17:26	John P Hook	1
06025	Arsenic	SW-846 6020	1	111806050002A	07/05/2011 10:12	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111806050002A	07/05/2011 10:12	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111801848006	06/30/2011 08:33	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111806050002	06/30/2011 08:28	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1253797
Reported: 07/08/11 at 04:24 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: P111822AA	Sample number(s): 6330638,6330640,6330642,6330644								
Benzene	< 1	1.	0.5	ug/l	90	87	79-120	4	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	87	85	70-130	3	30
Ethylbenzene	< 1	1.	0.5	ug/l	96	93	79-120	3	30
Isopropylbenzene	< 2	2.	0.5	ug/l	96	93	77-120	3	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	89	86	76-120	3	30
Toluene	< 1	1.	0.5	ug/l	98	96	79-120	2	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	92	90	74-120	2	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	95	92	75-120	2	30
Xylene (Total)	< 1	1.	0.5	ug/l	97	95	80-120	3	30
Batch number: 11180WAC026	Sample number(s): 6330638,6330640,6330642,6330644								
Chrysene	< 5	5.	1	ug/l	97	101	82-112	4	30
Fluorene	< 5	5.	1	ug/l	92	97	82-113	5	30
Naphthalene	< 5	5.	1	ug/l	87	96	77-107	10	30
Phenanthrene	< 5	5.	1	ug/l	95	98	83-112	3	30
Pyrene	< 5	5.	1	ug/l	95	99	80-115	4	30
Batch number: 111800012A	Sample number(s): 6330638,6330640,6330642,6330644								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	104	104	60-140	0	20
Batch number: 111801848006	Sample number(s): 6330638-6330645								
Cobalt	< 0.0050	0.0050	0.00062	mg/l	105		90-110		
Iron	< 0.200	0.200	0.0141	mg/l	101		90-112		
Manganese	< 0.0050	0.0050	0.00044	mg/l	103		90-110		
Batch number: 111806050002A	Sample number(s): 6330638-6330645								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	97		86-111		
Lead	< 0.0010	0.0010	0.00008 0	mg/l	104		90-115		
Batch number: 11180196901B	Sample number(s): 6330638,6330640,6330642,6330644								
Chloride	< 0.40	0.40	0.20	mg/l	100		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	98		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	100		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	100		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	95		90-110		
Batch number: 11182049502B	Sample number(s): 6330638,6330640,6330642,6330644								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	105		91-113		
Batch number: 11181021201A	Sample number(s): 6330638,6330640,6330642,6330644								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	96		80-120		
Batch number: 11181022101A	Sample number(s): 6330638,6330640,6330642,6330644								
Ammonia Nitrogen	< 0.60	0.60	0.20	mg/l	94	95	85-105	1	5

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1253797
Reported: 07/08/11 at 04:24 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 11182023001A	Sample number(s): 6330638,6330640,6330642,6330644								
Sulfide	< 0.16	0.16	0.054	mg/l	96		90-110		
Batch number: 11183020202B	Sample number(s): 6330638,6330640,6330642,6330644								
Alkalinity to pH 4.5	< 2.0	2.0	0.46	mg/l as CaCO3	99		98-103		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111800012A	Sample number(s): 6330638,6330640,6330642,6330644 UNSPK: 6330638								
Ethylene dibromide	100		65-135						
Batch number: 111801848006	Sample number(s): 6330638-6330645 UNSPK: P331151 BKG: P331151								
Cobalt	100	100	87-112	0	20	< 0.0050	< 0.0050	0 (1)	20
Iron	98	99	75-125	1	20	< 0.200	< 0.200	0 (1)	20
Manganese	97	100	75-125	2	20	0.209	0.206	1	20
Batch number: 111806050002A	Sample number(s): 6330638-6330645 UNSPK: P328225 BKG: P328225								
Arsenic	110	105	75-125	5	20	< 0.0020	< 0.0020	0 (1)	20
Lead	97	64*	83-120	26*	20	0.0069	0.0069	1	20
Batch number: 11180196901B	Sample number(s): 6330638,6330640,6330642,6330644 UNSPK: P331395 BKG: P331395								
Chloride	97		90-110			117	119	2	20
Fluoride	89*		90-110			1.2	1.3	7 (1)	20
Nitrate Nitrogen	95		90-110			0.87	0.85	2 (1)	20
Nitrite Nitrogen	88*		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	95		90-110			172	180	5 (1)	20
Batch number: 11182049502B	Sample number(s): 6330638,6330640,6330642,6330644 UNSPK: P328225 BKG: P328225								
Total Organic Carbon	110		63-142			2.5	2.0	22* (1)	3
Batch number: 11181021201A	Sample number(s): 6330638,6330640,6330642,6330644 UNSPK: P330081 BKG: P330081								
Total Dissolved Solids	96	96	62-135	0	12	2,140	2,200	3	9
Batch number: 11181022101A	Sample number(s): 6330638,6330640,6330642,6330644 BKG: P330872								
Ammonia Nitrogen						28.0	27.3	2	6
Batch number: 11182023001A	Sample number(s): 6330638,6330640,6330642,6330644 UNSPK: P331898 BKG: P329490								
Sulfide	106	104	50-130	2	10	0.74	0.77	4 (1)	5
Batch number: 11183020202B	Sample number(s): 6330638,6330640,6330642,6330644 UNSPK: P328542 BKG: P328542								
Alkalinity to pH 4.5	97		73-121			190	195	2	5
Alkalinity to pH 8.3						< 2.0	< 2.0	0 (1)	5

Surrogate Quality Control

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1253797
Reported: 07/08/11 at 04:24 PM

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: P111822AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6330638	96	95	103	99
6330640	96	94	102	98
6330642	96	97	102	102
6330644	96	96	101	98
Blank	96	94	102	98
LCS	96	99	102	99
LCSD	96	96	103	99
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11180WAC026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6330638	93	105	83
6330640	96	103	84
6330642	93	95	84
6330644	168*	173*	141*
Blank	96	102	91
LCS	92	103	89
LCSD	96	105	92
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111800012A

	1,1,2,2-Tetrachloroethane
6330638	120
6330640	100
6330642	94
6330644	89
Blank	97
LCS	96
LCSD	95
MS	115
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1253797 Sample # 6330638-45

COC # 266186

Please print. Instructions on reverse side correspond with circled numbers. 1.2-1.4°c

For Lab Use Only
FSC: _____
SCR#: _____

(1)
Client: SUN- AQUATERRA Acct. #: _____
Project Name/#: PHILA REF AOI-11 PWSID #: _____
Project Manager: T. DOERR P.O.#: _____
Sampler: S. SYKES Quote #: _____
Name of state where samples were collected: PA

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix (4) Soil	Water (Check if ☐ Potable ☐ NPDES Applicable)	Other	Total # of Containers	(5) Analyses Requested / Preservation Codes ☆	Remarks
N-13_06272011	6/27/11	1200	X			X		16	X	☆ See attached list for ☆ analyses ☆
N-19_06272011	6/27/11	1400	X			X		16	X	
N-4_06272011	6/27/11	1105	X			X		16	X	
N-9_06272011	6/27/11	1305	X			X		16	X	

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed: _____
Rush results requested by (please circle): Phone Fax E-mail
Phone #: _____ Fax #: _____
E-mail address: _____

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No _____

SDG Complete? Yes No

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
[signature] FAST	6/27/11	1700	Sample Fridge	6/27/11	1700
[signature]	6/28/11	9:38	[signature]	6/28/11	938
[signature]	6/28/11	1535	[signature]		
			[signature]	6/28/11	1535

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL LANCASTER LABORATORIES BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF LANCASTER LABORATORIES AND (B) WHETHER LANCASTER LABORATORIES HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Lancaster Laboratories which includes any conditions that vary from the Standard Terms and Conditions, and Lancaster hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Lancaster Laboratories

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Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

August 01, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 07/01/2011
Group Number: 1254489
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
B-133D_07012011 Grab Water	6334730
B-133D_07012011 Filtered Grab Water	6334731
B-134D_07012011 Grab Water	6334732
B-134D_07012011 Filtered Grab Water	6334733
B-48D_07012011 Grab Water	6334734
B-48D_07012011 Filtered Grab Water	6334735
C-134D_07012011 Grab Water	6334736
C-134D_07012011 Filtered Grab Water	6334737

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

Lancaster Laboratories

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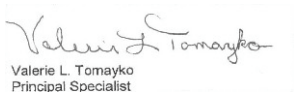
Analysis Report

Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,



Valerie L. Tomayko
Principal Specialist

Lancaster Laboratories

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Analysis Report

Sample Description: B-133D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-133D

LLI Sample # WW 6334730
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:50 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B133D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	33,200	200	14.1	1
07058	Manganese	7439-96-5	210	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	10.9	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		**ug/l**	**ug/l**	**ug/l**	
00224	Chloride	16887-00-6	66,200	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
	The method requirement for Nitrate Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <500 ug/l.					
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
	The method requirement for Nitrite Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <500 ug/l.					
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		**ug/l**	**ug/l**	**ug/l**	

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: B-133D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-133D

LLI Sample # WW 6334730
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:50 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B133D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 5310 C**		**ug/l**	**ug/l**	**ug/l**	
00273	Total Organic Carbon	n.a.	8,700	1,000	500	1
	SM20 2320 B		**ug/l as CaCO3**	**ug/l as CaCO3**	**ug/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	293,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	293,000	2,000	460	1
	SM20 2540 C		**ug/l**	**ug/l**	**ug/l**	
00212	Total Dissolved Solids	n.a.	344,000	30,000	9,700	1
	SM20 4500 S2 D		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	25,200	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111882AA	07/07/2011 15:54	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111882AA	07/07/2011 15:54	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/07/2011 02:48	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111870028A	07/09/2011 06:02	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111870028A	07/07/2011 13:30	Kerrie A Freeburn	1
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 22:53	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 22:53	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 22:53	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:17	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:17	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601B	07/11/2011 20:03	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11183373601B	07/06/2011 11:21	Ashley M Adams	5

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: B-133D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-133D

LLI Sample # WW 6334730
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:50 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B133D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 13:36	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 13:36	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11183373601B	07/06/2011 11:21	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 06:51	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-133D_07012011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-133D

LLI Sample # WW 6334731
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:50 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	14,300	200	14.1	1
07058	Manganese	7439-96-5	199	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	2.7	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 22:57	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 22:57	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 22:57	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:19	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:19	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: B-134D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-134D

LLI Sample # WW 6334732
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:00 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B134D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	35,200	200	14.1	1
07058	Manganese	7439-96-5	247	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	4.3	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		**ug/l**	**ug/l**	**ug/l**	
00224	Chloride	16887-00-6	51,200	4,000	2,000	10
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
	The method requirement for Nitrate Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <500 ug/l.					
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
	The method requirement for Nitrite Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <500 ug/l.					
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		**ug/l**	**ug/l**	**ug/l**	

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-134D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-134D

LLI Sample # WW 6334732
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:00 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B134D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 5310 C**		**ug/l**	**ug/l**	**ug/l**	
00273	Total Organic Carbon	n.a.	9,500	1,000	500	1
	SM20 2320 B		**ug/l as CaCO3**	**ug/l as CaCO3**	**ug/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	308,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	308,000	2,000	460	1
	SM20 2540 C		**ug/l**	**ug/l**	**ug/l**	
00212	Total Dissolved Solids	n.a.	320,000	30,000	9,700	1
	SM20 4500 S2 D		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	28,900	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111882AA	07/07/2011 16:15	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111882AA	07/07/2011 16:15	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/07/2011 03:15	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111870028A	07/09/2011 06:32	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111870028A	07/07/2011 13:30	Kerrie A Freeburn	1
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:00	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:00	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:00	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:21	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:21	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601B	07/11/2011 20:18	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11183373601B	07/06/2011 11:36	Ashley M Adams	5

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-134D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-134D

LLI Sample # WW 6334732
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:00 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B134D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 13:51	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 13:51	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11183373601B	07/06/2011 11:36	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 07:00	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-134D_07012011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-134D

LLI Sample # WW 6334733
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:00 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	15,300	200	14.1	1
07058	Manganese	7439-96-5	235	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:04	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:04	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:04	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:22	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:22	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-48D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-48D

LLI Sample # WW 6334734
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 10:30 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B-48D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	4	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	39,200	200	14.1	1
07058	Manganese	7439-96-5	2,030	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	2.2	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		**ug/l**	**ug/l**	**ug/l**	
00224	Chloride	16887-00-6	74,100	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
	The method requirement for Nitrate Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <500 ug/l.					
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
	The method requirement for Nitrite Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <500 ug/l.					
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		**ug/l**	**ug/l**	**ug/l**	

*=This limit was used in the evaluation of the final result

Sample Description: B-48D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-48D

LLI Sample # WW 6334734
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 10:30 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B-48D

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry		**SM20 5310 C**		**ug/l**	**ug/l**	**ug/l**	
00273	Total Organic Carbon		n.a.	7,100	1,000	500	1
		SM20 2320 B		**ug/l as CaCO3**	**ug/l as CaCO3**	**ug/l as CaCO3**	
00202	Alkalinity to pH 4.5		n.a.	274,000	2,000	460	1
00201	Alkalinity to pH 8.3		n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity		n.a.	274,000	2,000	460	1
		SM20 2540 C		**ug/l**	**ug/l**	**ug/l**	
00212	Total Dissolved Solids		n.a.	313,000	30,000	9,700	1
		SM20 4500 S2 D		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide		18496-25-8	< 160	160	54	1
		SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen		7664-41-7	8,400	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111882AA	07/07/2011 16:37	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111882AA	07/07/2011 16:37	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/07/2011 03:41	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111870028A	07/09/2011 07:02	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111870028A	07/07/2011 13:30	Kerrie A Freeburn	1
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:07	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:07	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:07	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:24	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:24	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601B	07/11/2011 20:34	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11183373601B	07/06/2011 11:51	Ashley M Adams	5

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-48D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-48D

LLI Sample # WW 6334734
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 10:30 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B-48D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 14:05	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 14:05	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11183373601B	07/06/2011 11:51	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 07:07	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11188021201A	07/07/2011 06:22	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-48D_07012011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266182 B-48D

LLI Sample # WW 6334735
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 10:30 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	12,500	200	14.1	1
07058	Manganese	7439-96-5	1,890	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:11	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:11	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:11	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:26	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:26	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: C-134D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 C-134D

LLI Sample # WW 6334736
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 09:15 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C134D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
	The surrogate data in the original extract is outside the QC limits. Results from the reextraction are also outside the QC limits, indicating possible matrix interference.					
Metals	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	649	200	14.1	1
07058	Manganese	7439-96-5	43.0	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	5.8	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		**ug/l**	**ug/l**	**ug/l**	
00224	Chloride	16887-00-6	82,900	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
	The method requirement for Nitrate Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <500 ug/l.					
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
	The method requirement for Nitrite Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <500 ug/l.					
00228	Sulfate	14808-79-8	18,600	5,000	1,500	5

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-134D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 C-134D

LLI Sample # WW 6334736
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 09:15 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C134D

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry		**SM20 5310 C**		**ug/l**	**ug/l**	**ug/l**	
00273	Total Organic Carbon		n.a.	37,000	1,000	500	1
		SM20 2320 B		**ug/l as CaCO3**	**ug/l as CaCO3**	**ug/l as CaCO3**	
00202	Alkalinity to pH 4.5		n.a.	222,000	2,000	460	1
00201	Alkalinity to pH 8.3		n.a.	157,000	2,000	460	1
01454	Bicarbonate Alkalinity		n.a.	< 2,000	2,000	460	1
		SM20 2540 C		**ug/l**	**ug/l**	**ug/l**	
00212	Total Dissolved Solids		n.a.	402,000	30,000	9,700	1
		SM20 4500 S2 D		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide		18496-25-8	1,100	160	54	1
		SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen		7664-41-7	18,600	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111882AA	07/07/2011 16:58	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111882AA	07/07/2011 16:58	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11187WAG026	07/13/2011 22:38	Jennifer R Riggs	1
07807	BNA Water Extraction	SW-846 3510C	1	11187WAG026	07/07/2011 08:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111870028A	07/09/2011 07:32	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111870028A	07/07/2011 13:30	Kerrie A Freeburn	1
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:14	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:14	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:14	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:28	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:28	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601B	07/11/2011 20:49	Ashley M Adams	20

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-134D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 266182 C-134D

LLI Sample # WW 6334736
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 09:15 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C134D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	11183373601B	07/06/2011 12:06	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 14:20	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 14:20	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11183373601B	07/06/2011 12:06	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 07:15	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11188021201A	07/07/2011 06:22	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: C-134D_07012011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266182 C-134D

LLI Sample # WW 6334737
LLI Group # 1254489
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 09:15 by SS

Submitted: 07/01/2011 17:45
Reported: 08/01/2011 16:15

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	< 5.0	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	2.3	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:18	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:18	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:18	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:29	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:29	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254489
Reported: 08/01/11 at 04:15 PM

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F111882AA	Sample number(s): 6334730,6334732,6334734,6334736								
Benzene	< 1	1.	0.5	ug/l	92	89	79-120	4	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	91	90	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	92	90	79-120	3	30
Isopropylbenzene	< 2	2.	0.5	ug/l	93	91	77-120	2	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	83	84	76-120	0	30
Toluene	< 1	1.	0.5	ug/l	93	89	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	89	87	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	91	88	75-120	2	30
Xylene (Total)	< 1	1.	0.5	ug/l	91	90	80-120	2	30
Batch number: 11183WAG026	Sample number(s): 6334730,6334732,6334734								
Chrysene	< 5	5.	1	ug/l	100	100	82-112	0	30
Fluorene	< 5	5.	1	ug/l	96	91	82-113	5	30
Naphthalene	< 5	5.	1	ug/l	95	93	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	95	96	83-112	1	30
Pyrene	< 5	5.	1	ug/l	99	97	80-115	3	30
Batch number: 11187WAG026	Sample number(s): 6334736								
Chrysene	< 5	5.	1	ug/l	94	92	82-112	2	30
Fluorene	< 5	5.	1	ug/l	97	92	82-113	5	30
Naphthalene	< 5	5.	1	ug/l	92	90	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	96	96	83-112	0	30
Pyrene	< 5	5.	1	ug/l	96	94	80-115	2	30
Batch number: 111870028A	Sample number(s): 6334730,6334732,6334734,6334736								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	100	60-140	4	20
Batch number: 111881848003	Sample number(s): 6334730-6334737								
Cobalt	< 5.0	5.0	0.62	ug/l	97		90-110		
Iron	< 200	200.	14.1	ug/l	101		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	100		90-110		
Batch number: 111886050002A	Sample number(s): 6334730-6334737								
Arsenic	< 2.0	2.0	0.95	ug/l	109		86-111		
Lead	< 1.0	1.0	0.080	ug/l	103		90-115		
Batch number: 11183373601B	Sample number(s): 6334730,6334732,6334734,6334736								
Chloride	< 400	400.	200	ug/l	100		90-110		
Fluoride	< 100	100.	80	ug/l	101		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	100		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	95		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	99		90-110		
Batch number: 11189049502B	Sample number(s): 6334730,6334732,6334734,6334736								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	106		91-113		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254489
Reported: 08/01/11 at 04:15 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 11187021202B	Sample number(s): 6334730,6334732								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	99		80-120		
Batch number: 11188021201A	Sample number(s): 6334734,6334736								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	102		80-120		
Batch number: 11188022101A	Sample number(s): 6334730,6334732,6334734,6334736								
Ammonia Nitrogen	< 600	600.	200	ug/l	94	93	85-105	2	5
Batch number: 11188023001A	Sample number(s): 6334730,6334732,6334734,6334736								
Sulfide	< 160	160.	54	ug/l	98		90-110		
Batch number: 11189020201B	Sample number(s): 6334730,6334732,6334734,6334736								
Alkalinity to pH 4.5	< 2,000	2,000.	460	ug/l as CaCO3	99		98-103		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111870028A	Sample number(s): 6334730,6334732,6334734,6334736 UNSPK: P334357								
Ethylene dibromide	74	65	65-135	13	20				
Batch number: 111881848003	Sample number(s): 6334730-6334737 UNSPK: P335984 BKG: P335984								
Cobalt	100	99	87-112	1	20	< 5.0	< 5.0	0 (1)	20
Iron	43 (2)	53 (2)	75-125	1	20	12,300	11,800	4	20
Manganese	94	96	75-125	1	20	420	407	3	20
Batch number: 111886050002A	Sample number(s): 6334730-6334737 UNSPK: P334744 BKG: P334744								
Arsenic	110	102	75-125	2	20	27.0	26.2	3	20
Lead	104	106	83-120	2	20	< 1.0	< 1.0	0 (1)	20
Batch number: 11183373601B	Sample number(s): 6334730,6334732,6334734,6334736 UNSPK: P334718 BKG: P334718								
Chloride	95		90-110			33,400	32,800	2	20
Fluoride	101		90-110			< 500	< 500	0 (1)	20
Nitrate Nitrogen	111*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	103		90-110			< 500	< 500	0 (1)	20
Sulfate	110		90-110			< 5,000	< 5,000	3 (1)	20
Batch number: 11189049502B	Sample number(s): 6334730,6334732,6334734,6334736 UNSPK: P334720 BKG: P334720								
Total Organic Carbon	101		63-142			11,200	11,100	1	3
Batch number: 11187021202B	Sample number(s): 6334730,6334732 UNSPK: P333815 BKG: P334716								
Total Dissolved Solids	92	94	62-135	1	12	594,000	598,000	1	9
Batch number: 11188021201A	Sample number(s): 6334734,6334736 UNSPK: P335551 BKG: P335551								
Total Dissolved Solids	400 (2)		62-135			26,300,000	27,600,000	5	9
Batch number: 11188022101A	Sample number(s): 6334730,6334732,6334734,6334736 BKG: P335876								
Ammonia Nitrogen						13,900	13,300	5	6

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254489
Reported: 08/01/11 at 04:15 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 11188023001A	Sample number(s): 6334730,6334732,6334734,6334736					UNSPK: P334945	BKG: P335895		
Sulfide	87	86	50-130	1	10	1,300	1,300	1	5
Batch number: 11189020201B	Sample number(s): 6334730,6334732,6334734,6334736					UNSPK: P334718	BKG: 6334736		
Alkalinity to pH 4.5	98		73-121			222,000	249,000	11*	5
Alkalinity to pH 8.3						157,000	187,000	17*	5

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111882AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6334730	95	103	103	93
6334732	96	103	101	93
6334734	96	101	101	93
6334736	96	100	102	95
Blank	97	102	100	93
LCS	96	101	101	99
LCSD	96	103	102	97
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11183WAG026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6334730	96	108	92
6334732	94	101	91
6334734	93	103	86
Blank	93	100	92
LCS	95	103	92
LCSD	91	101	90
Limits:	52-120	63-114	34-118

Analysis Name: PAHs by 8270
Batch number: 11187WAG026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6334736	95	100	91
Blank	105	114	103
LCS	88	98	90
LCSD	86	93	87
Limits:	52-120	63-114	34-118

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254489
Reported: 08/01/11 at 04:15 PM

Surrogate Quality Control

Analysis Name: EDB in Wastewater
Batch number: 111870028A

	1,1,2,2-Tetrachloroethane
6334730	66
6334732	83
6334734	84
6334736	36*
Blank	109
LCS	88
LCSD	92
MS	63
MSD	58
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1254489 Sample # 6334730-37

COC # 266182

Please print. Instructions on reverse side correspond with circled numbers. 0.8-3.8°C

(1) Client: SUN-AQUATERRA Acct. #:

Project Name/#: PHILA REF AOI-11 PWSID #:

Project Manager: T. DOERR P.O.#:

Sampler: S. SYKES Quote #:

Name of state where samples were collected: PA

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix (4) Soil	Water	Other	Total # of Containers	(5) Analyses Requested / Preservation Codes	Remarks
B-133D_07012011	7/1/2011	1150	X			X		16	X	*See attached for* *list of analyses*
B-134D_07012011	7/1/2011	1100	X			X		16	X	
B-48D_07012011	7/1/2011	1030	X			X		16	X	
C-134D_07012011	7/1/2011	915	X			X		16	X	

Matrix: Check if Applicable ☐ Potable ☐ NPDES

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

SDG Complete? Yes No

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
[signature] MGT	7/1/11	1400	Sample Fridge	7/1/11	1400
[signature]	7/1/11	1610	[signature]	7/1/11	1625
[signature]	7/1/11	1745			
			[signature]	7/1/11	1745

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 19, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 07/06/2011
Group Number: 1254858
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
BF-108_07052011 Grab Water	6336541
BF-108_07052011 Filtered Grab Water	6336542
BF-90D_07052011 Grab Water	6336543
BF-90D_07052011 Filtered Grab Water	6336544
C-144D_07052011 Grab Water	6336545
C-144D_07052011 Filtered Grab Water	6336546
C-50D_07052011 Grab Water	6336547
C-50D_07052011 Filtered Grab Water	6336548

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

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Analysis Report

Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,

Chad A. Moline
Group Leader

Lancaster Laboratories

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Analysis Report

Sample Description: BF-108_07052011 Grab Water
Philadelphia Refinery AOI-11
COC: 266183 BF-108

LLI Sample # WW 6336541
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 14:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

BF108

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0948	0.0050	0.00062	1
01754	Iron	7439-89-6	294	1.00	0.0705	5
07058	Manganese	7439-96-5	2.84	0.0050	0.00044	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0856	0.0020	0.00095	1
06035	Lead	7439-92-1	1.11	0.0050	0.00040	5
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	10.2	2.0	1.0	5
01504	Fluoride	16984-48-8	0.58	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	23.1	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	12.3	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	342	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	342	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	408	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: BF-108_07052011 Grab Water
Philadelphia Refinery AOI-11
COC: 266183 BF-108

LLI Sample # WW 6336541
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 14:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

BF108

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111921AA	07/11/2011 05:50	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111921AA	07/11/2011 05:50	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11188WAB026	07/13/2011 20:35	Jennifer R Riggs	1
07807	BNA Water Extraction	SW-846 3510C	1	11188WAB026	07/07/2011 19:30	Nicholas W Shroyer	1
07879	EDB in Wastewater	SW-846 8011	1	111880020A	07/12/2011 12:37	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111880020A	07/08/2011 16:15	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111881848008	07/12/2011 00:10	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111881848008	07/13/2011 00:48	John W Yanzuk II	5
07058	Manganese	SW-846 6010B	1	111881848008	07/12/2011 00:10	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111886050005A	07/13/2011 10:14	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050005A	07/13/2011 10:38	Choon Y Tian	5
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848008	07/08/2011 10:35	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050005	07/08/2011 10:25	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11188196901A	07/07/2011 10:58	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11188196901A	07/07/2011 10:58	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11188196901A	07/07/2011 10:58	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11188196901A	07/07/2011 10:58	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11188196901A	07/07/2011 10:58	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11192049502B	07/11/2011 04:59	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11189021201A	07/08/2011 09:19	Michelle L Lalli	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11194022101A	07/13/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: BF-108_07052011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266183 BF-108

LLI Sample # WW 6336542
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 14:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0141	1
07058	Manganese	7439-96-5	0.262	0.0050	0.00044	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848008	07/12/2011 00:13	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111881848008	07/12/2011 00:13	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111881848008	07/12/2011 00:13	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111886050005A	07/13/2011 10:17	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050005A	07/13/2011 10:17	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848008	07/08/2011 10:35	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050005	07/08/2011 10:25	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: BF-90D_07052011 Grab Water
Philadelphia Refinery AOI-11
COC: 266183 BF-90D

LLI Sample # WW 6336543
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 13:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

BF90D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0326	0.0050	0.00062	1
01754	Iron	7439-89-6	92.9	0.200	0.0141	1
07058	Manganese	7439-96-5	1.09	0.0050	0.00044	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0331	0.0020	0.00095	1
06035	Lead	7439-92-1	0.356	0.0010	0.000080	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	11.8	2.0	1.0	5
01504	Fluoride	16984-48-8	0.62	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	33.2	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	12.7	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	472	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	472	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	388	30.0	9.7	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: BF-90D_07052011 Grab Water
Philadelphia Refinery AOI-11
COC: 266183 BF-90D

LLI Sample # WW 6336543
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 13:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

BF90D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500NH3 B/C modified**		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111921AA	07/11/2011 06:12	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111921AA	07/11/2011 06:12	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11188WAB026	07/14/2011 10:28	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11188WAB026	07/07/2011 19:30	Nicholas W Shroyer	1
07879	EDB in Wastewater	SW-846 8011	1	111880020A	07/12/2011 13:38	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111880020A	07/08/2011 16:15	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111881848008	07/12/2011 00:24	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111881848008	07/12/2011 00:24	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111881848008	07/12/2011 00:24	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111886050005A	07/13/2011 10:24	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050005A	07/13/2011 10:24	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848008	07/08/2011 10:35	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050005	07/08/2011 10:25	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11188196901A	07/07/2011 11:13	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11188196901A	07/07/2011 11:13	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11188196901A	07/07/2011 11:13	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11188196901A	07/07/2011 11:13	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11188196901A	07/07/2011 11:13	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11192049502B	07/11/2011 05:07	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11189021201A	07/08/2011 09:19	Michelle L Lalli	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11194022101A	07/13/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: BF-90D_07052011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266183 BF-90D

LLI Sample # WW 6336544
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 13:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0141	1
07058	Manganese	7439-96-5	0.351	0.0050	0.00044	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0021	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848008	07/12/2011 00:28	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111881848008	07/12/2011 00:28	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111881848008	07/12/2011 00:28	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111886050005A	07/13/2011 10:26	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050005A	07/13/2011 10:26	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848008	07/08/2011 10:35	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050005	07/08/2011 10:25	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-144D_07052011 Grab Water
Philadelphia Refinery AOI-11
COC: 266183 C-144D

LLI Sample # WW 6336545
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 11:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C144D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	74.9	0.200	0.0141	1
07058	Manganese	7439-96-5	1.54	0.0050	0.00044	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0025	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	36.3	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	11.0	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	412	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	412	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	461	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-144D_07052011 Grab Water
Philadelphia Refinery AOI-11
COC: 266183 C-144D

LLI Sample # WW 6336545
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 11:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C144D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	22.3	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111921AA	07/11/2011 06:33	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111921AA	07/11/2011 06:33	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11188WAB026	07/13/2011 21:49	Jennifer R Riggs	1
07807	BNA Water Extraction	SW-846 3510C	1	11188WAB026	07/07/2011 19:30	Nicholas W Shroyer	1
07879	EDB in Wastewater	SW-846 8011	1	111880020A	07/12/2011 14:39	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111880020A	07/08/2011 16:15	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111881848008	07/12/2011 00:32	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111881848008	07/12/2011 00:32	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111881848008	07/12/2011 00:32	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111886050005A	07/13/2011 10:29	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050005A	07/13/2011 10:29	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848008	07/08/2011 10:35	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050005	07/08/2011 10:25	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11188196901A	07/11/2011 15:22	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11188196901A	07/07/2011 10:29	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11188196901A	07/07/2011 10:29	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11188196901A	07/07/2011 10:29	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11188196901A	07/07/2011 10:29	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11192049502B	07/11/2011 05:29	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11189021201A	07/08/2011 09:19	Michelle L Lalli	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11194022101A	07/13/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-144D_07052011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266183 C-144D

LLI Sample # WW 6336546
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 11:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	55.7	0.200	0.0141	1
07058	Manganese	7439-96-5	1.49	0.0050	0.00044	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848008	07/12/2011 00:35	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111881848008	07/12/2011 00:35	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111881848008	07/12/2011 00:35	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111886050005A	07/13/2011 10:31	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050005A	07/13/2011 10:31	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848008	07/08/2011 10:35	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050005	07/08/2011 10:25	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-50D_07052011 Grab Water
Philadelphia Refinery AOI-11
COC: 266183 C-50D

LLI Sample # WW 6336547
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 12:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C-50D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	56.0	0.200	0.0141	1
07058	Manganese	7439-96-5	3.14	0.0050	0.00044	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0450	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	212	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	17.5	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	379	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	379	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	693	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-50D_07052011 Grab Water
Philadelphia Refinery AOI-11
COC: 266183 C-50D

LLI Sample # WW 6336547
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 12:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C-50D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	12.4	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111921AA	07/11/2011 07:21	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111921AA	07/11/2011 07:21	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11188WAB026	07/13/2011 22:14	Jennifer R Riggs	1
07807	BNA Water Extraction	SW-846 3510C	1	11188WAB026	07/07/2011 19:30	Nicholas W Shroyer	1
07879	EDB in Wastewater	SW-846 8011	1	111880020A	07/12/2011 15:09	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111880020A	07/08/2011 16:15	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111881848008	07/12/2011 00:39	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111881848008	07/12/2011 00:39	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111881848008	07/12/2011 00:39	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111886050005A	07/13/2011 10:33	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050005A	07/13/2011 10:33	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848008	07/08/2011 10:35	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050005	07/08/2011 10:25	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11188196901A	07/11/2011 15:37	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11188196901A	07/07/2011 10:43	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11188196901A	07/07/2011 10:43	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11188196901A	07/07/2011 10:43	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11188196901A	07/07/2011 10:43	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11192049502B	07/11/2011 05:50	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11192020201B	07/11/2011 06:57	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11189021201A	07/08/2011 09:19	Michelle L Lalli	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11194022101A	07/13/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-50D_07052011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266183 C-50D

LLI Sample # WW 6336548
LLI Group # 1254858
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/05/2011 12:00 by SS

Submitted: 07/06/2011 15:55
Reported: 07/19/2011 12:35

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.00062	1
01754	Iron	7439-89-6	25.5	0.200	0.0141	1
07058	Manganese	7439-96-5	2.97	0.0050	0.00044	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0054	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848008	07/12/2011 00:43	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111881848008	07/12/2011 00:43	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111881848008	07/12/2011 00:43	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111886050005A	07/13/2011 10:36	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050005A	07/13/2011 10:36	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848008	07/08/2011 10:35	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050005	07/08/2011 10:25	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254858
Reported: 07/19/11 at 12:35 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F111921AA	Sample number(s): 6336541,6336543,6336545,6336547								
Benzene	< 1	1.	0.5	ug/l	92	90	79-120	2	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	93	93	70-130	0	30
Ethylbenzene	< 1	1.	0.5	ug/l	93	90	79-120	3	30
Isopropylbenzene	< 2	2.	0.5	ug/l	93	91	77-120	2	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	81	79	76-120	2	30
Toluene	< 1	1.	0.5	ug/l	92	90	79-120	2	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	89	87	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	90	88	75-120	2	30
Xylene (Total)	< 1	1.	0.5	ug/l	91	90	80-120	2	30
Batch number: 11188WAB026	Sample number(s): 6336541,6336543,6336545,6336547								
Chrysene	< 5	5.	1	ug/l	91	92	82-112	2	30
Fluorene	< 5	5.	1	ug/l	96	95	82-113	1	30
Naphthalene	< 5	5.	1	ug/l	92	91	77-107	1	30
Phenanthrene	< 5	5.	1	ug/l	96	95	83-112	1	30
Pyrene	< 5	5.	1	ug/l	94	97	80-115	3	30
Batch number: 111880020A	Sample number(s): 6336541,6336543,6336545,6336547								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	104	108	60-140	4	20
Batch number: 111881848008	Sample number(s): 6336541-6336548								
Cobalt	< 0.0050	0.0050	0.00062	mg/l	101		90-110		
Iron	< 0.200	0.200	0.0141	mg/l	108		90-112		
Manganese	< 0.0050	0.0050	0.00044	mg/l	104		90-110		
Batch number: 111886050005A	Sample number(s): 6336541-6336548								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	98		86-111		
Lead	< 0.0010	0.0010	0.00008 0	mg/l	105		90-115		
Batch number: 11188196901A	Sample number(s): 6336541,6336543,6336545,6336547								
Chloride	< 0.40	0.40	0.20	mg/l	100		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	100		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	102		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	99		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	99		90-110		
Batch number: 11192049502B	Sample number(s): 6336541,6336543,6336545,6336547								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	98		91-113		
Batch number: 11188023001A	Sample number(s): 6336541,6336545,6336547								
Sulfide	< 0.16	0.16	0.054	mg/l	98		90-110		
Batch number: 11189021201A	Sample number(s): 6336541,6336543,6336545,6336547								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	101		80-120		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254858
Reported: 07/19/11 at 12:35 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 11192020201B	Sample number(s): 6336541,6336543,6336545,6336547								
Alkalinity to pH 4.5	< 2.0	2.0	0.46	mg/l as CaCO3	99		98-103		
Batch number: 11194022101A	Sample number(s): 6336541,6336543,6336545,6336547								
Ammonia Nitrogen	< 0.60	0.60	0.20	mg/l	93	94	85-105	1	5

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111880020A	Sample number(s): 6336541,6336543,6336545,6336547 UNSPK: 6336541								
Ethylene dibromide	96		65-135						
Batch number: 111881848008	Sample number(s): 6336541-6336548 UNSPK: P337169 BKG: P337169								
Cobalt	98	99	87-112	1	20	< 0.0050	< 0.0050	15 (1)	20
Iron	103	97	75-125	5	20	0.305	0.409	29* (1)	20
Manganese	103	97	75-125	2	20	0.830	0.822	1	20
Batch number: 111886050005A	Sample number(s): 6336541-6336548 UNSPK: P335490 BKG: P335490								
Arsenic	105	107	75-125	1	20	< 0.0020	< 0.0020	6 (1)	20
Lead	104	105	83-120	1	20	0.0031	0.0030	3 (1)	20
Batch number: 11188196901A	Sample number(s): 6336541,6336543,6336545,6336547 UNSPK: P336672 BKG: P336672								
Chloride	103		90-110			7,370	7,370	0	20
Fluoride	88*		90-110			< 0.50	< 0.50	0 (1)	20
Nitrate Nitrogen	100		90-110			< 0.50	< 0.50	0 (1)	20
Nitrite Nitrogen	66*		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	102		90-110			19.2	18.2	6 (1)	20
Batch number: 11192049502B	Sample number(s): 6336541,6336543,6336545,6336547 UNSPK: 6336545 BKG: 6336545								
Total Organic Carbon	101		63-142			11.0	10.9	1	3
Batch number: 11188023001A	Sample number(s): 6336541,6336545,6336547 UNSPK: P334945 BKG: P335895								
Sulfide	87	86	50-130	1	10	1.3	1.3	1	5
Batch number: 11189021201A	Sample number(s): 6336541,6336543,6336545,6336547 UNSPK: P336696 BKG: P336696								
Total Dissolved Solids	96		62-135			1,860	1,830	2	9
Batch number: 11192020201B	Sample number(s): 6336541,6336543,6336545,6336547 UNSPK: P335817 BKG: 6336547								
Alkalinity to pH 4.5	84		73-121			379	385	2	5
Alkalinity to pH 8.3						< 2.0	< 2.0	0 (1)	5
Batch number: 11194022101A	Sample number(s): 6336541,6336543,6336545,6336547 BKG: P337406								
Ammonia Nitrogen						42.8	43.5	1	6

Surrogate Quality Control

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254858
Reported: 07/19/11 at 12:35 PM

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed
unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111921AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6336541	98	102	101	93
6336543	99	100	101	93
6336545	99	102	101	94
6336547	96	99	101	96
Blank	100	102	102	94
LCS	98	101	102	99
LCSD	98	102	102	98
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11188WAB026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6336541	87	99	75
6336543	82	87	61
6336545	93	101	88
6336547	91	103	88
Blank	88	99	88
LCS	88	98	87
LCSD	88	96	90
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111880020A

	1,1,2,2-Tetrachloroethane
6336541	89
6336543	90
6336545	92
6336547	94
Blank	98
LCS	96
LCSD	100
MS	87
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1254858 Sample # 6336541-48

COC # 266183

Please print. Instructions on reverse side correspond with circled numbers. 0.9-2.0°C

For Lab Use Only
FSC: _____
SCR#: _____

(1) Client: SUN - AQUATERRA Acct. #: _____
Project Name/#: PHILA REF AOI-1 PWSID #: _____
Project Manager: T. DOERR P.O.#: _____
Sampler: S. SYKES Quote #: _____
Name of state where samples were collected: PA

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix: Soil	Water (Check if Potable / NPDES)	Other	(4) Total # of Containers	(5) Analyses Requested / Preservation Codes	Remarks
BF-108_07052011	7/5/11	1400	X			X		6	X	☆ See attached for ☆ list of ☆ analyses ☆
BF-90D_07052011	7/5/11	1300	X			X		16	X	
✓ C-144D_07052011	7/5/11	1100	X			X		16	X	
C-50D_07052011	7/5/11	1200	X			X	~~16~~ 14		X	

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed: _____
Rush results requested by (please circle): Phone Fax E-mail
Phone #: _____ Fax #: _____
E-mail address: _____

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
SDG Complete? Yes No
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No _____

Relinquished by:	Date	Time	Received by:	Date	Time
[signature] AGT	7/5/11	1600	Sample Fridge	7/5/11	1600
[signature]	7/6/11	0945	[signature]	7/6/11	0945
[signature]	7/6/11	1555			
			[signature]	7/6/11	1555

(9)

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Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

10132|1254858|6336541-48

Table 1
Constituents of Concern for Groundwater
AOI 11 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.	8260B
1,2-Dichloroethane	107-06-2	
1,2,4-Trimethylbenzene	95-63-6	
1,3,5-Trimethylbenzene	108-67-8	
Benzene	71-43-2	
Cumene	98-82-8	
Ethylbenzene	100-41-4	
Ethylene Dibromide	106-93-4	(8011)
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4	
Toluene	108-88-3	
Xylenes (total)	1330-20-7	

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.	8270C
Chrysene	218-01-9	
Fluorene	86-73-7	
Naphthalene	91-20-3	
Phenanthrene	85-01-8	
Pyrene	129-00-0	

Metals	CAS No.	Method	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500) in ug/L
Arsenic (Total & Dissolved)	7440-38-2	6020	10
Cobalt (Total & Dissolved)	7440-48-4	6010B	31
Iron (Total & Dissolved)	7439-89-6	6010B	300
Lead (Total & Dissolved)	7439-92-1	6020	5
Manganese (Total & Dissolved)	7439-96-5	6010B for filtering	300

Misc Parameters	CAS No.		
Ammonia	7664-41-7	SM20 4500	30,000
			USEPA Drinking Water MCLs in mg/L
Chloride	16887-00-6	300.0	250
Fluoride	7782-41-4	300.0	4
Nitrate **48hr hold time**	84145-82-4	300.0	10
Nitrite included in nitrate cost	1594-56-5	300.0	1
Sulfate	18785-72-3	300.0	250
Sulfide	-	SM20 4500	Reported Result
Total Alkalinity	-	SM20 2320	Reported Result
Bicarbonate	71-52-3	SM20 2320	Reported Result
Total Organic Carbon	7440-44-0	SM20 5310	Reported Result
Total Dissolved Solids	CASID10052	SM20 2540	500

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

REVISED

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 29, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 06/29/2011
Group Number: 1254047
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-264_06282011 Grab Water	6331894
S-264_06282011 Filtered Grab Water	6331895
S-46D_06282011 Grab Water	6331896
S-46D_06282011 Filtered Grab Water	6331897
S-80D_06282011 Grab Water	6331898
S-80D_06282011 Filtered Grab Water	6331899
S-119D_06282011 Grab Water	6331900
S-119D_06282011 Filtered Grab Water	6331901
N-38D_06282011 Grab Water	6331902
N-38D_06282011 Filtered Grab Water	6331903
N-44D_06282011 Grab Water	6331904
N-44D_06282011 Filtered Grab Water	6331905

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

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Analysis Report

REVISED

Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,

Max E. Snavely
Senior Specialist

Lancaster Laboratories

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Analysis Report

REVISED

Sample Description: S-264_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-264

LLI Sample # WW 6331894
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:00 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-264

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	2	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	6	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	35.5	5.0	0.62	1
01754	Iron	7439-89-6	14,000	200	14.1	1
07058	Manganese	7439-96-5	8,570	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	2.7	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	91,100	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	130,000	20,000	6,000	20
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	13,800	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	316,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	316,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	695,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-264_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-264

LLI Sample # WW 6331894
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:00 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-264

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	2,000	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	Z111862AA	07/05/2011 15:26	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z111862AA	07/05/2011 15:26	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 13:39	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 10:06	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848001	07/06/2011 19:37	John P Hook	1
01754	Iron	SW-846 6010B	1	111821848001	07/06/2011 19:37	John P Hook	1
07058	Manganese	SW-846 6010B	1	111821848001	07/06/2011 19:37	John P Hook	1
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 20:28	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 20:28	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848001	07/04/2011 20:30	Annamaria Stipkovits	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196902B	07/07/2011 00:47	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11180196902B	06/30/2011 07:27	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196902B	06/30/2011 07:27	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196902B	06/30/2011 07:27	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196902B	07/09/2011 13:02	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11186049503A	07/05/2011 05:13	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-264_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-264

LLI Sample # WW 6331895
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:00 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	35.7	5.0	0.62	1
01754	Iron	7439-89-6	9,920	200	14.1	1
07058	Manganese	7439-96-5	8,580	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848001	07/06/2011 19:41	John P Hook	1
01754	Iron	SW-846 6010B	1	111821848001	07/06/2011 19:41	John P Hook	1
07058	Manganese	SW-846 6010B	1	111821848001	07/06/2011 19:41	John P Hook	1
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 20:31	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 20:31	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848001	07/04/2011 20:30	Annamaria Stipkovits	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-46D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-46D

LLI Sample # WW 6331896
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 12:30 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-46D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	17.8	5.0	0.62	1
01754	Iron	7439-89-6	10,400	200	14.1	1
07058	Manganese	7439-96-5	21,200	25.0	2.2	5
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	20.7	2.0	0.95	1
06035	Lead	7439-92-1	2.1	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	80,500	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	166,000	20,000	6,000	20
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	12,000	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	302,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	302,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	676,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-46D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-46D

LLI Sample # WW 6331896
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 12:30 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-46D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	4,300	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 10:14	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 10:14	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 14:04	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 10:36	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848001	07/06/2011 19:44	John P Hook	1
01754	Iron	SW-846 6010B	1	111821848001	07/06/2011 19:44	John P Hook	1
07058	Manganese	SW-846 6010B	1	111821848001	07/07/2011 06:15	Tara L Snyder	5
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 20:40	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 20:40	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848001	07/04/2011 20:30	Annamaria Stipkovits	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196902B	07/07/2011 01:02	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11180196902B	06/30/2011 07:42	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196902B	06/30/2011 07:42	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196902B	06/30/2011 07:42	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196902B	07/09/2011 13:17	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11186049503A	07/05/2011 05:21	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-46D_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-46D

LLI Sample # WW 6331897
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 12:30 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	18.2	5.0	0.62	1
01754	Iron	7439-89-6	7,400	200	14.1	1
07058	Manganese	7439-96-5	20,500	25.0	2.2	5
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	11.1	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848001	07/06/2011 19:48	John P Hook	1
01754	Iron	SW-846 6010B	1	111821848001	07/06/2011 19:48	John P Hook	1
07058	Manganese	SW-846 6010B	1	111821848001	07/07/2011 06:19	Tara L Snyder	5
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 20:43	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 20:43	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848001	07/04/2011 20:30	Annamaria Stipkovits	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-80D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-80D

LLI Sample # WW 6331898
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 11:45 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-80D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	43,700	200	14.1	1
07058	Manganese	7439-96-5	12,000	25.0	2.2	5
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	73,600	20,000	10,000	50
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	462,000	50,000	15,000	50
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	6,400	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	141,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	141,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	969,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-80D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-80D

LLI Sample # WW 6331898
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 11:45 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-80D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	< 600	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 10:37	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 10:37	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 14:29	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 11:07	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 20:41	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 20:41	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/08/2011 01:06	John W Yanzuk II	5
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 20:46	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 20:46	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196903A	07/06/2011 19:59	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 01:22	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 01:22	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 01:22	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	07/06/2011 19:59	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 05:44	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-80D_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-80D

LLI Sample # WW 6331899
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 11:45 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	42,900	200	14.1	1
07058	Manganese	7439-96-5	11,900	25.0	2.2	5
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 20:45	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 20:45	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/08/2011 01:09	John W Yanzuk II	5
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 20:49	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 20:49	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-119D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-119D

LLI Sample # WW 6331900
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:30 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S119D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
A preserved vial was submitted for analysis. However, the pH at the time of analysis was 5.						
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	7.5	5.0	0.62	1
01754	Iron	7439-89-6	31,300	200	14.1	1
07058	Manganese	7439-96-5	286	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	5.0	2.0	0.95	1
06035	Lead	7439-92-1	1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		**ug/l**	**ug/l**	**ug/l**	
00224	Chloride	16887-00-6	136,000	40,000	20,000	100
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	85,300	10,000	3,000	10
	SM20 5310 C		**ug/l**	**ug/l**	**ug/l**	
00273	Total Organic Carbon	n.a.	2,300	1,000	500	1
	SM20 2320 B		**ug/l as CaCO3**	**ug/l as CaCO3**	**ug/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	62,700	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	62,700	2,000	460	1
	SM20 2540 C		**ug/l**	**ug/l**	**ug/l**	

*=This limit was used in the evaluation of the final result

Sample Description: S-119D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-119D

LLI Sample # WW 6331900
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:30 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S119D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**ug/l**	**ug/l**	**ug/l**	
00212	Total Dissolved Solids	n.a.	487,000	30,000	9,700	1
	SM20 4500 S2 D		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	< 600	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 11:00	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 11:00	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 14:54	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 11:37	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 20:56	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 20:56	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 20:56	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 20:52	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 20:52	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1
00224	Chloride	EPA 300.0	2	11180196903A	07/14/2011 09:32	Ashley M Adams	100
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 01:37	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 01:37	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 01:37	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	07/09/2011 10:35	Ashley M Adams	10
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 05:51	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: **S-119D_06282011 Grab Water**
Philadelphia Refinery AOI-11
COC: 266178 S-119D

LLI Sample # WW 6331900
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:30 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S119D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-119D_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266178 S-119D

LLI Sample # WW 6331901
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:30 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	6.6	5.0	0.62	1
01754	Iron	7439-89-6	29,300	200	14.1	1
07058	Manganese	7439-96-5	277	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	4.6	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:00	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:00	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:00	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 20:55	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 20:55	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-38D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 N-38D

LLI Sample # WW 6331902
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 09:55 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-38D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0098	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	28,200	200	14.1	1
07058	Manganese	7439-96-5	445	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	12.5	2.0	0.95	1
06035	Lead	7439-92-1	5.4	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	15,600	2,000	1,000	5
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	920	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	7,100	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	40,900	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	1,080,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	1,080,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	860,000	120,000	38,800	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-38D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 N-38D

LLI Sample # WW 6331902
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 09:55 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-38D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	88,200	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 11:23	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 11:23	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 15:18	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 12:09	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:03	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:03	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:03	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 20:58	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 20:58	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196903A	06/30/2011 01:53	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 01:53	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 01:53	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 01:53	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	06/30/2011 01:53	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 06:14	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-38D_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266178 N-38D

LLI Sample # WW 6331903
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 09:55 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	340	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:07	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:07	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:07	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 21:01	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 21:01	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-44D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 N-44D

LLI Sample # WW 6331904
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 08:40 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-44D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	7	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	1	1	0.5	1
10943	Isopropylbenzene	98-82-8	9	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	3	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	36,600	200	14.1	1
07058	Manganese	7439-96-5	598	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	132	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	30,000	4,000	2,000	10
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	17,200	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	53,500	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	160,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	160,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	342,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-44D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266178 N-44D

LLI Sample # WW 6331904
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 08:40 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-44D

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry		**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide		18496-25-8	1,600	160	54	1
		SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen		7664-41-7	1,100	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 11:46	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 11:46	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 15:43	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 12:39	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:11	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:11	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:11	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 21:04	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 21:04	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196903A	07/06/2011 22:05	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 02:08	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 02:08	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 02:08	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	06/30/2011 02:08	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 06:21	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11182023001A	07/01/2011 08:30	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-44D_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266178 N-44D

LLI Sample # WW 6331905
LLI Group # 1254047
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 08:40 by MH

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:55

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	31,100	200	14.1	1
07058	Manganese	7439-96-5	605	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	62.2	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:14	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:14	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:14	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111826050002A	07/10/2011 21:07	David K Beck	1
06035	Lead	SW-846 6020	1	111826050002A	07/10/2011 21:07	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111826050002	07/05/2011 10:03	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254047
Reported: 07/29/11 at 01:55 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: D111892AA	Sample number(s): 6331896,6331898,6331900,6331902,6331904								
Benzene	< 1	1.	0.5	ug/l	98		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	96		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	95		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	93		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	89		76-120		
Toluene	< 1	1.	0.5	ug/l	99		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	89		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	87		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	95		80-120		
Batch number: Z111862AA	Sample number(s): 6331894								
Benzene	< 1	1.	0.5	ug/l	105	109	79-120	4	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	128	127	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	109	110	79-120	1	30
Isopropylbenzene	< 2	2.	0.5	ug/l	106	109	77-120	3	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	111	110	76-120	1	30
Toluene	< 1	1.	0.5	ug/l	108	112	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	97	100	74-120	4	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	96	100	75-120	4	30
Xylene (Total)	< 1	1.	0.5	ug/l	108	112	80-120	4	30
Batch number: 11181WAB026	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904								
Chrysene	< 5	5.	1	ug/l	99	98	82-112	1	30
Fluorene	< 5	5.	1	ug/l	104	101	82-113	3	30
Naphthalene	< 5	5.	1	ug/l	88	91	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	104	100	83-112	4	30
Pyrene	< 5	5.	1	ug/l	91	91	80-115	0	30
Batch number: 111810006A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	100	60-140	0	20
Batch number: 111821848001	Sample number(s): 6331894-6331897								
Cobalt	< 5.0	5.0	0.62	ug/l	105		90-110		
Iron	< 200	200.	14.1	ug/l	109		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	106		90-110		
Batch number: 111821848002	Sample number(s): 6331898-6331905								
Cobalt	< 5.0	5.0	0.62	ug/l	103		90-110		
Iron	< 200	200.	14.1	ug/l	107		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	102		90-110		
Batch number: 111826050002A	Sample number(s): 6331894-6331905								
Arsenic	< 2.0	2.0	0.95	ug/l	96		86-111		
Lead	< 1.0	1.0	0.080	ug/l	101		90-115		
Batch number: 11180196902B	Sample number(s): 6331894,6331896								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254047
Reported: 07/29/11 at 01:55 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Chloride	< 400	400.	200	ug/l	96		90-110		
Fluoride	< 100	100.	80	ug/l	97		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	95		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	96		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	90		90-110		
Batch number: 11180196903A	Sample number(s): 6331898,6331900,6331902,6331904								
Chloride	< 400	400.	200	ug/l	100		90-110		
Fluoride	< 100	100.	80	ug/l	99		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	97		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	96		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	93		90-110		
Batch number: 11186049503A	Sample number(s): 6331894,6331896								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	105		91-113		
Batch number: 11186049503B	Sample number(s): 6331898,6331900,6331902,6331904								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	105		91-113		
Batch number: 11182021202A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	97		80-120		
Batch number: 11182022101A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904								
Ammonia Nitrogen	< 600	600.	200	ug/l	96	94	85-105	2	5
Batch number: 11182023001A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904								
Sulfide	< 160	160.	54	ug/l	96		90-110		
Batch number: 11186020202A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904								
Alkalinity to pH 4.5	< 2,000	2,000.	460	ug/l as CaCO3	99		98-103		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: D111892AA	Sample number(s): 6331896,6331898,6331900,6331902,6331904 UNSPK: P333501								
Benzene	108	105	80-126	3	30				
1,2-Dichloroethane	103	101	66-141	3	30				
Ethylbenzene	102	101	71-134	1	30				
Isopropylbenzene	100	94	75-128	6	30				
Methyl Tertiary Butyl Ether	91	91	72-126	0	30				
Toluene	108	105	80-125	3	30				
1,2,4-Trimethylbenzene	92	88	72-130	5	30				
1,3,5-Trimethylbenzene	92	87	72-131	6	30				
Xylene (Total)	102	100	79-125	2	30				
Batch number: 111810006A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904 UNSPK: P331854								
Ethylene dibromide	91		65-135						
Batch number: 111821848001	Sample number(s): 6331894-6331897 UNSPK: P332207 BKG: P332207								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254047
Reported: 07/29/11 at 01:55 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Cobalt	99	99	87-112	0	20	< 5.0	< 5.0	12 (1)	20
Iron	107	113	75-125	1	20	3,170	3,180	0	20
Manganese	99	97	75-125	1	20	218	214	2	20
Batch number: 111821848002	Sample number(s): 6331898-6331905 UNSPK: P331914 BKG: P331914								
Cobalt	101	101	87-112	1	20	9.5	10.5	10 (1)	20
Iron	100	105	75-125	2	20	1,650	1,690	2	20
Manganese	112 (2)	100 (2)	75-125	1	20	5,850	5,910	1	20
Batch number: 111826050002A	Sample number(s): 6331894-6331905 UNSPK: P332394 BKG: P332394								
Arsenic	120	109	75-125	9	20	< 10.0	< 10.0	0 (1)	20
Lead	101	103	83-120	2	20	< 5.0	< 5.0	7 (1)	20
Batch number: 11180196902B	Sample number(s): 6331894,6331896 UNSPK: P331401 BKG: P331401								
Chloride	91		90-110			112,000	112,000	0	20
Fluoride	70*		90-110			1,300	1,100	13 (1)	20
Nitrate Nitrogen	79*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	70*		90-110			< 500	< 500	0 (1)	20
Sulfate	92		90-110			201,000	202,000	1 (1)	20
Batch number: 11180196903A	Sample number(s): 6331898,6331900,6331902,6331904 UNSPK: 6331898 BKG: 6331898								
Chloride	102		90-110			73,600	69,200	6 (1)	20
Fluoride	76*		90-110			< 500	< 500	0 (1)	20
Nitrate Nitrogen	85*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	79*		90-110			< 500	< 500	0 (1)	20
Sulfate	122*		90-110			462,000	415,000	11	20
Batch number: 11186049503A	Sample number(s): 6331894,6331896 UNSPK: 6331896 BKG: 6331896								
Total Organic Carbon	106		63-142			12,000	11,800	2	3
Batch number: 11186049503B	Sample number(s): 6331898,6331900,6331902,6331904 UNSPK: P331912 BKG: P331912								
Total Organic Carbon	107		63-142			5,900	5,900	1	3
Batch number: 11182021202A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904 UNSPK: 6331902 BKG: 6331902								
Total Dissolved Solids	100		62-135			860,000	870,000	1	9
Batch number: 11182022101A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904 BKG: P332926								
Ammonia Nitrogen						35,500	35,900	1	6
Batch number: 11182023001A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904 UNSPK: 6331898 BKG: P329490								
Sulfide	106	104	50-130	2	10	740	770	4 (1)	5
Batch number: 11186020202A	Sample number(s): 6331894,6331896,6331898,6331900,6331902,6331904 UNSPK: 6331900 BKG: 6331900								
Alkalinity to pH 4.5	76		73-121			62,700	62,800	0	5
Alkalinity to pH 8.3						< 2,000	< 2,000	0 (1)	5

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254047
Reported: 07/29/11 at 01:55 PM

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: D111892AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6331896	101	100	99	95
6331898	103	102	98	92
6331900	102	101	99	93
6331902	102	100	99	92
6331904	95	93	97	103
Blank	100	99	99	90
LCS	95	95	97	101
MS	98	99	99	100
MSD	98	98	98	102
Limits:	80-116	77-113	80-113	78-113

Analysis Name: UST BTEX, MTBE in Water
Batch number: Z111862AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6331894	91	105	101	99
Blank	93	103	101	96
LCS	93	105	100	98
LCSD	93	105	100	98
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11181WAB026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6331894	88	101	87
6331896	84	98	82
6331898	88	101	90
6331900	88	102	86
6331902	85	98	88
6331904	88	96	88
Blank	89	102	91
LCS	88	103	90
LCSD	88	103	91
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111810006A

	1,1,2,2-Tetrachloroethane
6331894	90
6331896	95
6331898	88
6331900	91
6331902	80
6331904	185*

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254047
Reported: 07/29/11 at 01:55 PM

Surrogate Quality Control

Blank	95
LCS	95
LCSD	98
MS	90
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1254047 Sample # 6331894-905

COC # 266178

Please print. Instructions on reverse side correspond with circled numbers. 0.9-1.8°c

(1) Client: SUN - AquaTerra Acct. #:

Project Name/#: Phila. Ref. AOI-II PWSID #:

Project Manager: T. Doerr P.O.#:

Sampler: M. Hinderliter Quote #:

Name of state where samples were collected: PA

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix: Soil	Water (Potable / NPDES)	Other	(4) Total # of Containers	(5) Analyses Requested / Preservation Codes *	Remarks
S-264-06282011	6/28/11	1400	X			X		16	*	* see attached *
S-46D-06282011	6/28/11	1230	X			X		16	*	For list of
S-80D-06282011	6/28/11	1145	X			X		16	*	* Analyses *
S-119D-06282011	6/28/11	1430	X			X		16	*	
N-38D-06282011	6/28/11	955	X			X		16	*	
N-44D-06282011	6/28/11	840	X			X		16	*	

(7) **Turnaround Time Requested** (TAT) (please circle): (Normal) Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
SDG Complete? (Yes) No
Site-specific QC (MS/MSD/Dup)? Yes (No)
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes (No)

Relinquished by:	Date	Time	Received by:	Date	Time
[signature]	6/28/11	1700	Fridge	6/28/11	1700
[signature]	6/29/11	1030	[signature]	6/29/11	1030
[signature]	6/29/11	1510	[signature]		
[signature]			[signature]		
[signature]			[signature]	6/29/11	1510

(9)

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-8766

Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

10132 | 1254047 | 6331894-905
0.9-1.8°c

Table 1
Constituents of Concern for Groundwater
AOI 11 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.	8260B
1,2-Dichloroethane	107-06-2	
1,2,4-Trimethylbenzene	95-63-6	
1,3,5-Trimethylbenzene	108-67-8	
Benzene	71-43-2	
Cumene	98-82-8	
Ethylbenzene	100-41-4	
Ethylene Dibromide	106-93-4	(8011)
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4	
Toluene	108-88-3	
Xylenes (total)	1330-20-7	

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.	8270C
Chrysene	218-01-9	
Fluorene	86-73-7	
Naphthalene	91-20-3	
Phenanthrene	85-01-8	
Pyrene	129-00-0	

Metals	CAS No.	Method	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500) in ug/L
Arsenic (Total & Dissolved)	7440-38-2	6020	10
Cobalt (Total & Dissolved)	7440-48-4	6010B	31
Iron (Total & Dissolved)	7439-89-6	6010B	300
Lead (Total & Dissolved)	7439-92-1	6020	5
Manganese (Total & Dissolved)	7439-96-5	6010B for filtering	300

Misc Parameters	CAS No.		
Ammonia	7664-41-7	SM20 4500	30,000
			USEPA Drinking Water MCLs in mg/L
Chloride	16887-00-6	300.0	250
Fluoride	7782-41-4	300.0	4
Nitrate **48hr hold time**	84145-82-4	300.0	10
Nitrite included in nitrate cost	1594-56-5	300.0	1
Sulfate	18785-72-3	300.0	250
Sulfide	-	SM20 4500	Reported Result
Total Alkalinity	-	SM20 2320	Reported Result
Bicarbonate	71-52-3	SM20 2320	Reported Result
Total Organic Carbon	7440-44-0	SM20 5310	Reported Result
Total Dissolved Solids	CASID10052	SM20 2540	500

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

REVISED

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 29, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 06/29/2011
Group Number: 1254048
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-72D_06282011 Grab Water	6331906
S-72D_06282011 Filtered Grab Water	6331907
S-294D_06282011 Grab Water	6331908
S-294D_06282011 Filtered Grab Water	6331909
S-302D_06282011 Grab Water	6331910
S-302D_06282011 Filtered Grab Water	6331911
S-280D_06282011 Grab Water	6331912
S-280D_06282011 Filtered Grab Water	6331913
N-27_06282011 Grab Water	6331914
N-27_06282011 Filtered Grab Water	6331915
N-30_06282011 Grab Water	6331916
N-30_06282011 Filtered Grab Water	6331917

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

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Analysis Report

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Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,

Max E. Snavely
Senior Specialist

Lancaster Laboratories

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Analysis Report

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Sample Description: S-72D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-72D

LLI Sample # WW 6331906
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 13:50 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-72D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	62,200	200	14.1	1
07058	Manganese	7439-96-5	3,690	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	77,700	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	216,000	20,000	6,000	20
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	4,300	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	221,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	221,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	688,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: S-72D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-72D

LLI Sample # WW 6331906
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 13:50 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-72D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	4,000	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 12:09	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 12:09	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 16:07	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 14:10	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:18	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:18	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:18	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:23	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:23	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196903A	07/06/2011 22:20	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 02:23	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 02:23	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 02:23	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	07/09/2011 10:50	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 06:29	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11186023001A	07/05/2011 08:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-72D_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-72D

LLI Sample # WW 6331907
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 13:50 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	58,100	200	14.1	1
07058	Manganese	7439-96-5	3,770	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:21	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:21	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:21	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:24	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:24	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-294D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-294D

LLI Sample # WW 6331908
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 12:30 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S294D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	69,100	200	14.1	1
07058	Manganese	7439-96-5	8,400	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	4.5	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	93,600	20,000	10,000	50
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	350,000	50,000	15,000	50
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	4,600	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	236,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	236,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	883,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-294D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-294D

LLI Sample # WW 6331908
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 12:30 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S294D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	1,500	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 12:31	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 12:31	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 16:32	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 14:40	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:25	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:25	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:25	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:26	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:26	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196903A	07/06/2011 22:35	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 02:38	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 02:38	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 02:38	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	07/09/2011 15:44	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 06:36	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11186023001A	07/05/2011 08:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-294D_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-294D

LLI Sample # WW 6331909
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 12:30 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	65,000	200	14.1	1
07058	Manganese	7439-96-5	8,390	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	3.2	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:29	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:29	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:29	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:28	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:28	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-302D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-302D

LLI Sample # WW 6331910
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 13:30 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S302D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	76,300	200	14.1	1
07058	Manganese	7439-96-5	4,000	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	75,000	20,000	10,000	50
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	400,000	50,000	15,000	50
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	10,000	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	266,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	266,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	950,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-302D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-302D

LLI Sample # WW 6331910
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 13:30 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S302D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	13,200	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 12:54	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 12:54	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 16:56	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 15:11	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:40	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:40	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:40	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:30	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:30	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196903A	07/06/2011 22:49	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 02:53	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 02:53	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 02:53	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	07/09/2011 11:49	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 06:44	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11186023001A	07/05/2011 08:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-302D_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-302D

LLI Sample # WW 6331911
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 13:30 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	66,900	200	14.1	1
07058	Manganese	7439-96-5	3,930	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:43	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:43	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:43	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:32	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:32	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-280D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-280D

LLI Sample # WW 6331912
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:55 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S280D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	23,300	200	14.1	1
07058	Manganese	7439-96-5	672	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	14.5	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	43,400	4,000	2,000	10
01504	Fluoride	16984-48-8	580	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	6,500	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	5,900	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	210,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	210,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	258,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-280D_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-280D

LLI Sample # WW 6331912
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:55 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S280D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	17,200	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 13:17	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 13:17	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 17:21	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 15:41	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:47	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:47	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:47	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:33	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:33	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196903A	07/06/2011 23:04	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 03:09	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 03:09	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 03:09	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	06/30/2011 03:09	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 06:51	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11186023001A	07/05/2011 08:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: S-280D_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266184 S-280D

LLI Sample # WW 6331913
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 14:55 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	9,270	200	14.1	1
07058	Manganese	7439-96-5	661	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	2.4	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:50	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:50	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:50	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:39	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:39	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-27_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 N-27

LLI Sample # WW 6331914
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 09:05 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N--27

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	9.5	5.0	0.62	1
01754	Iron	7439-89-6	1,650	200	14.1	1
07058	Manganese	7439-96-5	5,850	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	108,000	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	192,000	20,000	6,000	20
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	3,300	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	197,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	197,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	635,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-27_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 N-27

LLI Sample # WW 6331914
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 09:05 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N--27

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	740	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 13:40	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 13:40	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 17:45	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111810006A	07/02/2011 16:13	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111810006A	06/30/2011 17:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 20:20	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 20:20	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 20:20	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:40	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:40	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196903A	07/06/2011 23:19	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 03:24	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 03:24	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 03:24	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	07/09/2011 15:59	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 07:14	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11186023001A	07/05/2011 08:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-27_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266184 N-27

LLI Sample # WW 6331915
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 09:05 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	9.8	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	5,850	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:54	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:54	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:54	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050001A	07/07/2011 01:42	David K Beck	1
06035	Lead	SW-846 6020	1	111866050001A	07/07/2011 01:42	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050001	07/06/2011 08:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-30_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 N-30

LLI Sample # WW 6331916
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 09:50 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N--30

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	22.3	5.0	0.62	1
01754	Iron	7439-89-6	56,400	200	14.1	1
07058	Manganese	7439-96-5	380	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	5.3	2.0	0.95	1
06035	Lead	7439-92-1	42.4	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	136,000	20,000	10,000	50
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	148,000	50,000	15,000	50
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	6,000	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	65,800	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	65,800	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	468,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

REVISED

Sample Description: N-30_06282011 Grab Water
Philadelphia Refinery AOI-11
COC: 266184 N-30

LLI Sample # WW 6331916
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 09:50 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N--30

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	< 600	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111892AA	07/08/2011 14:03	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111892AA	07/08/2011 14:03	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11181WAB026	07/01/2011 18:10	Dale R Stoneroad	1
07807	BNA Water Extraction	SW-846 3510C	1	11181WAB026	06/30/2011 00:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/06/2011 23:28	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 21:58	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 21:58	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 21:58	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050002A	07/07/2011 12:35	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111866050002A	07/07/2011 12:35	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050002	07/06/2011 09:05	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11180196903A	07/07/2011 00:03	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11180196903A	06/30/2011 03:39	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 03:39	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11180196903A	06/30/2011 03:39	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11180196903A	07/09/2011 12:18	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11186049503B	07/05/2011 07:21	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11186020202A	07/05/2011 10:52	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11182021202A	07/01/2011 10:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11186023001A	07/05/2011 08:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11182022101A	07/01/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-30_06282011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266184 N-30

LLI Sample # WW 6331917
LLI Group # 1254048
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/28/2011 09:50 by SS

Submitted: 06/29/2011 15:10
Reported: 07/29/2011 13:54

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	21,900	200	14.1	1
07058	Manganese	7439-96-5	237	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111821848002	07/07/2011 22:01	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111821848002	07/07/2011 22:01	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111821848002	07/07/2011 22:01	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111866050002A	07/07/2011 12:39	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111866050002A	07/07/2011 12:39	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111821848002	07/05/2011 10:17	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111866050002	07/06/2011 09:05	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254048
Reported: 07/29/11 at 01:54 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: D111892AA	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916								
Benzene	< 1	1.	0.5	ug/l	98		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	96		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	95		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	93		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	89		76-120		
Toluene	< 1	1.	0.5	ug/l	99		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	89		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	87		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	95		80-120		
Batch number: 11181WAB026	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916								
Chrysene	< 5	5.	1	ug/l	99	98	82-112	1	30
Fluorene	< 5	5.	1	ug/l	104	101	82-113	3	30
Naphthalene	< 5	5.	1	ug/l	88	91	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	104	100	83-112	4	30
Pyrene	< 5	5.	1	ug/l	91	91	80-115	0	30
Batch number: 111810006A	Sample number(s): 6331906,6331908,6331910,6331912,6331914								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	100	60-140	0	20
Batch number: 111830011A	Sample number(s): 6331916								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	96	60-140	4	20
Batch number: 111821848002	Sample number(s): 6331906-6331917								
Cobalt	< 5.0	5.0	0.62	ug/l	103		90-110		
Iron	< 200	200.	14.1	ug/l	107		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	102		90-110		
Batch number: 111866050001A	Sample number(s): 6331906-6331915								
Arsenic	< 2.0	2.0	0.95	ug/l	98		86-111		
Lead	< 1.0	1.0	0.080	ug/l	102		90-115		
Batch number: 111866050002A	Sample number(s): 6331916-6331917								
Arsenic	< 2.0	2.0	0.95	ug/l	105		86-111		
Lead	< 1.0	1.0	0.080	ug/l	104		90-115		
Batch number: 11180196903A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916								
Chloride	< 400	400.	200	ug/l	100		90-110		
Fluoride	< 100	100.	80	ug/l	99		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	97		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	96		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	93		90-110		
Batch number: 11186049503B	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	105		91-113		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254048
Reported: 07/29/11 at 01:54 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 11182021202A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	97		80-120		
Batch number: 11182022101A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916								
Ammonia Nitrogen	< 600	600.	200	ug/l	96	94	85-105	2	5
Batch number: 11186020202A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916								
Alkalinity to pH 4.5	< 2,000	2,000.	460	ug/l as CaCO3	99		98-103		
Batch number: 11186023001A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916								
Sulfide	< 160	160.	54	ug/l	103		90-110		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: D111892AA	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916 UNSPK: P333501								
Benzene	108	105	80-126	3	30				
1,2-Dichloroethane	103	101	66-141	3	30				
Ethylbenzene	102	101	71-134	1	30				
Isopropylbenzene	100	94	75-128	6	30				
Methyl Tertiary Butyl Ether	91	91	72-126	0	30				
Toluene	108	105	80-125	3	30				
1,2,4-Trimethylbenzene	92	88	72-130	5	30				
1,3,5-Trimethylbenzene	92	87	72-131	6	30				
Xylene (Total)	102	100	79-125	2	30				
Batch number: 111810006A	Sample number(s): 6331906,6331908,6331910,6331912,6331914 UNSPK: P331854								
Ethylene dibromide	91		65-135						
Batch number: 111830011A	Sample number(s): 6331916 UNSPK: P332975 BKG: P332971								
Ethylene dibromide	57*		65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 111821848002	Sample number(s): 6331906-6331917 UNSPK: 6331914 BKG: 6331914								
Cobalt	101	101	87-112	1	20	9.5	10.5	10 (1)	20
Iron	100	105	75-125	2	20	1,650	1,690	2	20
Manganese	112 (2)	100 (2)	75-125	1	20	5,850	5,910	1	20
Batch number: 111866050001A	Sample number(s): 6331906-6331915 UNSPK: P334929 BKG: P334929								
Arsenic	103	103	75-125	0	20	< 2.0	< 2.0	0 (1)	20
Lead	103	103	83-120	0	20	< 1.0	< 1.0	0 (1)	20
Batch number: 111866050002A	Sample number(s): 6331916-6331917 UNSPK: P333906 BKG: P333906								
Arsenic	114	118	75-125	2	20	5.6	5.7	1 (1)	20
Lead	108	108	83-120	0	20	< 1.0	< 1.0	13 (1)	20
Batch number: 11180196903A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916 UNSPK: P331898 BKG: P331898								
Chloride	102		90-110			73,600	69,200	6 (1)	20
Fluoride	76*		90-110			< 500	< 500	0 (1)	20

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254048
Reported: 07/29/11 at 01:54 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Nitrate Nitrogen	85*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	79*		90-110			< 500	< 500	0 (1)	20
Sulfate	122*		90-110			462,000	415,000	11	20
Batch number: 11186049503B	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916 UNSPK: 6331912 BKG: 6331912								
Total Organic Carbon	107		63-142			5,900	5,900	1	3
Batch number: 11182021202A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916 UNSPK: P331902 BKG: P331902								
Total Dissolved Solids	100		62-135			860,000	870,000	1	9
Batch number: 11182022101A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916 BKG: P332926								
Ammonia Nitrogen						35,500	35,900	1	6
Batch number: 11186020202A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916 UNSPK: P331900 BKG: P331900								
Alkalinity to pH 4.5	76		73-121			62,700	62,800	0	5
Alkalinity to pH 8.3						< 2,000	< 2,000	0 (1)	5
Batch number: 11186023001A	Sample number(s): 6331906,6331908,6331910,6331912,6331914,6331916 UNSPK: 6331908 BKG: 6331908								
Sulfide	101	110	50-130	8	10	< 160	< 160	0 (1)	5

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed
unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: D111892AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6331906	102	102	98	93
6331908	104	102	99	92
6331910	100	103	98	93
6331912	102	100	99	92
6331914	100	105	97	89
6331916	100	101	100	92
Blank	100	99	99	90
LCS	95	95	97	101
MS	98	99	99	100
MSD	98	98	98	102
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11181WAB026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254048
Reported: 07/29/11 at 01:54 PM

Surrogate Quality Control

6331906	87	100	88
6331908	90	101	89
6331910	91	103	91
6331912	92	106	91
6331914	88	105	90
6331916	86	99	76
Blank	89	102	91
LCS	88	103	90
LCSD	88	103	91
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111810006A

	1,1,2,2-Tetrachloroethane
6331906	95
6331908	92
6331910	88
6331912	85
6331914	91
Blank	95
LCS	95
LCSD	98
MS	90
Limits:	46-136

Analysis Name: EDB in Wastewater
Batch number: 111830011A

	1,1,2,2-Tetrachloroethane
6331916	83
Blank	93
DUP	66
LCS	91
LCSD	90
MS	48
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1754048 Sample # 6331906-17

COC # 266184

Please print. Instructions on reverse side correspond with circled numbers. B-8 0.9-1.8°C on ice

For Lab Use Only
FSC:
SCR#:

(1)
Client: SUN - AQUATERRA Acct. #:
Project Name/#: PHILA REF AOI-11 PWSID #:
Project Manager: T. DOERR P.O.#:
Sampler: S. SYKES Quote #:
Name of state where samples were collected: PA

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix: Soil	Water (Potable / NPDES)	Other	(4) Total # of Containers	(5) Analyses Requested / Preservation Codes	Remarks
S-720_06282011	6/28/11	1350	X			X		16	X	☆ See attatched ☆
S-294D_06282011	6/28/11	1230	X			X		16	X	for list of
S-302D_06282011	6/28/11	1330	X			X		16	X	☆ analyses ☆
S-280D_06282011	6/28/11	1455	X			X		16	X	
N-27_06282011	6/28/11	905	X			X		16	X	
N-30_06282011	6/28/11	950	X			X		16	X	

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
SDG Complete? Yes No
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
AQT	6/28/11	1700	Sample Fridge	6/28/11	1700
	6/29/11	1030		6/29/11	1030
	6/29/11	1510			
				6/29/11	1510

10132|1254048|6331906-17
0.9-1.8°c

Table 1
Constituents of Concern for Groundwater
AOI 11 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.	
1,2-Dichloroethane	107-06-2	8260B
1,2,4-Trimethylbenzene	95-63-6	
1,3,5-Trimethylbenzene	108-67-8	
Benzene	71-43-2	
Cumene	98-82-8	
Ethylbenzene	100-41-4	
Ethylene Dibromide	106-93-4	(8011)
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4	
Toluene	108-88-3	
Xylenes (total)	1330-20-7	

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.	
Chrysene	218-01-9	8270C
Fluorene	86-73-7	
Naphthalene	91-20-3	
Phenanthrene	85-01-8	
Pyrene	129-00-0	

Metals	CAS No.	Method	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500) in ug/L
Arsenic (Total & Dissolved)	7440-38-2	6020	10
Cobalt (Total & Dissolved)	7440-48-4	6010B	31
Iron (Total & Dissolved)	7439-89-6	6010B	300
Lead (Total & Dissolved)	7439-92-1	6020	5
Manganese (Total & Dissolved)	7439-96-5	6010B	300
		for filtering	

Misc Parameters	CAS No.		
Ammonia	7664-41-7	SM20 4500	30,000
			USEPA Drinking Water MCLs in mg/L
Chloride	16887-00-6	300.0	250
Fluoride	7782-41-4	300.0	4
Nitrate **48hr hold time**	84145-82-4	300.0	10
Nitrite included in nitrate cost	1594-56-5	300.0	1
Sulfate	18785-72-3	300.0	250
Sulfide	-	SM20 4500	Reported Result
Total Alkalinity	-	SM20 2320	Reported Result
Bicarbonate	71-52-3	SM20 2320	Reported Result
Total Organic Carbon	7440-44-0	SM20 5310	Reported Result
Total Dissolved Solids	CASID10052	SM20 2540	500

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 29, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 06/30/2011
Group Number: 1254227
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-305D_06292011 Grab Water	6332969
S-305D_06292011 Filtered Grab Water	6332970
S-22_06292011 Grab Water	6332971
S-22_06292011 Filtered Grab Water	6332972
S-8_06292011 Grab Water	6332973
S-8_06292011 Filtered Grab Water	6332974
S-38D_06292011 Grab Water	6332975
S-38D_06292011 Filtered Grab Water	6332976
S-38D2_06292011 Grab Water	6332977
S-38D2_06292011 Filtered Grab Water	6332978
S-59D_06292011 Grab Water	6332979
S-59D_06292011 Filtered Grab Water	6332980

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

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Analysis Report

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Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,

Max E. Snavely
Senior Specialist

Lancaster Laboratories

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Analysis Report

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Sample Description: S-305D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-305D

LLI Sample # WW 6332969
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 11:30 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S305D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	23.6	5.0	0.62	1
01754	Iron	7439-89-6	114,000	200	14.1	1
07058	Manganese	7439-96-5	2,170	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	367	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		**ug/l**	**ug/l**	**ug/l**	
00224	Chloride	16887-00-6	76,600	20,000	10,000	50
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
	The sample was analyzed outside of the 48 hour holding time for nitrate nitrogen.					
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
	The sample was analyzed outside of the 48 hour holding time for nitrite nitrogen.					
00228	Sulfate	14808-79-8	508,000	50,000	15,000	50
	SM20 5310 C		**ug/l**	**ug/l**	**ug/l**	
00273	Total Organic Carbon	n.a.	14,800	1,000	500	1
	SM20 2320 B		**ug/l as CaCO3**	**ug/l as CaCO3**	**ug/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	283,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	283,000	2,000	460	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-305D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-305D

LLI Sample # WW 6332969
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 11:30 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S305D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**ug/l**	**ug/l**	**ug/l**	
00212	Total Dissolved Solids	n.a.	1,160,000	60,000	19,400	1
	SM20 4500 S2 D		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	10,200	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 10:15	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 10:15	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11182WAB026	07/02/2011 15:51	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11182WAB026	07/01/2011 07:30	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 02:30	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/07/2011 23:38	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/07/2011 23:38	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/07/2011 23:38	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 03:55	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 03:55	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902A	07/07/2011 06:40	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11181196902A	07/07/2011 04:57	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/07/2011 04:57	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/07/2011 04:57	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/07/2011 06:40	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11188049502B	07/07/2011 05:04	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021201A	07/05/2011 11:15	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11186023002A	07/05/2011 11:30	Michele L Graham	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: **S-305D_06292011 Grab Water**
Philadelphia Refinery AOI-11
COC: 266179 S-305D

LLI Sample # WW 6332969
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 11:30 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S305D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: S-305D_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-305D

LLI Sample # WW 6332970
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 11:30 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	24.0	5.0	0.62	1
01754	Iron	7439-89-6	78,700	200	14.1	1
07058	Manganese	7439-96-5	2,160	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	51.9	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/07/2011 23:42	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/07/2011 23:42	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/07/2011 23:42	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 03:57	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 03:57	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-22_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-22

LLI Sample # WW 6332971
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 13:10 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S--22

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	28	5	3	5
10943	1,2-Dichloroethane	107-06-2	< 5	5	3	5
10943	Ethylbenzene	100-41-4	7	5	3	5
10943	Isopropylbenzene	98-82-8	< 10	10	3	5
10943	Methyl Tertiary Butyl Ether	1634-04-4	49	5	3	5
10943	Toluene	108-88-3	53	5	3	5
10943	1,2,4-Trimethylbenzene	95-63-6	< 10	10	3	5
10943	1,3,5-Trimethylbenzene	108-67-8	< 10	10	3	5
10943	Xylene (Total)	1330-20-7	140	5	3	5
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	7.1	5.0	0.62	1
01754	Iron	7439-89-6	28,500	200	14.1	1
07058	Manganese	7439-96-5	272	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	2.6	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	35,700	4,000	2,000	10
01504	Fluoride	16984-48-8	910	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	12,700	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	199,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	199,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	320,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-22_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-22

LLI Sample # WW 6332971
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 13:10 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S--22

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	1,600	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 10:37	Anita M Dale	5
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 10:37	Anita M Dale	5
07805	PAHs by 8270	SW-846 8270C	1	11182WAB026	07/02/2011 16:16	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11182WAB026	07/01/2011 07:30	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 03:00	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/07/2011 23:53	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/07/2011 23:53	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/07/2011 23:53	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:02	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:02	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902A	07/07/2011 07:24	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11181196902A	07/01/2011 02:47	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 02:47	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 02:47	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/01/2011 02:47	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11188049502B	07/07/2011 05:26	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021201A	07/05/2011 11:15	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11186023002A	07/05/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-22_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-22

LLI Sample # WW 6332972
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 13:10 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	1,750	200	14.1	1
07058	Manganese	7439-96-5	239	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/07/2011 23:57	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/07/2011 23:57	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/07/2011 23:57	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:04	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:04	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-8_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-8

LLI Sample # WW 6332973
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 14:10 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S---8

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	8	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	46.8	5.0	0.62	1
01754	Iron	7439-89-6	54,500	200	14.1	1
07058	Manganese	7439-96-5	1,460	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	13.7	2.0	0.95	1
06035	Lead	7439-92-1	239	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	27,300	2,000	1,000	5
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	5,800	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	5,500	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	55,800	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	55,800	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	154,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-8_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-8

LLI Sample # WW 6332973
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 14:10 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S---8

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 3,200	3,200	1,100	20
	Reporting limits were raised due to interference from the sample matrix.					
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	3,000	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 11:00	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 11:00	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11182WAB026	07/03/2011 19:37	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11182WAB026	07/01/2011 07:30	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 04:00	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:00	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:00	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:00	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:05	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:05	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902A	07/01/2011 03:02	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11181196902A	07/01/2011 03:02	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 03:02	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 03:02	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/01/2011 03:02	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11188049502B	07/07/2011 05:48	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021201A	07/05/2011 11:15	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	20
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-8_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-8

LLI Sample # WW 6332974
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 14:10 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	368	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:04	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:04	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:04	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:07	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:07	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-38D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-38D

LLI Sample # WW 6332975
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 09:20 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-38D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	3	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	5,710	200	14.1	1
07058	Manganese	7439-96-5	309	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	1.7	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	3,200	2,000	1,000	5
01504	Fluoride	16984-48-8	630	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	1,200	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	123,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	123,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	174,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-38D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-38D

LLI Sample # WW 6332975
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 09:20 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-38D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		ug/l	ug/l	ug/l	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		ug/l	ug/l	ug/l	
00221	Ammonia Nitrogen	7664-41-7	< 600	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 11:23	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 11:23	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11182WAB026	07/03/2011 20:03	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11182WAB026	07/01/2011 07:30	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 04:30	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:07	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:07	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:07	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:09	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:09	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902A	07/01/2011 03:16	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11181196902A	07/01/2011 03:16	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 03:16	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 03:16	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/01/2011 03:16	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11188049502B	07/07/2011 05:55	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021201A	07/05/2011 11:15	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-38D_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-38D

LLI Sample # WW 6332976
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 09:20 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	430	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:11	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:11	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:11	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:11	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:11	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-38D2_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-38D2

LLI Sample # WW 6332977
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 09:55 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S38D2

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	110	2	1	2
10943	1,2-Dichloroethane	107-06-2	< 2	2	1	2
10943	Ethylbenzene	100-41-4	12	2	1	2
10943	Isopropylbenzene	98-82-8	< 4	4	1	2
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 2	2	1	2
10943	Toluene	108-88-3	14	2	1	2
10943	1,2,4-Trimethylbenzene	95-63-6	< 4	4	1	2
10943	1,3,5-Trimethylbenzene	108-67-8	< 4	4	1	2
10943	Xylene (Total)	1330-20-7	20	2	1	2
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	5.0	5.0	0.62	1
01754	Iron	7439-89-6	8,740	200	14.1	1
07058	Manganese	7439-96-5	7,270	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	4.2	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	44,900	4,000	2,000	10
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	11,400	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	2,700	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	251,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	251,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	384,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-38D2_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-38D2

LLI Sample # WW 6332977
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 09:55 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S38D2

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	< 600	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 11:46	Anita M Dale	2
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 11:46	Anita M Dale	2
07805	PAHs by 8270	SW-846 8270C	1	11182WAB026	07/03/2011 20:28	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11182WAB026	07/01/2011 07:30	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 05:31	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:15	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:15	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:15	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:13	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:13	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902A	07/07/2011 07:39	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11181196902A	07/01/2011 03:31	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 03:31	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 03:31	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/01/2011 03:31	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11188049502B	07/07/2011 06:03	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021201A	07/05/2011 11:15	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-38D2_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-38D2

LLI Sample # WW 6332978
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 09:55 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	1,120	200	14.1	1
07058	Manganese	7439-96-5	6,410	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:18	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:18	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:18	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:14	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:14	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-59D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-59D

LLI Sample # WW 6332979
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 12:10 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-59D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	11.2	5.0	0.62	1
01754	Iron	7439-89-6	11,500	200	14.1	1
07058	Manganese	7439-96-5	2,460	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	49.3	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	171,000	20,000	10,000	50
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	9,500	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	7,600	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	414,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	414,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	688,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-59D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-59D

LLI Sample # WW 6332979
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 12:10 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-59D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	2,300	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 12:09	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 12:09	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11182WAB026	07/03/2011 20:53	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11182WAB026	07/01/2011 07:30	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 06:02	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/07/2011 23:17	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/07/2011 23:17	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/07/2011 23:17	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:16	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:16	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902A	07/07/2011 07:53	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11181196902A	07/01/2011 03:46	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 03:46	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 03:46	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/01/2011 03:46	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11188049502B	07/07/2011 06:10	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021201A	07/05/2011 11:15	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-59D_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266179 S-59D

LLI Sample # WW 6332980
LLI Group # 1254227
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 12:10 by MH

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	10.8	5.0	0.62	1
01754	Iron	7439-89-6	1,620	200	14.1	1
07058	Manganese	7439-96-5	2,440	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	13.2	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:22	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:22	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:22	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:18	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:18	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254227
Reported: 07/29/11 at 01:50 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: D111872AA	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979								
Benzene	< 1	1.	0.5	ug/l	91	99	79-120	9	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	90	99	70-130	10	30
Ethylbenzene	< 1	1.	0.5	ug/l	89	98	79-120	10	30
Isopropylbenzene	< 2	2.	0.5	ug/l	87	98	77-120	11	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	83	86	76-120	4	30
Toluene	< 1	1.	0.5	ug/l	93	102	79-120	10	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	84	92	74-120	10	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	83	91	75-120	8	30
Xylene (Total)	< 1	1.	0.5	ug/l	89	99	80-120	11	30
Batch number: 11182WAB026	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979								
Chrysene	< 5	5.	1	ug/l	99		82-112		
Fluorene	< 5	5.	1	ug/l	98		82-113		
Naphthalene	< 5	5.	1	ug/l	97		77-107		
Phenanthrene	< 5	5.	1	ug/l	100		83-112		
Pyrene	< 5	5.	1	ug/l	101		80-115		
Batch number: 111830011A	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	96	60-140	4	20
Batch number: 111871848001	Sample number(s): 6332969-6332980								
Cobalt	< 5.0	5.0	0.62	ug/l	101		90-110		
Iron	< 200	200.	14.1	ug/l	98		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	102		90-110		
Batch number: 111876050002A	Sample number(s): 6332969-6332980								
Arsenic	< 2.0	2.0	0.95	ug/l	108		86-111		
Lead	< 1.0	1.0	0.080	ug/l	105		90-115		
Batch number: 11181196902A	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979								
Chloride	< 400	400.	200	ug/l	101		90-110		
Fluoride	< 100	100.	80	ug/l	95		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	100		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	99		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	97		90-110		
Batch number: 11188049502B	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	97		91-113		
Batch number: 11186021201A	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	102		80-120		
Batch number: 11186023002A	Sample number(s): 6332969,6332971								
Sulfide	< 160	160.	54	ug/l	107		90-110		
Batch number: 11187020202B	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254227
Reported: 07/29/11 at 01:50 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Alkalinity to pH 4.5	< 2,000	2,000.	460	ug/l as CaCO3	98		98-103		
Batch number: 11187022101A	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979								
Ammonia Nitrogen	< 600	600.	200	ug/l	94	93	85-105	1	5
Batch number: 11187023001A	Sample number(s): 6332973,6332975,6332977,6332979								
Sulfide	< 160	160.	54	ug/l	100		90-110		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 11182WAB026	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979 UNSPK: P332490								
Chrysene	103	102	78-116	4	30				
Fluorene	101	99	71-123	2	30				
Naphthalene	101	98	73-113	2	30				
Phenanthrene	103	98	72-121	1	30				
Pyrene	102	100	77-117	3	30				
Batch number: 111830011A	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979 UNSPK: 6332975 BKG: 6332971								
Ethylene dibromide	57*		65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 111871848001	Sample number(s): 6332969-6332980 UNSPK: 6332979 BKG: 6332979								
Cobalt	99	101	87-112	1	20	11.2	10.5	7 (1)	20
Iron	115 (2)	155 (2)	75-125	3	20	11,500	11,700	2	20
Manganese	94 (2)	108 (2)	75-125	2	20	2,460	2,430	1	20
Batch number: 111876050002A	Sample number(s): 6332969-6332980 UNSPK: P332989 BKG: P332989								
Arsenic	99	86	75-125	3	20	29.6	29.6	0	20
Lead	113 (2)	-96 (2)	83-120	5	20	576	571	1	20
Batch number: 11181196902A	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979 UNSPK: 6332969 BKG: 6332969								
Chloride	111*		90-110			75,600	80,000	6 (1)	20
Fluoride	78*		90-110			< 500	< 500	0 (1)	20
Nitrate Nitrogen	84*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	81*		90-110			< 500	< 500	0 (1)	20
Sulfate	118*		90-110			508,000	545,000	7	20
Batch number: 11188049502B	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979 UNSPK: 6332971 BKG: 6332971								
Total Organic Carbon	102		63-142			12,700	12,700	0	3
Batch number: 11186021201A	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979 UNSPK: 6332979 BKG: 6332979								
Total Dissolved Solids	95		62-135			688,000	690,000	0	9
Batch number: 11186023002A	Sample number(s): 6332969,6332971 UNSPK: P332247 BKG: P332247								
Sulfide	100	95	50-130	5	10	< 160	< 160	0 (1)	5

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254227
Reported: 07/29/11 at 01:50 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 11187020202B	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979 UNSPK: P332605 BKG: P332983								
Alkalinity to pH 4.5	97		73-121			315,000	314,000	0	5
Alkalinity to pH 8.3						< 2,000	< 2,000	0 (1)	5
Batch number: 11187022101A	Sample number(s): 6332969,6332971,6332973,6332975,6332977,6332979 BKG: P335860								
Ammonia Nitrogen						73,100	72,200	1	6
Batch number: 11187023001A	Sample number(s): 6332973,6332975,6332977,6332979 UNSPK: P332241 BKG: P332241								
Sulfide	98	92	50-130	7	10	< 160	< 160	0 (1)	5

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: D111872AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6332969	100	101	100	96
6332971	99	100	102	98
6332973	104	102	100	90
6332975	95	94	100	99
6332977	97	100	102	98
6332979	100	102	99	94
Blank	101	103	99	91
LCS	98	99	99	102
LCSD	97	97	99	104
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11182WAB026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6332969	95	101	94
6332971	91	95	84
6332973	72	80	69
6332975	91	105	103
6332977	94	107	104
6332979	93	104	100
Blank	98	100	96
LCS	96	100	94
MS	98	102	94
MSD	95	101	92
Limits:	52-120	63-114	34-118

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254227
Reported: 07/29/11 at 01:50 PM

Surrogate Quality Control

Analysis Name: EDB in Wastewater
Batch number: 111830011A

	1,1,2,2-Tetrachloroethane
6332969	111
6332971	85
6332973	71
6332975	68
6332977	78
6332979	78
Blank	93
DUP	66
LCS	91
LCSD	90
MS	48
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1254227 Sample # 6332969-80

COC # 266179

Please print. Instructions on reverse side correspond with circled numbers. 1.5-4.3°c

(1) Client: SUN - Aquaterra Acct. #:

Project Name/#: PHila. Ref. AOI-11 PWSID #:

Project Manager: T. Doerr P.O.#:

Sampler: M. Hinderling Quote #:

Name of state where samples were collected: PA

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix (4) Soil	Potable ☐ NPDES ☐ Check if Applicable	Water	Other	Total # of Containers	(5) Analyses Requested: *	Preservation Codes	Remarks
S-305D_06292011	6/29/11	1130	X				X		16	X		* See attached for *
S-22_06292011	6/29/11	1310	X				X		16	X		* list of analyses *
S-8_06292011	6/29/11	1410	X				X		16	X		
S-38D_06292011	6/29/11	920	X				X		16	X		
S-38D2_06292011	6/29/11	955	X				X		16	X		
S-59D_06292011	6/29/11	1210	X				X		16	X		

(7) **Turnaround Time Requested** (TAT) (please circle): (Normal) Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg) TX TRRP-13
Type II (Tier II) MA MCP CT RCP
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)

SDG Complete? (Yes) No

Site-specific QC (MS/MSD/Dup)? Yes (No)
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / (No)

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
[signature]	6/29/11	1700	Fridge	6/29/11	1700
[signature]	6/30/11	1125	[signature]	6/30/11	1125
[signature]	6/30/11	1530			
			[signature]	6/30/11	1530

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

10132|1254227|6332969-80

1.5-4.3°C

Table 1
Constituents of Concern for Groundwater
AOI 11 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.	8260B
1,2-Dichloroethane	107-06-2	
1,2,4-Trimethylbenzene	95-63-6	
1,3,5-Trimethylbenzene	108-67-8	
Benzene	71-43-2	
Cumene	98-82-8	
Ethylbenzene	100-41-4	
Ethylene Dibromide	106-93-4	(8011)
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4	
Toluene	108-88-3	
Xylenes (total)	1330-20-7	

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.	8270C
Chrysene	218-01-9	
Fluorene	86-73-7	
Naphthalene	91-20-3	
Phenanthrene	85-01-8	
Pyrene	129-00-0	

Metals	CAS No.	Method	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500) in ug/L
Arsenic (Total & Dissolved)	7440-38-2	6020	10
Cobalt (Total & Dissolved)	7440-48-4	6010B	31
Iron (Total & Dissolved)	7439-89-6	6010B	300
Lead (Total & Dissolved)	7439-92-1	6020	5
Manganese (Total & Dissolved)	7439-96-5	6010B for filtering	300

Misc Parameters	CAS No.		
Ammonia	7664-41-7	SM20 4500	30,000
			USEPA Drinking Water MCLs in mg/L
Chloride	16887-00-6	300.0	250
Fluoride	7782-41-4	300.0	4
Nitrate **48hr hold time**	84145-82-4	300.0	10
Nitrite included in nitrate cost	1594-56-5	300.0	1
Sulfate	18785-72-3	300.0	250
Sulfide	-	SM20 4500	Reported Result
Total Alkalinity	-	SM20 2320	Reported Result
Bicarbonate	71-52-3	SM20 2320	Reported Result
Total Organic Carbon	7440-44-0	SM20 5310	Reported Result
Total Dissolved Solids	CASID10052	SM20 2540	500

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Lancaster Laboratories

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Analysis Report

REVISED

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 29, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 06/30/2011
Group Number: 1254228
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-69D_06292011 Grab Water	6332981
S-69D_06292011 Filtered Grab Water	6332982
S-284D_06292011 Grab Water	6332983
S-284D_06292011 Filtered Grab Water	6332984
C-129D_06292011 Grab Water	6332985
C-129D_06292011 Filtered Grab Water	6332986
N-21_06292011 Grab Water	6332987
N-21_06292011 Filtered Grab Water	6332988
N-50D_06292011 Grab Water	6332989
N-50D_06292011 Filtered Grab Water	6332990

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

Lancaster Laboratories

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Analysis Report

REVISED

Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,

Max E. Snavely
Senior Specialist

Lancaster Laboratories

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Analysis Report

REVISED

Sample Description: S-69D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 S-69D

LLI Sample # WW 6332981
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 11:10 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-69D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	4	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	2,770	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	91,600	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	19,600	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	3,900	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	324,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	324,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	492,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-69D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 S-69D

LLI Sample # WW 6332981
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 11:10 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-69D

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry		**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide		18496-25-8	< 160	160	54	1
		SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen		7664-41-7	3,300	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 12:32	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 12:32	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11182WAB026	07/03/2011 21:18	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11182WAB026	07/01/2011 07:30	Karen L Beyer	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 07:32	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:26	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:26	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:26	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:23	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:23	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902A	07/07/2011 08:08	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11181196902A	07/01/2011 04:00	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 04:00	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 04:00	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/01/2011 04:00	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11188049502B	07/07/2011 06:17	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021202B	07/05/2011 11:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-69D_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266177 S-69D

LLI Sample # WW 6332982
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 11:10 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	2,730	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:36	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:36	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:36	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:25	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:25	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-284D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 S-284D

LLI Sample # WW 6332983
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 10:30 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S284D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	2,710	200	14.1	1
07058	Manganese	7439-96-5	905	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	66,300	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	166,000	20,000	6,000	20
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	5,000	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	315,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	315,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	550,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-284D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 S-284D

LLI Sample # WW 6332983
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 10:30 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S284D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	23,500	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 12:55	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 12:55	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAF026	07/07/2011 07:40	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAF026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 08:03	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:40	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:40	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:40	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:27	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:27	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902A	07/07/2011 08:52	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11181196902A	07/01/2011 04:15	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 04:15	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 04:15	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/07/2011 08:52	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11188049503A	07/07/2011 06:54	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021202B	07/05/2011 11:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-284D_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266177 S-284D

LLI Sample # WW 6332984
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 10:30 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	821	200	14.1	1
07058	Manganese	7439-96-5	922	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:44	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:44	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:44	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:29	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:29	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

REVISED

Sample Description: C-129D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 C-129D

LLI Sample # WW 6332985
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 14:10 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C129D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	20,800	200	14.1	1
07058	Manganese	7439-96-5	114	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	9.6	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	47,100	4,000	2,000	10
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	8,000	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	386,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	386,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	343,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: C-129D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 C-129D

LLI Sample # WW 6332985
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 14:10 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C129D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		ug/l	ug/l	ug/l	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		ug/l	ug/l	ug/l	
00221	Ammonia Nitrogen	7664-41-7	36,900	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 13:17	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 13:17	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAF026	07/07/2011 08:07	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAF026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 08:33	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:47	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:47	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:47	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:30	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:30	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902A	07/07/2011 09:07	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11181196902A	07/01/2011 04:59	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 04:59	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 04:59	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/01/2011 04:59	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11188049503A	07/07/2011 07:16	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021202B	07/05/2011 11:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: C-129D_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266177 C-129D

LLI Sample # WW 6332986
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 14:10 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	104	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:51	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:51	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:51	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:32	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:32	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-21_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 N-21

LLI Sample # WW 6332987
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 12:30 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N--21

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	110	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	64	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	228	5.0	0.62	1
01754	Iron	7439-89-6	526,000	1,000	70.5	5
07058	Manganese	7439-96-5	4,810	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	55.7	2.0	0.95	1
06035	Lead	7439-92-1	1.2	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	83,600	8,000	4,000	20
01504	Fluoride	16984-48-8	1,200	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	5,400,000	500,000	150,000	500
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	31,700	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	< 2,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	< 2,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	7,000,000	240,000	77,600	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-21_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 N-21

LLI Sample # WW 6332987
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 12:30 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N--21

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	12,900	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.
Preservation requirements were not met. The pH was out of range upon receipt at the laboratory and after adding the maximum amount of preservative, the pH was still out of range for sulfide

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 13:40	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 13:40	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAF026	07/07/2011 08:33	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAF026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 09:03	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848003	07/08/2011 00:53	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111871848003	07/08/2011 09:36	Eric L Eby	5
07058	Manganese	SW-846 6010B	1	111871848003	07/08/2011 00:53	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:06	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:06	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848003	07/07/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11181196902A	07/07/2011 09:21	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11181196902A	07/01/2011 05:14	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 05:14	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902A	07/01/2011 05:14	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902A	07/07/2011 09:36	Ashley M Adams	500
00273	Total Organic Carbon	SM20 5310 C	1	11188049503A	07/07/2011 07:24	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021202B	07/05/2011 11:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

REVISED

Sample Description: **N-21_06292011 Grab Water**
Philadelphia Refinery AOI-11
COC: 266177 N-21

LLI Sample # WW 6332987
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 12:30 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N--21

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-21_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266177 N-21

LLI Sample # WW 6332988
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 12:30 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	228	5.0	0.62	1
01754	Iron	7439-89-6	535,000	1,000	70.5	5
07058	Manganese	7439-96-5	4,830	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	54.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848003	07/08/2011 02:44	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111871848003	07/08/2011 11:00	Eric L Eby	5
07058	Manganese	SW-846 6010B	1	111871848003	07/08/2011 02:44	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:08	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:08	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848003	07/07/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: N-50D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 N-50D

LLI Sample # WW 6332989
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 09:10 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-50D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	14	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	2	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	8	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	13.0	5.0	0.62	1
01754	Iron	7439-89-6	71,500	200	14.1	1
07058	Manganese	7439-96-5	1,230	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	29.6	2.0	0.95	1
06035	Lead	7439-92-1	576	5.0	0.40	5
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	17,200	2,000	1,000	5
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	8,800	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	18,400	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	304,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	304,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	430,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

REVISED

Sample Description: N-50D_06292011 Grab Water
Philadelphia Refinery AOI-11
COC: 266177 N-50D

LLI Sample # WW 6332989
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 09:10 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-50D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	2,400	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111872AA	07/06/2011 14:03	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111872AA	07/06/2011 14:03	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAF026	07/07/2011 09:00	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAF026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111830011A	07/07/2011 09:34	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111830011A	07/05/2011 16:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:55	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:55	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:55	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 03:44	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 14:28	Choon Y Tian	5
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1
00224	Chloride	EPA 300.0	1	11181196902B	07/01/2011 05:29	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11181196902B	07/01/2011 05:29	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11181196902B	07/01/2011 05:29	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11181196902B	07/01/2011 05:29	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11181196902B	07/01/2011 05:29	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11188049503A	07/07/2011 07:31	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11187020202B	07/06/2011 09:32	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11186021202B	07/05/2011 11:19	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11187022101A	07/06/2011 18:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

REVISED

Sample Description: N-50D_06292011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266177 N-50D

LLI Sample # WW 6332990
LLI Group # 1254228
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/29/2011 09:10 by SS

Submitted: 06/30/2011 15:30
Reported: 07/29/2011 13:50

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	588	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111871848001	07/08/2011 00:58	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111871848001	07/08/2011 00:58	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111871848001	07/08/2011 00:58	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111876050002A	07/07/2011 04:34	David K Beck	1
06035	Lead	SW-846 6020	1	111876050002A	07/07/2011 04:34	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111871848001	07/06/2011 11:15	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111876050002	07/06/2011 11:26	James L Mertz	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254228
Reported: 07/29/11 at 01:50 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: D111872AA	Sample number(s): 6332981,6332983,6332985,6332987,6332989								
Benzene	< 1	1.	0.5	ug/l	91	99	79-120	9	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	90	99	70-130	10	30
Ethylbenzene	< 1	1.	0.5	ug/l	89	98	79-120	10	30
Isopropylbenzene	< 2	2.	0.5	ug/l	87	98	77-120	11	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	83	86	76-120	4	30
Toluene	< 1	1.	0.5	ug/l	93	102	79-120	10	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	84	92	74-120	10	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	83	91	75-120	8	30
Xylene (Total)	< 1	1.	0.5	ug/l	89	99	80-120	11	30
Batch number: 11182WAB026	Sample number(s): 6332981								
Chrysene	< 5	5.	1	ug/l	99		82-112		
Fluorene	< 5	5.	1	ug/l	98		82-113		
Naphthalene	< 5	5.	1	ug/l	97		77-107		
Phenanthrene	< 5	5.	1	ug/l	100		83-112		
Pyrene	< 5	5.	1	ug/l	101		80-115		
Batch number: 11183WAF026	Sample number(s): 6332983,6332985,6332987,6332989								
Chrysene	< 5	5.	1	ug/l	101	99	82-112	3	30
Fluorene	< 5	5.	1	ug/l	95	94	82-113	1	30
Naphthalene	< 5	5.	1	ug/l	98	96	77-107	2	30
Phenanthrene	< 5	5.	1	ug/l	98	94	83-112	4	30
Pyrene	< 5	5.	1	ug/l	101	101	80-115	0	30
Batch number: 111830011A	Sample number(s): 6332981,6332983,6332985,6332987,6332989								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	96	60-140	4	20
Batch number: 111871848001	Sample number(s): 6332981-6332986,6332989-6332990								
Cobalt	< 5.0	5.0	0.62	ug/l	101		90-110		
Iron	< 200	200.	14.1	ug/l	98		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	102		90-110		
Batch number: 111871848003	Sample number(s): 6332987-6332988								
Cobalt	< 5.0	5.0	0.62	ug/l	103		90-110		
Iron	< 200	200.	14.1	ug/l	111		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	100		90-110		
Batch number: 111876050002A	Sample number(s): 6332981-6332986,6332989-6332990								
Arsenic	< 2.0	2.0	0.95	ug/l	108		86-111		
Lead	< 1.0	1.0	0.080	ug/l	105		90-115		
Batch number: 111886050002A	Sample number(s): 6332987-6332988								
Arsenic	< 2.0	2.0	0.95	ug/l	109		86-111		
Lead	< 1.0	1.0	0.080	ug/l	103		90-115		
Batch number: 11181196902A	Sample number(s): 6332981,6332983,6332985,6332987								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254228
Reported: 07/29/11 at 01:50 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Chloride	< 400	400.	200	ug/l	101		90-110		
Fluoride	< 100	100.	80	ug/l	95		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	100		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	99		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	97		90-110		
Batch number: 11181196902B	Sample number(s): 6332989								
Chloride	< 400	400.	200	ug/l	101		90-110		
Fluoride	< 100	100.	80	ug/l	95		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	100		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	99		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	97		90-110		
Batch number: 11188049502B	Sample number(s): 6332981								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	97		91-113		
Batch number: 11188049503A	Sample number(s): 6332983,6332985,6332987,6332989								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	98		91-113		
Batch number: 11186021202B	Sample number(s): 6332981,6332983,6332985,6332987,6332989								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	103		80-120		
Batch number: 11187020202B	Sample number(s): 6332981,6332983,6332985,6332987,6332989								
Alkalinity to pH 4.5	< 2,000	2,000.	460	ug/l as CaCO3	98		98-103		
Batch number: 11187022101A	Sample number(s): 6332981,6332983,6332985,6332987,6332989								
Ammonia Nitrogen	< 600	600.	200	ug/l	94	93	85-105	1	5
Batch number: 11187023001A	Sample number(s): 6332981,6332983,6332985,6332987,6332989								
Sulfide	< 160	160.	54	ug/l	100		90-110		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 11182WAB026	Sample number(s): 6332981 UNSPK: P332490								
Chrysene	103	102	78-116	4	30				
Fluorene	101	99	71-123	2	30				
Naphthalene	101	98	73-113	2	30				
Phenanthrene	103	98	72-121	1	30				
Pyrene	102	100	77-117	3	30				
Batch number: 111830011A	Sample number(s): 6332981,6332983,6332985,6332987,6332989 UNSPK: P332975 BKG: P332971								
Ethylene dibromide	57*		65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 111871848001	Sample number(s): 6332981-6332986,6332989-6332990 UNSPK: P332979 BKG: P332979								
Cobalt	99	101	87-112	1	20	11.2	10.5	7 (1)	20
Iron	115 (2)	155 (2)	75-125	3	20	11,500	11,700	2	20
Manganese	94 (2)	108 (2)	75-125	2	20	2,460	2,430	1	20

*- Outside of specification
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(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254228
Reported: 07/29/11 at 01:50 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111871848003	Sample number(s): 6332987-6332988 UNSPK: 6332987 BKG: 6332987								
Cobalt	76*	76*	87-112	0	20	228	232	2	20
Iron	1424 (2)	4007 (2)	75-125	5	20	526,000	549,000	4	20
Manganese	87 (2)	91 (2)	75-125	0	20	4,810	4,900	2	20
Batch number: 111876050002A	Sample number(s): 6332981-6332986,6332989-6332990 UNSPK: 6332989 BKG: 6332989								
Arsenic	99	86	75-125	3	20	29.6	29.6	0	20
Lead	113 (2)	-96 (2)	83-120	5	20	576	571	1	20
Batch number: 111886050002A	Sample number(s): 6332987-6332988 UNSPK: P334744 BKG: P334744								
Arsenic	110	102	75-125	2	20	27.0	26.2	3	20
Lead	104	106	83-120	2	20	< 1.0	< 1.0	0 (1)	20
Batch number: 11181196902A	Sample number(s): 6332981,6332983,6332985,6332987 UNSPK: P332969 BKG: P332969								
Chloride	111*		90-110			75,600	80,000	6 (1)	20
Fluoride	78*		90-110			< 500	< 500	0 (1)	20
Nitrate Nitrogen	84*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	81*		90-110			< 500	< 500	0 (1)	20
Sulfate	118*		90-110			508,000	545,000	7	20
Batch number: 11181196902B	Sample number(s): 6332989 UNSPK: 6332989 BKG: 6332989								
Chloride	108		90-110			17,200	17,800	4	20
Fluoride	94		90-110			< 500	< 500	0 (1)	20
Nitrate Nitrogen	105		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	96		90-110			< 500	< 500	0 (1)	20
Sulfate	89*		90-110			8,800	< 5,000	99* (1)	20
Batch number: 11188049502B	Sample number(s): 6332981 UNSPK: P332971 BKG: P332971								
Total Organic Carbon	102		63-142			12,700	12,700	0	3
Batch number: 11188049503A	Sample number(s): 6332983,6332985,6332987,6332989 UNSPK: 6332983 BKG: 6332983								
Total Organic Carbon	106		63-142			5,000	4,900	2 (1)	3
Batch number: 11186021202B	Sample number(s): 6332981,6332983,6332985,6332987,6332989 UNSPK: P334149 BKG: 6332987								
Total Dissolved Solids	96		62-135			7,000,000	7,220,000	3	9
Batch number: 11187020202B	Sample number(s): 6332981,6332983,6332985,6332987,6332989 UNSPK: P332605 BKG: 6332983								
Alkalinity to pH 4.5	97		73-121			315,000	314,000	0	5
Alkalinity to pH 8.3						< 2,000	< 2,000	0 (1)	5
Batch number: 11187022101A	Sample number(s): 6332981,6332983,6332985,6332987,6332989 BKG: P335860								
Ammonia Nitrogen						73,100	72,200	1	6
Batch number: 11187023001A	Sample number(s): 6332981,6332983,6332985,6332987,6332989 UNSPK: P332241 BKG: P332241								
Sulfide	98	92	50-130	7	10	< 160	< 160	0 (1)	5

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254228
Reported: 07/29/11 at 01:50 PM

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: D111872AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6332981	101	103	100	91
6332983	98	102	99	91
6332985	101	101	99	92
6332987	96	101	100	113
6332989	95	99	100	101
Blank	101	103	99	91
LCS	98	99	99	102
LCSD	97	97	99	104
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11182WAB026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6332981	86	97	93
Blank	98	100	96
LCS	96	100	94
MS	98	102	94
MSD	95	101	92
Limits:	52-120	63-114	34-118

Analysis Name: PAHs by 8270
Batch number: 11183WAF026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6332983	94	103	86
6332985	94	105	88
6332987	97	105	81
6332989	92	100	80
Blank	95	102	93
LCS	95	104	92
LCSD	94	101	90
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111830011A

	1,1,2,2-Tetrachloroethane
6332981	76
6332983	81
6332985	90
6332987	100
6332989	102
Blank	93
DUP	66

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254228
Reported: 07/29/11 at 01:50 PM

Surrogate Quality Control

LCS	91
LCSD	90
MS	48
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1254228 Sample # 6332981-90

COC # 266177

Please print. Instructions on reverse side correspond with circled numbers. 1.5-4.3°c

(1) Client: SUN-AQUATERRA Acct. #:

Project Name/#: PHILA REF AOI-11 PWSID #:

Project Manager: T. DOERR P.O.#:

Sampler: S. SYKES Quote #:

Name of state where samples were collected: PA

For Lab Use Only
FSC:
SCR#: 107163

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix: Soil	Water	Other	(4) Total # of Containers	(5) Analyses Requested / Preservation Codes: *	Remarks
S-69D_06292011	6/29/11	1110	X			X		16	X	* See attached for *
S-28D_06292011	6/29/11	1030	X			X		16	X	* list of analyses *
C-12D_06292011	6/29/11	1410	X			X		16	X	
N-21_06292011	6/29/11	1230	X			X		16	X	
N-50D_06292011	6/29/11	910	X			X		16	X	

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
SDG Complete? Yes No
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
Bottle Storage			Sydney	6/22/11	765
Sydney	6/22/11	1950			
AQT	6/29/11	1700	Sample Fridge	6/29/11	1700
	6/30/11	1125	Sydney	6/30/11	1125
Sydney	6/30/11	1530		6/30/11	1530

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

10132|1254228|6332981-90

1.5-4.3°C

Table 1
Constituents of Concern for Groundwater
AOI 11 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.	8260B
1,2-Dichloroethane	107-06-2	
1,2,4-Trimethylbenzene	95-63-6	
1,3,5-Trimethylbenzene	108-67-8	
Benzene	71-43-2	
Cumene	98-82-8	
Ethylbenzene	100-41-4	
Ethylene Dibromide	106-93-4	(8011)
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4	
Toluene	108-88-3	
Xylenes (total)	1330-20-7	

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.	8270C
Chrysene	218-01-9	
Fluorene	86-73-7	
Naphthalene	91-20-3	
Phenanthrene	85-01-8	
Pyrene	129-00-0	

Metals	CAS No.	Method	PADEP Non-Residential Used Aquifer Groundwater MSCs (TDS <2,500) in ug/L
Arsenic (Total & Dissolved)	7440-38-2	6020	10
Cobalt (Total & Dissolved)	7440-48-4	6010B	31
Iron (Total & Dissolved)	7439-89-6	6010B	300
Lead (Total & Dissolved)	7439-92-1	6020	5
Manganese (Total & Dissolved)	7439-96-5	6010B for filtering	300

Misc Parameters	CAS No.		
Ammonia	7664-41-7	SM20 4500	30,000
			USEPA Drinking Water MCLs in mg/L
Chloride	16887-00-6	300.0	250
Fluoride	7782-41-4	300.0	4
Nitrate **48hr hold time**	84145-82-4	300.0	10
Nitrite included in nitrate cost	1594-56-5	300.0	1
Sulfate	18785-72-3	300.0	250
Sulfide	-	SM20 4500	Reported Result
Total Alkalinity	-	SM20 2320	Reported Result
Bicarbonate	71-52-3	SM20 2320	Reported Result
Total Organic Carbon	7440-44-0	SM20 5310	Reported Result
Total Dissolved Solids	CASID10052	SM20 2540	500

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 29, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 07/01/2011
Group Number: 1254487
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
W-1D_06302011 Grab Water	6334708
W-1D_06302011 Filtered Grab Water	6334709
W-13_06302011 Grab Water	6334710
W-13_06302011 Filtered Grab Water	6334711
W-9_06302011 Grab Water	6334712
W-9_06302011 Filtered Grab Water	6334713
S-74D1SRTF_06302011 Grab Water	6334714
S-74D1SRTF_063020 Filt. Grab Water	6334715
S-74D2SRTF_06302011 Grab Water	6334716
S-74D2SRTF_06302011 Filt. Grab Water	6334717

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

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Analysis Report

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Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,

Max E. Snavely
Senior Specialist

Lancaster Laboratories

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Analysis Report

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Sample Description: W-1D_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 W-1D

LLI Sample # WW 6334708
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 10:15 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

-W-1D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	42,100	200	14.1	1
07058	Manganese	7439-96-5	891	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	26,500	2,000	1,000	5
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	15,900	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	455,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	455,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	409,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-1D_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 W-1D

LLI Sample # WW 6334708
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 10:15 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

-W-1D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		ug/l	ug/l	ug/l	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		ug/l	ug/l	ug/l	
00221	Ammonia Nitrogen	7664-41-7	45,400	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 14:38	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 14:38	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/06/2011 14:42	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/07/2011 12:06	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 05:31	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 05:31	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 05:31	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:20	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:20	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601A	07/02/2011 09:23	Joseph E McKenzie	5
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 09:23	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 09:23	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 09:23	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/02/2011 09:23	Joseph E McKenzie	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502A	07/08/2011 04:30	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021201A	07/06/2011 11:26	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: W-1D_06302011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266180 W-1D

LLI Sample # WW 6334709
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 10:15 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	10,400	200	14.1	1
07058	Manganese	7439-96-5	836	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 05:54	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 05:54	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 05:54	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:22	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:22	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: W-13_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 W-13

LLI Sample # WW 6334710
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 11:25 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W--13

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	69,400	200	14.1	1
07058	Manganese	7439-96-5	1,830	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	6.2	2.0	0.95	1
06035	Lead	7439-92-1	23.8	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	22,200	2,000	1,000	5
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	16,200	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	549,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	549,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	492,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-13_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 W-13

LLI Sample # WW 6334710
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 11:25 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W--13

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	35,300	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 14:59	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 14:59	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/06/2011 15:08	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/11/2011 23:23	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 05:57	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 05:57	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 05:57	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:28	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:28	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601A	07/02/2011 10:07	Joseph E McKenzie	5
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 10:07	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 10:07	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 10:07	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/02/2011 10:07	Joseph E McKenzie	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502A	07/08/2011 04:52	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021201A	07/06/2011 11:26	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-13_06302011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266180 W-13

LLI Sample # WW 6334711
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 11:25 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	1,440	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:08	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:08	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:08	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:29	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:29	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-9_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 W-9

LLI Sample # WW 6334712
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 10:45 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

-W--9

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	58,800	200	14.1	1
07058	Manganese	7439-96-5	1,860	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	5.1	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	18,200	2,000	1,000	5
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	15,100	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	335,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	335,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	324,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-9_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 W-9

LLI Sample # WW 6334712
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 10:45 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

-W--9

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		ug/l	ug/l	ug/l	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		ug/l	ug/l	ug/l	
00221	Ammonia Nitrogen	7664-41-7	26,700	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 15:21	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 15:21	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/06/2011 15:35	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/11/2011 23:53	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:12	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:12	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:12	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:31	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:31	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601A	07/02/2011 09:52	Joseph E McKenzie	5
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 09:52	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 09:52	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 09:52	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/02/2011 09:52	Joseph E McKenzie	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502A	07/08/2011 05:15	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021201A	07/06/2011 11:26	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: W-9_06302011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266180 W-9

LLI Sample # WW 6334713
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 10:45 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	10,400	200	14.1	1
07058	Manganese	7439-96-5	1,690	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:15	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:15	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:15	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:33	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:33	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-74D1SRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 S-74D1SRTF

LLI Sample # WW 6334714
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 13:10 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D1-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.028	0.028	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	24.4	5.0	0.62	1
01754	Iron	7439-89-6	39,200	200	14.1	1
07058	Manganese	7439-96-5	171	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	18.8	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	45,600	4,000	2,000	10
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	8,200	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	298,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	298,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	313,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-74D1SRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 S-74D1SRTF

LLI Sample # WW 6334714
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 13:10 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D1-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	26,200	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 15:42	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 15:42	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/06/2011 16:02	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/12/2011 00:24	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:19	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:19	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:19	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:35	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:35	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601A	07/11/2011 17:16	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 10:37	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 10:37	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 10:37	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/02/2011 10:37	Joseph E McKenzie	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502A	07/08/2011 05:21	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023001A	07/06/2011 09:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-74D1SRTF_063020 Filt. Grab Water
Philadelphia Refinery AOI-11
COC: 266180 S-74D1SRTF

LLI Sample # WW 6334715
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 13:10 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	24.3	5.0	0.62	1
01754	Iron	7439-89-6	6,360	200	14.1	1
07058	Manganese	7439-96-5	177	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:23	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:23	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:23	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:36	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:36	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-74D2SRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 S-74D2SRTF

LLI Sample # WW 6334716
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 13:50 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D2-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	25,700	200	14.1	1
07058	Manganese	7439-96-5	268	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	4.1	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	36,500	4,000	2,000	10
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	7,400	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	534,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	534,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	594,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-74D2SRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266180 S-74D2SRTF

LLI Sample # WW 6334716
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 13:50 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D2-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	16,800	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 16:04	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 16:04	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/06/2011 16:28	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/08/2011 11:32	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:26	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:26	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:26	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:38	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:38	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601A	07/11/2011 17:46	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 11:07	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 11:07	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 11:07	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/02/2011 11:07	Joseph E McKenzie	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502A	07/08/2011 05:30	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023002A	07/06/2011 12:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-74D2SRTF_06302011 Filt. Grab Water
Philadelphia Refinery AOI-11
COC: 266180 S-74D2SRTF

LLI Sample # WW 6334717
LLI Group # 1254487
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 13:50 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:02

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	529	200	14.1	1
07058	Manganese	7439-96-5	253	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:30	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:30	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:30	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:40	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:40	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254487
Reported: 07/29/11 at 02:02 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F111881AA	Sample number(s): 6334708,6334710,6334712,6334714,6334716								
Benzene	< 1	1.	0.5	ug/l	92	89	79-120	3	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	90	87	70-130	3	30
Ethylbenzene	< 1	1.	0.5	ug/l	92	90	79-120	2	30
Isopropylbenzene	< 2	2.	0.5	ug/l	91	90	77-120	2	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	86	83	76-120	4	30
Toluene	< 1	1.	0.5	ug/l	92	89	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	88	85	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	90	87	75-120	3	30
Xylene (Total)	< 1	1.	0.5	ug/l	90	88	80-120	2	30
Batch number: 11183WAG026	Sample number(s): 6334708,6334710,6334712,6334714,6334716								
Chrysene	< 5	5.	1	ug/l	100	100	82-112	0	30
Fluorene	< 5	5.	1	ug/l	96	91	82-113	5	30
Naphthalene	< 5	5.	1	ug/l	95	93	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	95	96	83-112	1	30
Pyrene	< 5	5.	1	ug/l	99	97	80-115	3	30
Batch number: 111860012A	Sample number(s): 6334708,6334710,6334712,6334714,6334716								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	100	60-140	0	20
Batch number: 111881848002	Sample number(s): 6334708-6334717								
Cobalt	< 5.0	5.0	0.62	ug/l	102		90-110		
Iron	< 200	200.	14.1	ug/l	101		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	102		90-110		
Batch number: 111886050001A	Sample number(s): 6334708-6334717								
Arsenic	< 2.0	2.0	0.95	ug/l	105		86-111		
Lead	< 1.0	1.0	0.080	ug/l	102		90-115		
Batch number: 11183373601A	Sample number(s): 6334708,6334710,6334712,6334714,6334716								
Chloride	< 400	400.	200	ug/l	100		90-110		
Fluoride	< 100	100.	80	ug/l	101		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	100		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	95		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	99		90-110		
Batch number: 11189049502A	Sample number(s): 6334708,6334710,6334712,6334714,6334716								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	106		91-113		
Batch number: 11187021201A	Sample number(s): 6334708,6334710,6334712								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	101		80-120		
Batch number: 11187021202B	Sample number(s): 6334714,6334716								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	99		80-120		
Batch number: 11187023001A	Sample number(s): 6334708,6334710,6334712,6334714								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254487
Reported: 07/29/11 at 02:02 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Sulfide	< 160	160.	54	ug/l	100		90-110		
Batch number: 11187023002A	Sample number(s): 6334716								
Sulfide	< 160	160.	54	ug/l	97		90-110		
Batch number: 11188022101A	Sample number(s): 6334708,6334710,6334712,6334714,6334716								
Ammonia Nitrogen	< 600	600.	200	ug/l	94	93	85-105	2	5
Batch number: 11189020201A	Sample number(s): 6334708,6334710,6334712,6334714,6334716								
Alkalinity to pH 4.5	< 2,000	2,000.	460	ug/l as CaCO3	99		98-103		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111860012A	Sample number(s): 6334708,6334710,6334712,6334714,6334716 UNSPK: 6334708 BKG: P334724								
Ethylene dibromide	74		65-135			< 0.028	< 0.028	0 (1)	30
Batch number: 111881848002	Sample number(s): 6334708-6334717 UNSPK: 6334708 BKG: 6334708								
Cobalt	99	97	87-112	2	20	< 5.0	< 5.0	0 (1)	20
Iron	131 (2)	165 (2)	75-125	1	20	42,100	41,500	1	20
Manganese	102	99	75-125	1	20	891	894	0	20
Batch number: 111886050001A	Sample number(s): 6334708-6334717 UNSPK: P334726 BKG: P334726								
Arsenic	107	111	75-125	2	20	7.6	7.7	2 (1)	20
Lead	103	103	83-120	0	20	< 1.0	< 1.0	71* (1)	20
Batch number: 11183373601A	Sample number(s): 6334708,6334710,6334712,6334714,6334716 UNSPK: P334722 BKG: P334722								
Chloride	97		90-110			24,300	24,400	1	20
Fluoride	100		90-110			< 500	< 500	0 (1)	20
Nitrate Nitrogen	114*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	107		90-110			< 500	< 500	0 (1)	20
Sulfate	117*		90-110			< 5,000	< 5,000	28* (1)	20
Batch number: 11189049502A	Sample number(s): 6334708,6334710,6334712,6334714,6334716 UNSPK: 6334708 BKG: 6334708								
Total Organic Carbon	98		63-142			15,900	15,800	0	3
Batch number: 11187021201A	Sample number(s): 6334708,6334710,6334712 UNSPK: P333460 BKG: P333460								
Total Dissolved Solids	112	114	62-135	1	12	31,300,000	29,400,000	6	9
Batch number: 11187021202B	Sample number(s): 6334714,6334716 UNSPK: P333815 BKG: 6334716								
Total Dissolved Solids	92	94	62-135	1	12	594,000	598,000	1	9
Batch number: 11187023001A	Sample number(s): 6334708,6334710,6334712,6334714 UNSPK: P332241 BKG: P332241								
Sulfide	98	92	50-130	7	10	< 160	< 160	0 (1)	5
Batch number: 11187023002A	Sample number(s): 6334716 UNSPK: P333872 BKG: P333872								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254487
Reported: 07/29/11 at 02:02 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Sulfide	96	87	50-130	9	10	< 160	< 160	0 (1)	5
Batch number: 11188022101A	Sample number(s): 6334708,6334710,6334712,6334714,6334716 BKG: P335876								
Ammonia Nitrogen						13,900	13,300	5	6
Batch number: 11189020201A	Sample number(s): 6334708,6334710,6334712,6334714,6334716 UNSPK: P334718 BKG: P334718								
Alkalinity to pH 4.5	98		73-121			204,000	214,000	5	5
Alkalinity to pH 8.3						< 2,000	< 2,000	0 (1)	5

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111881AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6334708	97	102	101	93
6334710	97	101	104	94
6334712	97	101	101	91
6334714	97	102	101	93
6334716	97	102	102	93
Blank	99	98	102	92
LCS	96	101	102	99
LCSD	96	100	101	98
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11183WAG026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6334708	93	104	89
6334710	93	100	89
6334712	95	103	89
6334714	93	102	91
6334716	90	103	90
Blank	93	100	92
LCS	95	103	92
LCSD	91	101	90
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111860012A

	1,1,2,2-Tetrachloroethane

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254487
Reported: 07/29/11 at 02:02 PM

Surrogate Quality Control

6334708	68
6334710	80
6334712	85
6334714	87
6334716	85
Blank	88
DUP	78
LCS	90
LCSD	92
MS	67
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1254487 Sample # 6334708 -17

COC # 266180

Please print. Instructions on reverse side correspond with circled numbers. 0.8 - 3.8°C

(1)

Client: SUN - Aquaterra Acct. #:

Project Name/#: PHila. Ref. AOI-11 PWSID #:

Project Manager: T. Doerr P.O.#:

Sampler: M. Hinderling Quote #:

Name of state where samples were collected: PA

For Lab Use Only

FSC:

SCR#:

Preservation Codes

H=HCl T=Thiosulfate

N=HNO_3 B=NaOH

S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix: Soil	Water (Potable / NPDES)	Other	(4) Total # of Containers	(5) Analyses Requested / Preservation Codes *	Remarks
W-1D_06302011	6/30/11	1015	X			X		16	X	*See attached for *
W-13_06302011	6/30/11	1125	X			X		16	X	*list of analyses *
W-9_06302011	6/30/11	1045	X			X		16	X	
S-74D1SRTF_06302011	6/30/11	1310	X			X		16	X	
S-74D2SRTF_06302011	6/30/11	1350	X			X		16	X	

(7) **Turnaround Time Requested** (TAT) (please circle): (Normal) Rush

(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)

Date results are needed:

Rush results requested by (please circle): Phone Fax E-mail

Phone #: Fax #:

E-mail address:

(8) **Data Package Options** (please circle if required)

Type I (validation/NJ Reg) TX TRRP-13

Type II (Tier II) MA MCP CT RCP

Type III (Reduced NJ)

Type IV (CLP SOW)

Type VI (Raw Data Only)

SDG Complete? (Yes) No

Site-specific QC (MS/MSD/Dup)? Yes (No)

(If yes, indicate QC sample and submit triplicate volume.)

Internal COC Required? Yes / No

Relinquished by:	Date	Time	Received by:	Date	Time
	6/30/11	1700	Fridge	6/30/11	1700
	7/1/11	1030		7/1/11	1030
	7/1/11	1745			
				7/1/11	1745

(9)

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766

Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management 2102.05

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL LANCASTER LABORATORIES BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF LANCASTER LABORATORIES AND (B) WHETHER LANCASTER LABORATORIES HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Lancaster Laboratories which includes any conditions that vary from the Standard Terms and Conditions, and Lancaster hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

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Analysis Report

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 29, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 07/01/2011
Group Number: 1254488
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-76DSRTF_06302011 Grab Water	6334718
S-76DSRTF_06302011 Filt. Grab Water	6334719
S-106DSRTF_06302011 Grab Water	6334720
S-106DSRTF_06302011 Filt. Grab Water	6334721
S-120DSRTF_06302011 Grab Water	6334722
S-120DSRTF_06302011 Filt. Grab Water	6334723
W-19_06302011 Grab Water	6334724
W-19_06302011 Filtered Grab Water	6334725
W-26_06302011 Grab Water	6334726
W-26_06302011 Filtered Grab Water	6334727
W-32D_06302011 Grab Water	6334728
W-32D_06302011 Filtered Grab Water	6334729

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

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Analysis Report

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Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,

Max E. Snavely
Senior Specialist

Lancaster Laboratories

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Analysis Report

REVISED

Sample Description: S-76DSRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-76DSRTF

LLI Sample # WW 6334718
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 14:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

76D--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	3	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.028	0.028	0.0094	1
Metals	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	1,840	200	14.1	1
07058	Manganese	7439-96-5	3,470	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		**ug/l**	**ug/l**	**ug/l**	
00224	Chloride	16887-00-6	33,400	4,000	2,000	10
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
	The method requirement for Nitrate Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <0.50 mg/l.					
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
	The method requirement for Nitrite Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <0.50 mg/l.					
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		**ug/l**	**ug/l**	**ug/l**	

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-76DSRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-76DSRTF

LLI Sample # WW 6334718
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 14:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

76D--

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry		**SM20 5310 C**		**ug/l**	**ug/l**	**ug/l**	
00273	Total Organic Carbon		n.a.	2,400	1,000	500	1
		SM20 2320 B		**ug/l as CaCO3**	**ug/l as CaCO3**	**ug/l as CaCO3**	
00202	Alkalinity to pH 4.5		n.a.	204,000	2,000	460	1
00201	Alkalinity to pH 8.3		n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity		n.a.	204,000	2,000	460	1
		SM20 2540 C		**ug/l**	**ug/l**	**ug/l**	
00212	Total Dissolved Solids		n.a.	268,000	30,000	9,700	1
		SM20 4500 S2 D		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide		18496-25-8	< 160	160	54	1
		SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen		7664-41-7	4,800	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 16:25	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 16:25	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/06/2011 16:55	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/12/2011 00:54	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:34	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:34	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:34	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:42	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:42	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601B	07/11/2011 18:47	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11183373601B	07/06/2011 10:22	Ashley M Adams	5

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-76DSRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-76DSRTF

LLI Sample # WW 6334718
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 14:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

76D--

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 12:36	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 12:36	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11183373601B	07/06/2011 10:22	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502A	07/08/2011 05:36	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023002A	07/06/2011 12:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: S-76DSRTF_06302011 Filt. Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-76DSRTF

LLI Sample # WW 6334719
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 14:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	949	200	14.1	1
07058	Manganese	7439-96-5	3,540	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:38	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:38	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:38	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:44	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:44	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-106DSRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-106DSRTF

LLI Sample # WW 6334720
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 13:30 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

106D-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	260	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	9.4	5.0	0.62	1
01754	Iron	7439-89-6	29,900	200	14.1	1
07058	Manganese	7439-96-5	969	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	5.1	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	48,800	4,000	2,000	10
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	33,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	11,200	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	409,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	409,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	511,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

REVISED

Sample Description: S-106DSRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-106DSRTF

LLI Sample # WW 6334720
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 13:30 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

106D-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	16,200	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 16:47	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 16:47	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/06/2011 17:21	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/12/2011 01:25	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:41	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:41	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:41	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:49	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:49	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601A	07/11/2011 17:31	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 10:52	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 10:52	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 10:52	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/02/2011 10:52	Joseph E McKenzie	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 05:44	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023002A	07/06/2011 12:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-106DSRTF_06302011 Filt. Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-106DSRTF

LLI Sample # WW 6334721
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 13:30 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	10.2	5.0	0.62	1
01754	Iron	7439-89-6	1,710	200	14.1	1
07058	Manganese	7439-96-5	913	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:52	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:52	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:52	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:51	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:51	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-120DSRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-120DSRTF

LLI Sample # WW 6334722
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 14:05 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

120-D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	4	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	30	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	37,800	200	14.1	1
07058	Manganese	7439-96-5	1,890	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	9.2	2.0	0.95	1
06035	Lead	7439-92-1	14.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	24,300	4,000	2,000	10
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	12,900	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	354,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	354,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	394,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-120DSRTF_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-120DSRTF

LLI Sample # WW 6334722
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 14:05 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

120-D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	20,300	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 17:09	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 17:09	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/06/2011 17:48	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/12/2011 01:55	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:55	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:55	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:55	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:53	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:53	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	2	11183373601A	07/11/2011 18:02	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 11:22	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 11:22	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 11:22	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/02/2011 11:22	Joseph E McKenzie	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 06:06	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023002A	07/06/2011 12:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: S-120DSRTF_06302011 Filt. Grab Water
Philadelphia Refinery AOI-11
COC: 266181 S-120DSRTF

LLI Sample # WW 6334723
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 14:05 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	< 200	200	14.1	1
07058	Manganese	7439-96-5	1,710	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 06:59	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 06:59	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 06:59	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:55	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:55	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-19_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 W-19

LLI Sample # WW 6334724
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 10:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

-W-19

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.028	0.028	0.0094	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	74,200	200	14.1	1
07058	Manganese	7439-96-5	581	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	56,900	10,000	5,000	25
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	301,000	25,000	7,500	25
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	15,700	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	326,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	326,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	819,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-19_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 W-19

LLI Sample # WW 6334724
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 10:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

-W-19

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	13,000	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 17:30	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 17:30	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/06/2011 18:14	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/12/2011 02:25	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 07:03	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 07:03	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 07:03	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:56	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:56	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601A	07/11/2011 17:01	Ashley M Adams	25
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 09:37	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 09:37	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 09:37	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/11/2011 17:01	Ashley M Adams	25
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 06:14	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023002A	07/06/2011 12:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-19_06302011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266181 W-19

LLI Sample # WW 6334725
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 10:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	42,000	200	14.1	1
07058	Manganese	7439-96-5	562	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 07:06	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 07:06	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 07:06	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:58	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:58	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-26_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 W-26

LLI Sample # WW 6334726
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 09:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

-W-26

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.028	0.028	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	57,900	200	14.1	1
07058	Manganese	7439-96-5	2,740	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	7.6	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	15,800	2,000	1,000	5
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	14,200	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	200,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	200,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	254,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-26_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 W-26

LLI Sample # WW 6334726
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 09:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

-W-26

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	9,900	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111881AA	07/07/2011 17:51	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111881AA	07/07/2011 17:51	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/07/2011 01:55	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/08/2011 12:02	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 07:10	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 07:10	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 07:10	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 09:10	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 09:10	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601A	07/02/2011 09:08	Joseph E McKenzie	5
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 09:08	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 09:08	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 09:08	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/02/2011 09:08	Joseph E McKenzie	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 06:22	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023002A	07/06/2011 12:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: W-26_06302011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266181 W-26

LLI Sample # WW 6334727
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 09:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	25,900	200	14.1	1
07058	Manganese	7439-96-5	2,760	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848002	07/08/2011 07:13	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848002	07/08/2011 07:13	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848002	07/08/2011 07:13	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050001A	07/12/2011 10:00	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050001A	07/12/2011 10:00	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848002	07/07/2011 12:52	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050001	07/08/2011 09:55	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-32D_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 W-32D

LLI Sample # WW 6334728
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 11:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-23D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	68,500	200	14.1	1
07058	Manganese	7439-96-5	2,460	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	10.5	2.0	0.95	1
06035	Lead	7439-92-1	19.4	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	11,400	2,000	1,000	5
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	33,800	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	25,500	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	547,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	547,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	581,000	60,000	19,400	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-32D_06302011 Grab Water
Philadelphia Refinery AOI-11
COC: 266181 W-32D

LLI Sample # WW 6334728
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 11:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-23D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	31,700	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111882AA	07/07/2011 15:32	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111882AA	07/07/2011 15:32	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11183WAG026	07/07/2011 02:21	Mark A Clark	1
07807	BNA Water Extraction	SW-846 3510C	1	11183WAG026	07/05/2011 08:15	Catherine R Wiker	1
07879	EDB in Wastewater	SW-846 8011	1	111860012A	07/12/2011 03:26	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111860012A	07/06/2011 11:45	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 22:39	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 22:39	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 22:39	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:13	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:13	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601A	07/02/2011 10:22	Joseph E McKenzie	5
01504	Fluoride	EPA 300.0	1	11183373601A	07/02/2011 10:22	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 10:22	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601A	07/02/2011 10:22	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601A	07/02/2011 10:22	Joseph E McKenzie	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 06:45	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201A	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11187021202B	07/06/2011 11:30	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11187023002A	07/06/2011 12:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: W-32D_06302011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 266181 W-32D

LLI Sample # WW 6334729
LLI Group # 1254488
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 06/30/2011 11:40 by SS

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 13:59

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	1,760	200	14.1	1
07058	Manganese	7439-96-5	2,180	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 22:43	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 22:43	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 22:43	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:15	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:15	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254488
Reported: 07/29/11 at 01:59 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F111881AA	Sample number(s): 6334718,6334720,6334722,6334724,6334726								
Benzene	< 1	1.	0.5	ug/l	92	89	79-120	3	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	90	87	70-130	3	30
Ethylbenzene	< 1	1.	0.5	ug/l	92	90	79-120	2	30
Isopropylbenzene	< 2	2.	0.5	ug/l	91	90	77-120	2	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	86	83	76-120	4	30
Toluene	< 1	1.	0.5	ug/l	92	89	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	88	85	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	90	87	75-120	3	30
Xylene (Total)	< 1	1.	0.5	ug/l	90	88	80-120	2	30
Batch number: F111882AA	Sample number(s): 6334728								
Benzene	< 1	1.	0.5	ug/l	92	89	79-120	4	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	91	90	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	92	90	79-120	3	30
Isopropylbenzene	< 2	2.	0.5	ug/l	93	91	77-120	2	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	83	84	76-120	0	30
Toluene	< 1	1.	0.5	ug/l	93	89	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	89	87	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	91	88	75-120	2	30
Xylene (Total)	< 1	1.	0.5	ug/l	91	90	80-120	2	30
Batch number: 11183WAG026	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728								
Chrysene	< 5	5.	1	ug/l	100	100	82-112	0	30
Fluorene	< 5	5.	1	ug/l	96	91	82-113	5	30
Naphthalene	< 5	5.	1	ug/l	95	93	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	95	96	83-112	1	30
Pyrene	< 5	5.	1	ug/l	99	97	80-115	3	30
Batch number: 111860012A	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	100	60-140	0	20
Batch number: 111881848002	Sample number(s): 6334718-6334727								
Cobalt	< 5.0	5.0	0.62	ug/l	102		90-110		
Iron	< 200	200.	14.1	ug/l	101		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	102		90-110		
Batch number: 111881848003	Sample number(s): 6334728-6334729								
Cobalt	< 5.0	5.0	0.62	ug/l	97		90-110		
Iron	< 200	200.	14.1	ug/l	101		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	100		90-110		
Batch number: 111886050001A	Sample number(s): 6334718-6334727								
Arsenic	< 2.0	2.0	0.95	ug/l	105		86-111		
Lead	< 1.0	1.0	0.080	ug/l	102		90-115		
Batch number: 111886050002A	Sample number(s): 6334728-6334729								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254488
Reported: 07/29/11 at 01:59 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Arsenic	< 2.0	2.0	0.95	ug/l	109		86-111		
Lead	< 1.0	1.0	0.080	ug/l	103		90-115		
Batch number: 11183373601A	Sample number(s): 6334720,6334722,6334724,6334726,6334728								
Chloride	< 400	400.	200	ug/l	100		90-110		
Fluoride	< 100	100.	80	ug/l	101		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	100		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	95		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	99		90-110		
Batch number: 11183373601B	Sample number(s): 6334718								
Chloride	< 400	400.	200	ug/l	100		90-110		
Fluoride	< 100	100.	80	ug/l	101		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	100		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	95		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	99		90-110		
Batch number: 11189049502A	Sample number(s): 6334718								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	106		91-113		
Batch number: 11189049502B	Sample number(s): 6334720,6334722,6334724,6334726,6334728								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	106		91-113		
Batch number: 11187021202B	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	99		80-120		
Batch number: 11187023002A	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728								
Sulfide	< 160	160.	54	ug/l	97		90-110		
Batch number: 11188022101A	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728								
Ammonia Nitrogen	< 600	600.	200	ug/l	94	93	85-105	2	5
Batch number: 11189020201A	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728								
Alkalinity to pH 4.5	< 2,000	2,000.	460	ug/l as CaCO3	99		98-103		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111860012A	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728 UNSPK: P334708 BKG: 6334724								
Ethylene dibromide	74		65-135			< 0.028	< 0.028	0 (1)	30
Batch number: 111881848002	Sample number(s): 6334718-6334727 UNSPK: P334708 BKG: P334708								
Cobalt	99	97	87-112	2	20	< 5.0	< 5.0	0 (1)	20
Iron	131 (2)	165 (2)	75-125	1	20	42,100	41,500	1	20
Manganese	102	99	75-125	1	20	891	894	0	20
Batch number: 111881848003	Sample number(s): 6334728-6334729 UNSPK: P335984 BKG: P335984								
Cobalt	100	99	87-112	1	20	< 5.0	< 5.0	0 (1)	20

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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254488
Reported: 07/29/11 at 01:59 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Iron	43 (2)	53 (2)	75-125	1	20	12,300	11,800	4	20
Manganese	94	96	75-125	1	20	420	407	3	20
Batch number: 111886050001A	Sample number(s): 6334718-6334727 UNSPK: 6334726 BKG: 6334726								
Arsenic	107	111	75-125	2	20	7.6	7.7	2 (1)	20
Lead	103	103	83-120	0	20	< 1.0	< 1.0	71* (1)	20
Batch number: 111886050002A	Sample number(s): 6334728-6334729 UNSPK: P334744 BKG: P334744								
Arsenic	110	102	75-125	2	20	27.0	26.2	3	20
Lead	104	106	83-120	2	20	< 1.0	< 1.0	0 (1)	20
Batch number: 11183373601A	Sample number(s): 6334720,6334722,6334724,6334726,6334728 UNSPK: 6334722 BKG: 6334722								
Chloride	97		90-110			24,300	24,400	1	20
Fluoride	100		90-110			< 500	< 500	0 (1)	20
Nitrate Nitrogen	114*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	107		90-110			< 500	< 500	0 (1)	20
Sulfate	117*		90-110			< 5,000	< 5,000	28* (1)	20
Batch number: 11183373601B	Sample number(s): 6334718 UNSPK: 6334718 BKG: 6334718								
Chloride	95		90-110			33,400	32,800	2	20
Fluoride	101		90-110			< 500	< 500	0 (1)	20
Nitrate Nitrogen	111*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	103		90-110			< 500	< 500	0 (1)	20
Sulfate	110		90-110			< 5,000	< 5,000	3 (1)	20
Batch number: 11189049502A	Sample number(s): 6334718 UNSPK: P334708 BKG: P334708								
Total Organic Carbon	98		63-142			15,900	15,800	0	3
Batch number: 11189049502B	Sample number(s): 6334720,6334722,6334724,6334726,6334728 UNSPK: 6334720 BKG: 6334720								
Total Organic Carbon	101		63-142			11,200	11,100	1	3
Batch number: 11187021202B	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728 UNSPK: P333815 BKG: P334716								
Total Dissolved Solids	92	94	62-135	1	12	594,000	598,000	1	9
Batch number: 11187023002A	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728 UNSPK: P333872 BKG: P333872								
Sulfide	96	87	50-130	9	10	< 160	< 160	0 (1)	5
Batch number: 11188022101A	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728 BKG: P335876								
Ammonia Nitrogen						13,900	13,300	5	6
Batch number: 11189020201A	Sample number(s): 6334718,6334720,6334722,6334724,6334726,6334728 UNSPK: 6334718 BKG: 6334718								
Alkalinity to pH 4.5	98		73-121			204,000	214,000	5	5
Alkalinity to pH 8.3						< 2,000	< 2,000	0 (1)	5

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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254488
Reported: 07/29/11 at 01:59 PM

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111881AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6334718	96	99	101	93
6334720	96	99	100	96
6334722	95	100	103	95
6334724	97	100	102	94
6334726	95	98	101	92
Blank	99	98	102	92
LCS	96	101	102	99
LCSD	96	100	101	98
Limits:	80-116	77-113	80-113	78-113

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111882AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6334728	98	104	100	92
Blank	97	102	100	93
LCS	96	101	101	99
LCSD	96	103	102	97
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11183WAG026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6334718	95	103	95
6334720	90	98	87
6334722	96	104	91
6334724	92	101	91
6334726	94	103	91
6334728	89	98	80
Blank	93	100	92
LCS	95	103	92
LCSD	91	101	90
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111860012A

	1,1,2,2-Tetrachloroethane
6334718	80
6334720	63
6334722	104
6334724	85
6334726	86
6334728	84
Blank	88

*- Outside of specification
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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254488
Reported: 07/29/11 at 01:59 PM

Surrogate Quality Control

DUP	78
LCS	90
LCSD	92
MS	67
Limits:	46-136

*- Outside of specification
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(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1254488 Sample # 6334718-29

COC # 266181

Please print. Instructions on reverse side correspond with circled numbers. 0.8-3.8°C

(1)
Client: SUN- AQUATERRA Acct. #:
Project Name/#: PHILA REF AOI-11 PWSID #:
Project Manager: T. DOERR P.O.#:
Sampler: S. SYKES Quote #:
Name of state where samples were collected: PA

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix (4) Soil	Water (Check if ☐ Potable ☐ NPDES Applicable)	Other	Total # of Containers	(5) Analyses Requested / Preservation Codes ★	Remarks
S-76D SRTF_06302011	6/30/11	1440	X			X		16	X	★ See attached for list of analyses ★
S-106D SRTF_06302011	6/30/11	1330	X			X		16	X	
S-120D SRTF_06302011	6/30/11	1405	X			X		16	X	
W-19_06302011	6/30/11	1040	X			X		16	X	
W-26_06302011	6/30/11	940	X			X		16	X	
W-32D_06302011	6/30/11	1140	X			X		16	X	

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg) TX TRRP-13
Type II (Tier II) MA MCP CT RCP
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
SDG Complete? Yes No
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
FAC	6/30/11	1700	Sample Fridge	6/30/11	1700
	7/1/11	1030	DRyody	7/1/11	1030
DRyody 7/1/11		1745			

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Lancaster Laboratories

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Analysis Report

REVISED

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

July 29, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 07/01/2011
Group Number: 1254490
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
A-21D_07012011 Grab Water	6334738
A-21D_07012011 Filtered Grab Water	6334739
B-132D_07012011 Grab Water	6334740
B-132D_07012011 Filtered Grab Water	6334741
A-13D_07012011 Grab Water	6334742
A-13D_07012011 Filtered Grab Water	6334743
A-19D_07012011 Grab Water	6334744
A-19D_07012011 Filtered Grab Water	6334745

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

Lancaster Laboratories

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Analysis Report

REVISED

Questions? Contact your Client Services Representative
Loran A Carter at (717) 656-2300 Ext. 1375

Respectfully Submitted,

Max E. Snavely
Senior Specialist

Lancaster Laboratories

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Analysis Report

REVISED

Sample Description: A-21D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 258153 A-21D

LLI Sample # WW 6334738
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 10:20 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-21D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	45,400	200	14.1	1
07058	Manganese	7439-96-5	638	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	4.6	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		**ug/l**	**ug/l**	**ug/l**	
00224	Chloride	16887-00-6	62,300	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
	The method requirement for Nitrate Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <0.50 mg/l.					
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
	The method requirement for Nitrite Nitrogen is a Continuing Calibration Verification standard (CCV) and Continuing Calibration Blank (CCB) must be analyzed every 10 samples. For the reported result, 11 samples were analyzed between CCV/CCB pairs. The sample was repeated outside of the 48 hour holding time with a result of <0.50 mg/l.					
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		**ug/l**	**ug/l**	**ug/l**	

*=This limit was used in the evaluation of the final result

Sample Description: A-21D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 258153 A-21D

LLI Sample # WW 6334738
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 10:20 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-21D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 5310 C**		**ug/l**	**ug/l**	**ug/l**	
00273	Total Organic Carbon	n.a.	9,600	1,000	500	1
	SM20 2320 B		**ug/l as CaCO3**	**ug/l as CaCO3**	**ug/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	289,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	289,000	2,000	460	1
	SM20 2540 C		**ug/l**	**ug/l**	**ug/l**	
00212	Total Dissolved Solids	n.a.	352,000	30,000	9,700	1
	SM20 4500 S2 D		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	25,500	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111882AA	07/07/2011 17:19	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111882AA	07/07/2011 17:19	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11187WAG026	07/13/2011 23:02	Jennifer R Riggs	1
07807	BNA Water Extraction	SW-846 3510C	1	11187WAG026	07/07/2011 08:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111870028A	07/09/2011 08:03	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111870028A	07/07/2011 13:30	Kerrie A Freeburn	1
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:22	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:22	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:22	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:35	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:35	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601B	07/11/2011 21:04	Ashley M Adams	20

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: **A-21D_07012011 Grab Water**
Philadelphia Refinery AOI-11
COC: 258153 A-21D

LLI Sample # WW 6334738
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 10:20 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-21D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01504	Fluoride	EPA 300.0	1	11183373601B	07/06/2011 12:51	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 14:35	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 14:35	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11183373601B	07/06/2011 12:51	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049502B	07/08/2011 07:22	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11188021201A	07/07/2011 06:22	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: A-21D_07012011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258153 A-21D

LLI Sample # WW 6334739
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 10:20 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	27,000	200	14.1	1
07058	Manganese	7439-96-5	611	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:25	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:25	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:25	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:37	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:37	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

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Sample Description: B-132D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 258153 B-132D

LLI Sample # WW 6334740
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 09:00 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B132D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	37,100	200	14.1	1
07058	Manganese	7439-96-5	247	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	4.3	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	68,800	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	8,000	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	307,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	307,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	343,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: B-132D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 258153 B-132D

LLI Sample # WW 6334740
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 09:00 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B132D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**ug/l**	**ug/l**	**ug/l**	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		**ug/l**	**ug/l**	**ug/l**	
00221	Ammonia Nitrogen	7664-41-7	26,400	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111882AA	07/07/2011 17:41	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111882AA	07/07/2011 17:41	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11187WAG026	07/13/2011 23:27	Jennifer R Riggs	1
07807	BNA Water Extraction	SW-846 3510C	1	11187WAG026	07/07/2011 08:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111870028A	07/09/2011 08:33	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111870028A	07/07/2011 13:30	Kerrie A Freeburn	1
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:36	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:36	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:36	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:38	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:38	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601B	07/11/2011 21:34	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11183373601B	07/02/2011 15:20	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 15:20	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 15:20	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601B	07/11/2011 21:19	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049503A	07/08/2011 07:45	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11188021201A	07/07/2011 06:22	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: B-132D_07012011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258153 B-132D

LLI Sample # WW 6334741
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 09:00 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	18,100	200	14.1	1
07058	Manganese	7439-96-5	246	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:39	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:39	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:39	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:40	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:40	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

REVISED

Sample Description: A-13D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 258153 A-13D

LLI Sample # WW 6334742
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:30 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-13D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	4	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	44,400	200	14.1	1
07058	Manganese	7439-96-5	647	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	4.4	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	90,200	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	< 5,000	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	9,300	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	316,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	316,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	456,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: A-13D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 258153 A-13D

LLI Sample # WW 6334742
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:30 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-13D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		ug/l	ug/l	ug/l	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		ug/l	ug/l	ug/l	
00221	Ammonia Nitrogen	7664-41-7	14,400	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111882AA	07/07/2011 18:02	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111882AA	07/07/2011 18:02	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11187WAG026	07/13/2011 23:51	Jennifer R Riggs	1
07807	BNA Water Extraction	SW-846 3510C	1	11187WAG026	07/07/2011 08:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111870028A	07/09/2011 10:03	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111870028A	07/07/2011 13:30	Kerrie A Freeburn	1
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:43	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:43	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:43	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:42	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:42	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601B	07/11/2011 22:05	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11183373601B	07/02/2011 15:35	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 15:35	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 15:35	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601B	07/11/2011 21:50	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049503A	07/08/2011 07:52	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11188021201A	07/07/2011 06:22	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: A-13D_07012011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258153 A-13D

LLI Sample # WW 6334743
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 11:30 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	20,400	200	14.1	1
07058	Manganese	7439-96-5	621	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	< 2.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:46	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:46	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:46	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:44	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:44	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: A-19D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 258153 A-19D

LLI Sample # WW 6334744
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 12:30 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-19D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	40	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		ug/l	ug/l	ug/l	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	44,100	200	14.1	1
07058	Manganese	7439-96-5	3,320	5.0	0.44	1
	SW-846 6020		ug/l	ug/l	ug/l	
06025	Arsenic	7440-38-2	27.0	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1
Wet Chemistry	**EPA 300.0**		ug/l	ug/l	ug/l	
00224	Chloride	16887-00-6	58,400	8,000	4,000	20
01504	Fluoride	16984-48-8	< 500	500	400	5
00368	Nitrate Nitrogen	14797-55-8	< 500	500	250	5
01506	Nitrite Nitrogen	14797-65-0	< 500	500	400	5
00228	Sulfate	14808-79-8	14,800	5,000	1,500	5
	SM20 5310 C		ug/l	ug/l	ug/l	
00273	Total Organic Carbon	n.a.	9,600	1,000	500	1
	SM20 2320 B		ug/l as CaCO3	ug/l as CaCO3	ug/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	174,000	2,000	460	1
00201	Alkalinity to pH 8.3	n.a.	< 2,000	2,000	460	1
01454	Bicarbonate Alkalinity	n.a.	174,000	2,000	460	1
	SM20 2540 C		ug/l	ug/l	ug/l	
00212	Total Dissolved Solids	n.a.	313,000	30,000	9,700	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: A-19D_07012011 Grab Water
Philadelphia Refinery AOI-11
COC: 258153 A-19D

LLI Sample # WW 6334744
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 12:30 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-19D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		ug/l	ug/l	ug/l	
00230	Sulfide	18496-25-8	< 160	160	54	1
	SM20 4500NH3 B/C modified		ug/l	ug/l	ug/l	
00221	Ammonia Nitrogen	7664-41-7	1,600	600	200	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111882AA	07/07/2011 18:24	Nicholas R Rossi	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111882AA	07/07/2011 18:24	Nicholas R Rossi	1
07805	PAHs by 8270	SW-846 8270C	1	11187WAG026	07/14/2011 00:15	Jennifer R Riggs	1
07807	BNA Water Extraction	SW-846 3510C	1	11187WAG026	07/07/2011 08:00	Cynthia J Salvatori	1
07879	EDB in Wastewater	SW-846 8011	1	111870028A	07/09/2011 10:34	John W Perkins	1
07786	EDB Extraction	SW-846 8011	1	111870028A	07/07/2011 13:30	Kerrie A Freeburn	1
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:50	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:50	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:50	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 07:56	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 07:56	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11183373601B	07/11/2011 23:06	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11183373601B	07/02/2011 15:50	Joseph E McKenzie	5
00368	Nitrate Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 15:50	Joseph E McKenzie	5
01506	Nitrite Nitrogen	EPA 300.0	1	11183373601B	07/02/2011 15:50	Joseph E McKenzie	5
00228	Sulfate	EPA 300.0	1	11183373601B	07/11/2011 22:20	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11189049503A	07/08/2011 08:15	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11189020201B	07/08/2011 10:00	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11188021201A	07/07/2011 06:22	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11188023001A	07/07/2011 15:15	Susan E Hibner	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11188022101A	07/07/2011 17:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

REVISED

Sample Description: A-19D_07012011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258153 A-19D

LLI Sample # WW 6334745
LLI Group # 1254490
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 07/01/2011 12:30 by MH

Submitted: 07/01/2011 17:45
Reported: 07/29/2011 14:11

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**ug/l**	**ug/l**	**ug/l**	
07052	Cobalt	7440-48-4	< 5.0	5.0	0.62	1
01754	Iron	7439-89-6	24,300	200	14.1	1
07058	Manganese	7439-96-5	3,130	5.0	0.44	1
	SW-846 6020		**ug/l**	**ug/l**	**ug/l**	
06025	Arsenic	7440-38-2	5.2	2.0	0.95	1
06035	Lead	7439-92-1	< 1.0	1.0	0.080	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111881848003	07/10/2011 23:53	Tara L Snyder	1
01754	Iron	SW-846 6010B	1	111881848003	07/10/2011 23:53	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	111881848003	07/10/2011 23:53	Tara L Snyder	1
06025	Arsenic	SW-846 6020	1	111886050002A	07/11/2011 08:45	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111886050002A	07/11/2011 08:45	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111881848003	07/07/2011 14:00	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111886050002	07/08/2011 10:08	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254490
Reported: 07/29/11 at 02:11 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F111882AA	Sample number(s): 6334738,6334740,6334742,6334744								
Benzene	< 1	1.	0.5	ug/l	92	89	79-120	4	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	91	90	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	92	90	79-120	3	30
Isopropylbenzene	< 2	2.	0.5	ug/l	93	91	77-120	2	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	83	84	76-120	0	30
Toluene	< 1	1.	0.5	ug/l	93	89	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	89	87	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	91	88	75-120	2	30
Xylene (Total)	< 1	1.	0.5	ug/l	91	90	80-120	2	30
Batch number: 11187WAG026	Sample number(s): 6334738,6334740,6334742,6334744								
Chrysene	< 5	5.	1	ug/l	94	92	82-112	2	30
Fluorene	< 5	5.	1	ug/l	97	92	82-113	5	30
Naphthalene	< 5	5.	1	ug/l	92	90	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	96	96	83-112	0	30
Pyrene	< 5	5.	1	ug/l	96	94	80-115	2	30
Batch number: 111870028A	Sample number(s): 6334738,6334740,6334742,6334744								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	100	60-140	4	20
Batch number: 111881848003	Sample number(s): 6334738-6334745								
Cobalt	< 5.0	5.0	0.62	ug/l	97		90-110		
Iron	< 200	200.	14.1	ug/l	101		90-112		
Manganese	< 5.0	5.0	0.44	ug/l	100		90-110		
Batch number: 111886050002A	Sample number(s): 6334738-6334745								
Arsenic	< 2.0	2.0	0.95	ug/l	109		86-111		
Lead	< 1.0	1.0	0.080	ug/l	103		90-115		
Batch number: 11183373601B	Sample number(s): 6334738,6334740,6334742,6334744								
Chloride	< 400	400.	200	ug/l	100		90-110		
Fluoride	< 100	100.	80	ug/l	101		90-110		
Nitrate Nitrogen	< 100	100.	50	ug/l	100		90-110		
Nitrite Nitrogen	< 100	100.	80	ug/l	95		90-110		
Sulfate	< 1,000	1,000.	300	ug/l	99		90-110		
Batch number: 11189049502B	Sample number(s): 6334738								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	106		91-113		
Batch number: 11189049503A	Sample number(s): 6334740,6334742,6334744								
Total Organic Carbon	< 1,000	1,000.	500	ug/l	107		91-113		
Batch number: 11188021201A	Sample number(s): 6334738,6334740,6334742,6334744								
Total Dissolved Solids	< 30,000	30,000.	9,700	ug/l	102		80-120		
Batch number: 11188022101A	Sample number(s): 6334738,6334740,6334742,6334744								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254490
Reported: 07/29/11 at 02:11 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Ammonia Nitrogen	< 600	600.	200	ug/l	94	93	85-105	2	5
Batch number: 11188023001A	Sample number(s): 6334738,6334740,6334742,6334744								
Sulfide	< 160	160.	54	ug/l	98		90-110		
Batch number: 11189020201B	Sample number(s): 6334738,6334740,6334742,6334744								
Alkalinity to pH 4.5	< 2,000	2,000.	460	ug/l as CaCO3	99		98-103		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111870028A	Sample number(s): 6334738,6334740,6334742,6334744 UNSPK: P334357								
Ethylene dibromide	74	65	65-135	13	20				
Batch number: 111881848003	Sample number(s): 6334738-6334745 UNSPK: P335984 BKG: P335984								
Cobalt	100	99	87-112	1	20	< 5.0	< 5.0	0 (1)	20
Iron	43 (2)	53 (2)	75-125	1	20	12,300	11,800	4	20
Manganese	94	96	75-125	1	20	420	407	3	20
Batch number: 111886050002A	Sample number(s): 6334738-6334745 UNSPK: 6334744 BKG: 6334744								
Arsenic	110	102	75-125	2	20	27.0	26.2	3	20
Lead	104	106	83-120	2	20	< 1.0	< 1.0	0 (1)	20
Batch number: 11183373601B	Sample number(s): 6334738,6334740,6334742,6334744 UNSPK: P334718 BKG: P334718								
Chloride	95		90-110			33,400	32,800	2	20
Fluoride	101		90-110			< 500	< 500	0 (1)	20
Nitrate Nitrogen	111*		90-110			< 500	< 500	0 (1)	20
Nitrite Nitrogen	103		90-110			< 500	< 500	0 (1)	20
Sulfate	110		90-110			< 5,000	< 5,000	3 (1)	20
Batch number: 11189049502B	Sample number(s): 6334738 UNSPK: P334720 BKG: P334720								
Total Organic Carbon	101		63-142			11,200	11,100	1	3
Batch number: 11189049503A	Sample number(s): 6334740,6334742,6334744 UNSPK: P336348 BKG: P336348								
Total Organic Carbon	107		63-142			4,600	4,800	4* (1)	3
Batch number: 11188021201A	Sample number(s): 6334738,6334740,6334742,6334744 UNSPK: P335551 BKG: P335551								
Total Dissolved Solids	400 (2)		62-135			26,300,000	27,600,000	5	9
Batch number: 11188022101A	Sample number(s): 6334738,6334740,6334742,6334744 BKG: P335876								
Ammonia Nitrogen						13,900	13,300	5	6
Batch number: 11188023001A	Sample number(s): 6334738,6334740,6334742,6334744 UNSPK: P334945 BKG: P335895								
Sulfide	87	86	50-130	1	10	1,300	1,300	1	5
Batch number: 11189020201B	Sample number(s): 6334738,6334740,6334742,6334744 UNSPK: P334718 BKG: P334736								
Alkalinity to pH 4.5	98		73-121			222,000	249,000	11*	5
Alkalinity to pH 8.3						157,000	187,000	17*	5

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1254490
Reported: 07/29/11 at 02:11 PM

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111882AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6334738	97	101	101	93
6334740	97	106	102	92
6334742	96	100	102	92
6334744	97	102	100	92
Blank	97	102	100	93
LCS	96	101	101	99
LCSD	96	103	102	97
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11187WAG026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6334738	88	100	90
6334740	92	100	90
6334742	88	98	90
6334744	89	102	92
Blank	105	114	103
LCS	88	98	90
LCSD	86	93	87
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111870028A

	1,1,2,2-Tetrachloroethane
6334738	57
6334740	70
6334742	67
6334744	77
Blank	109
LCS	88
LCSD	92
MS	63
MSD	58
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1754490 Sample # 6334738-45

COC # 258153

Please print. Instructions on reverse side correspond with circled numbers. 0.8-3.8°C

(1) Client: SUN - Aquaterra Acct. #:

Project Name/#: PHila. Ref. AOI-11 PWSID #:

Project Manager: T. Doerr P.O.#:

Sampler: M. Hinderliter Quote #:

Name of state where samples were collected: PA

For Lab Use Only
FSC:
SCR#:

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	(4) Matrix: Soil	Water (Potable / NPDES)	Other	Total # of Containers	(5) Analyses Requested / Preservation Codes: *	Remarks	(6) Temperature of samples upon receipt (if requested)
A-21D_07012011	7/1/11	1020	X			X		16	X	* See Attached for *	
B-132D_07012011	7/1/11	900	X			X		16	X	* list of Analyses *	
A-13D_07012011	7/1/11	1130	X			X		16	X		
A-19D_07012011	7/1/11	1230	X			X		16	X		

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(7) **Turnaround Time Requested** (TAT) (please circle): (Normal) Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
SDG Complete? (Yes) No
Site-specific QC (MS/MSD/Dup)? Yes (No)
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
	7/1/11	1410	Fridge	7/1/11	1900
	7/1/11	1610		7/1/11	1610
	7/1/11	1745			
				7/1/11	1745

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

April 20, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 04/06/2011
Group Number: 1240831
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
N-30_4-5-11 Grab Water	6250842
N-30_4-5-11 Filtered Grab Water	6250843
N-44D_4-5-11 Grab Water	6250844
N-44D_4-5-11 Filtered Grab Water	6250845
N-50D_4-5-11 Grab Water	6250846
N-50D_4-5-11 Filtered Grab Water	6250847
N-19_4-5-11 Grab Water	6250848
N-19_4-5-11 Filtered Grab Water	6250849
N-27_4-5-11 Grab Water	6250850
N-27_4-5-11 Filtered Grab Water	6250851
N-9_4-5-11 Grab Water	6250852
N-9_4-5-11 Filtered Grab Water	6250853

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

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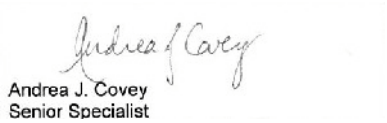
Analysis Report

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Andrea J. Covey
Senior Specialist

Lancaster Laboratories

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Analysis Report

Sample Description: N-30_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-30_4-5-11

LLI Sample # WW 6250842
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:40 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A30

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	2	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0070	0.0050	0.0023	1
01754	Iron	7439-89-6	36.5	0.200	0.0522	1
07058	Manganese	7439-96-5	0.288	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0030	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0239	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	136	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	132	50.0	15.0	50
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	3.9	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	68.1	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	68.1	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	503	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-30_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-30_4-5-11

LLI Sample # WW 6250842
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:40 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A30

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.64	0.64	0.22	4
	Reporting limits were raised due to interference from the sample matrix.					
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	Z110981AA	04/08/2011 22:02	Daniel H Heller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z110981AA	04/08/2011 22:02	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 04:15	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111010025A	04/14/2011 02:59	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111010025A	04/11/2011 19:25	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:05	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 02:22	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:05	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 08:25	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 08:25	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11096130902B	04/12/2011 06:39	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11096130902B	04/07/2011 11:22	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 11:22	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 11:22	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11096130902B	04/12/2011 06:39	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11102049501A	04/12/2011 03:02	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11097021201B	04/07/2011 10:12	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11101023001A	04/11/2011 14:40	Michele L Graham	4

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **N-30_4-5-11 Grab Water**
Philadelphia Refinery AOI-11
COC: 258156 N-30_4-5-11

LLI Sample # WW 6250842
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:40 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A30

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11101022101A	04/11/2011 14:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-30_4-5-11 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-30_4-5-11

LLI Sample # WW 6250843
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:40 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	22.9	0.200	0.0522	1
07058	Manganese	7439-96-5	0.243	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:09	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 02:33	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:09	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 08:40	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 08:40	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-44D_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-44D_4-5-11

LLI Sample # WW 6250844
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 12:15 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A44

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	10	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	2	1	0.5	1
10943	Isopropylbenzene	98-82-8	14	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	5	2	0.5	1
10943	Xylene (Total)	1330-20-7	6	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.029	1
Reporting limits were raised due to interference from the sample matrix.						
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	27.4	0.200	0.0522	1
07058	Manganese	7439-96-5	0.560	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.114	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0017	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	28.4	2.0	1.0	5
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	15.7	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	49.4	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	134	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	134	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	275	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-44D_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-44D_4-5-11

LLI Sample # WW 6250844
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 12:15 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A44

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	2.0	0.32	0.11	2
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	0.98	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	Z110981AA	04/08/2011 22:22	Daniel H Heller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z110981AA	04/08/2011 22:22	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 04:40	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111010025A	04/14/2011 03:29	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111010025A	04/11/2011 19:25	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:19	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 02:36	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:19	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 08:42	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 08:42	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11096130902B	04/07/2011 11:37	Nicole M Kepley	5
01504	Fluoride	EPA 300.0	1	11096130902B	04/07/2011 11:37	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 11:37	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 11:37	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11096130902B	04/12/2011 06:53	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11102049501A	04/12/2011 03:09	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	2	11102021201A	04/12/2011 09:01	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11101023001A	04/11/2011 14:40	Michele L Graham	2
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11101022101A	04/11/2011 14:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-44D_4-5-11 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-44D_4-5-11

LLI Sample # WW 6250845
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 12:15 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	17.2	0.200	0.0522	1
07058	Manganese	7439-96-5	0.486	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0551	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:22	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 02:40	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:22	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 08:49	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 08:49	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-50D_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-50D_4-5-11

LLI Sample # WW 6250846
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 14:55 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A50

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	5	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	25.1	0.200	0.0522	1
07058	Manganese	7439-96-5	1.07	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0041	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0377	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	18.7	2.0	1.0	5
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	20.5	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	409	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	409	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	653	30.0	9.7	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: N-50D_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-50D_4-5-11

LLI Sample # WW 6250846
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 14:55 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A50

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	2.5	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	Z110981AA	04/08/2011 22:43	Daniel H Heller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z110981AA	04/08/2011 22:43	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 05:05	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 06:29	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:26	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 02:43	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:26	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 08:52	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 08:52	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11096130902B	04/07/2011 11:52	Nicole M Kepley	5
01504	Fluoride	EPA 300.0	1	11096130902B	04/07/2011 11:52	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 11:52	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 11:52	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11096130902B	04/12/2011 07:07	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11102049501A	04/12/2011 03:16	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11097021201B	04/07/2011 10:12	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11101023001A	04/11/2011 14:40	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11101022101A	04/11/2011 14:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-50D_4-5-11 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-50D_4-5-11

LLI Sample # WW 6250847
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 14:55 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	9.62	0.200	0.0522	1
07058	Manganese	7439-96-5	1.00	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:29	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 02:47	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:29	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 08:54	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 08:54	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-19_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-19_4-5-11

LLI Sample # WW 6250848
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:55 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A19

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	30.1	0.200	0.0522	1
07058	Manganese	7439-96-5	0.489	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0023	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	87.2	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	36.3	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	3.4	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	164	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	164	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	369	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-19_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-19_4-5-11

LLI Sample # WW 6250848
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:55 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A19

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	Z110981AA	04/08/2011 23:04	Daniel H Heller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z110981AA	04/08/2011 23:04	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 05:30	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 07:30	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:33	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 02:51	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:33	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 08:57	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 08:57	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11096130902B	04/12/2011 07:48	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11096130902B	04/07/2011 12:21	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 12:21	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 12:21	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11096130902B	04/12/2011 07:34	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11102049501A	04/12/2011 03:23	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11097021201B	04/07/2011 10:12	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11101023001A	04/11/2011 14:40	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11101022101A	04/11/2011 14:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-19_4-5-11 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-19_4-5-11

LLI Sample # WW 6250849
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:55 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	29.6	0.200	0.0522	1
07058	Manganese	7439-96-5	0.484	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:36	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 02:54	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:36	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 08:59	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 08:59	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-27_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-27_4-5-11

LLI Sample # WW 6250850
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:00 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A27

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	3	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0106	0.0050	0.0023	1
01754	Iron	7439-89-6	1.53	0.200	0.0522	1
07058	Manganese	7439-96-5	6.07	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	108	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	176	20.0	6.0	20
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	2.6	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	198	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	198	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	629	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-27_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-27_4-5-11

LLI Sample # WW 6250850
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:00 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A27

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	0.71	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	Z110981AA	04/08/2011 23:25	Daniel H Heller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z110981AA	04/08/2011 23:25	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 05:55	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 08:00	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:39	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 02:58	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:39	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 09:01	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 09:01	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11096130902B	04/12/2011 07:20	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11096130902B	04/07/2011 12:06	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 12:06	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 12:06	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11096130902B	04/12/2011 07:20	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11102049501A	04/12/2011 03:30	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11097021201B	04/07/2011 10:12	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11101023001A	04/11/2011 14:40	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11101022101A	04/11/2011 14:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-27_4-5-11 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-27_4-5-11

LLI Sample # WW 6250851
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 13:00 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0104	0.0050	0.0023	1
01754	Iron	7439-89-6	0.867	0.200	0.0522	1
07058	Manganese	7439-96-5	5.93	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:43	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 03:02	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:43	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 09:04	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 09:04	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: N-9_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-9_4-5-11

LLI Sample # WW 6250852
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 14:50 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A09

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0083	0.0050	0.0023	1
01754	Iron	7439-89-6	3.96	0.200	0.0522	1
07058	Manganese	7439-96-5	1.43	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0026	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	54.9	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	89.0	20.0	6.0	20
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	2.5	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	479	2.0	0.46	1
	The total alkalinity result is greater than the TDS result. A check of the different sample bottles used revealed a disparity in the specific conductance of each that corresponds to this result disparity. The conductance of the alkalinity bottle is 1040 umhos/cm while the conductance of the TDS bottle is 690 umhos/cm.					
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-9_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-9_4-5-11

LLI Sample # WW 6250852
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 14:50 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A09

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2320 B**		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
01454	Bicarbonate Alkalinity	n.a.	479	2.0	0.46	1
	SM20 2540 C		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	431	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	Z110981AA	04/08/2011 23:46	Daniel H Heller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z110981AA	04/08/2011 23:46	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	11102WAA026	04/12/2011 20:31	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	2	11102WAA026	04/12/2011 12:45	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 08:30	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:46	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 03:06	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:46	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 09:06	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 09:06	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11096130902B	04/12/2011 08:29	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11096130902B	04/07/2011 12:36	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 12:36	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11096130902B	04/07/2011 12:36	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11096130902B	04/12/2011 08:29	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11102049501A	04/12/2011 03:38	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-9_4-5-11 Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-9_4-5-11

LLI Sample # WW 6250852
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 14:50 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

11A09

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11102020201A	04/12/2011 13:38	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11097021201B	04/07/2011 10:12	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11101023001A	04/11/2011 14:40	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11101022101A	04/11/2011 14:30	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-9_4-5-11 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258156 N-9_4-5-11

LLI Sample # WW 6250853
LLI Group # 1240831
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/05/2011 14:50 by JRW

Submitted: 04/06/2011 16:15
Reported: 04/20/2011 16:01

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	0.155	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110971848002	04/14/2011 11:50	Joanne M Gates	1
01754	Iron	SW-846 6010B	1	110971848002	04/15/2011 03:17	Tara L Snyder	1
07058	Manganese	SW-846 6010B	1	110971848002	04/14/2011 11:50	Joanne M Gates	1
06025	Arsenic	SW-846 6020	1	110976050002A	04/08/2011 09:08	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110976050002A	04/08/2011 09:08	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110971848002	04/07/2011 21:00	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110976050002	04/07/2011 21:00	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1240831
Reported: 04/20/11 at 04:01 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: Z110981AA	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852								
Benzene	< 1	1.	0.5	ug/l	97		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	89		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	106		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	107		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	98		76-120		
Toluene	< 1	1.	0.5	ug/l	105		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	108		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	107		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	105		80-120		
Batch number: 11098WAF026	Sample number(s): 6250842,6250844,6250846,6250848,6250850								
Chrysene	< 5	5.	1	ug/l	91	93	82-112	2	30
Fluorene	< 5	5.	1	ug/l	92	94	82-113	2	30
Naphthalene	< 5	5.	1	ug/l	89	92	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	96	95	83-112	2	30
Pyrene	< 5	5.	1	ug/l	92	95	80-115	2	30
Batch number: 11102WAA026	Sample number(s): 6250852								
Chrysene	< 5	5.	1	ug/l	96	94	82-112	2	30
Fluorene	< 5	5.	1	ug/l	97	96	82-113	1	30
Naphthalene	< 5	5.	1	ug/l	96	94	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	99	97	83-112	3	30
Pyrene	< 5	5.	1	ug/l	96	94	80-115	2	30
Batch number: 111010025A	Sample number(s): 6250842,6250844								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	100	60-140	0	20
Batch number: 111020015A	Sample number(s): 6250846,6250848,6250850,6250852								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	96	60-140	0	20
Batch number: 110971848002	Sample number(s): 6250842-6250853								
Cobalt	< 0.0050	0.0050	0.0023	mg/l	107		90-110		
Iron	< 0.200	0.200	0.0522	mg/l	103		90-112		
Manganese	< 0.0050	0.0050	0.00084	mg/l	100		90-110		
Batch number: 110976050002A	Sample number(s): 6250842-6250853								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	103		86-111		
Lead	< 0.0010	0.0010	0.00005	mg/l	104		90-115		
			2						
Batch number: 11096130902B	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852								
Chloride	< 0.40	0.40	0.20	mg/l	98		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	96		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	109		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	100		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	103		89-110		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1240831
Reported: 04/20/11 at 04:01 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 11102049501A	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	100		91-113		
Batch number: 11097021201B	Sample number(s): 6250842,6250846,6250848,6250850,6250852								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	94		80-120		
Batch number: 11101022101A	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852								
Ammonia Nitrogen	< 0.60	0.60	0.20	mg/l	94	93	85-105	1	5
Batch number: 11101023001A	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852								
Sulfide	< 0.16	0.16	0.054	mg/l	98		90-110		
Batch number: 11102020201A	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852								
Alkalinity to pH 4.5	< 2.0	2.0	0.46	mg/l as CaCO3	99	99	98-103	0	5
Batch number: 11102021201A	Sample number(s): 6250844								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	103		80-120		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: Z110981AA	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852 UNSPK: P252027								
Benzene	109	105	80-126	4	30				
1,2-Dichloroethane	98	95	66-141	3	30				
Ethylbenzene	116	115	71-134	2	30				
Isopropylbenzene	116	116	75-128	0	30				
Methyl Tertiary Butyl Ether	108	103	72-126	4	30				
Toluene	115	113	80-125	1	30				
1,2,4-Trimethylbenzene	119	116	72-130	3	30				
1,3,5-Trimethylbenzene	120	116	72-131	3	30				
Xylene (Total)	118	116	79-125	2	30				
Batch number: 111010025A	Sample number(s): 6250842,6250844 UNSPK: P248949								
Ethylene dibromide	96	96	65-135	0	20				
Batch number: 111020015A	Sample number(s): 6250846,6250848,6250850,6250852 UNSPK: 6250846 BKG: P253801								
Ethylene dibromide	91		65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 110971848002	Sample number(s): 6250842-6250853 UNSPK: P250914 BKG: P250914								
Cobalt	107	102	87-112	4	20	< 0.0050	< 0.0050	0 (1)	20
Iron	101	102	75-125	1	20	< 0.200	< 0.200	0 (1)	20
Manganese	101	98	75-125	3	20	< 0.0050	< 0.0050	0 (1)	20
Batch number: 110976050002A	Sample number(s): 6250842-6250853 UNSPK: 6250842 BKG: 6250842								
Arsenic	98	95	75-125	2	20	0.0030	0.0029	2 (1)	20
Lead	102	107	83-120	2	20	0.0239	0.0241	1	20
Batch number: 11096130902B	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852 UNSPK: 6250852								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1240831
Reported: 04/20/11 at 04:01 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
	BKG: 6250852								
Chloride	111*		90-110			54.9	54.0	2	20
Fluoride	106		90-110			< 0.50	< 0.50	0 (1)	20
Nitrate Nitrogen	118*		90-110			< 0.50	< 0.50	0 (1)	20
Nitrite Nitrogen	103		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	111*		90-110			89.0	87.8	1 (1)	20
Batch number: 11102049501A	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852 UNSPK: P249030 BKG: P249030								
Total Organic Carbon	49*		63-142			15.1	12.4	20*	3
Batch number: 11097021201B	Sample number(s): 6250842,6250846,6250848,6250850,6250852 UNSPK: P249030 BKG: 6250850								
Total Dissolved Solids	64		62-135			629	613	3	9
Batch number: 11101022101A	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852 BKG: P250607								
Ammonia Nitrogen						68.8	68.2	1	2
Batch number: 11101023001A	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852 UNSPK: 6250852 BKG: 6250852								
Sulfide	85	79	69-133	8*	5	< 0.16	< 0.16	0 (1)	5
Batch number: 11102020201A	Sample number(s): 6250842,6250844,6250846,6250848,6250850,6250852 UNSPK: P249093 BKG: P250070								
Alkalinity to pH 4.5	109 (2)	84 (2)	73-121	2	5	189	186	2	5
Alkalinity to pH 8.3						< 2.0	< 2.0	0 (1)	5
Batch number: 11102021201A	Sample number(s): 6250844 UNSPK: P253316 BKG: P253316								
Total Dissolved Solids	102		62-135			922	926	0	9

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: Z110981AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6250842	101	100	100	97
6250844	97	95	100	106
6250846	100	98	101	100
6250848	103	100	99	99
6250850	102	98	100	95
6250852	102	98	101	96
Blank	100	100	100	97
LCS	97	100	101	103
MS	101	100	100	104
MSD	100	101	101	103

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1240831
Reported: 04/20/11 at 04:01 PM

Surrogate Quality Control

Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11098WAF026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6250842	97	97	83
6250844	94	93	87
6250846	95	98	92
6250848	94	95	84
6250850	96	98	91
Blank	98	98	85
LCS	98	98	88
LCSD	97	98	89
Limits:	52-120	63-114	34-118

Analysis Name: PAHs by 8270
Batch number: 11102WAA026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6250852	80	84	72
Blank	105	107	97
LCS	101	103	90
LCSD	97	100	89
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111010025A

	1,1,2,2-Tetrachloroethane
6250842	74
6250844	119
Blank	105
LCS	106
LCSD	106
MS	102
MSD	103
Limits:	46-136

Analysis Name: EDB in Wastewater
Batch number: 111020015A

	1,1,2,2-Tetrachloroethane
6250846	96
6250848	105
6250850	90
6250852	93
Blank	95
DUP	87
LCS	94
LCSD	94
MS	89

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1240831
Reported: 04/20/11 at 04:01 PM

Surrogate Quality Control

Limits: 46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 124083 Sample # 6250842-53

COC # 258156

Please print. Instructions on reverse side correspond with circled numbers. Cooler temp 1.0-1.8°C

For Lab Use Only
FSC:
SCR#:

(1)
Client: Aquaterra Technologies Inc. Acct. #:
Project Name/#: Sun-Phillg Refinery (~~Deep well Sampling~~) PWSID #: AOI-11
Project Manager: Tiffani Doell P.O.#:
Sampler: J R Williams / Mike Hinderling Quote #:
Name of state where samples were collected: Pa

(2) Sample Identification | Date Collected | Time Collected | (3) Grab | Composite | Matrix: Soil | Water | Other (Potable / NPDES) | (4) Total # of Containers | (5) Analyses Requested / Preservation Codes

Sample Identification	Date Collected	Time Collected	Grab	Composite	Soil	Water	Other	Total # of Containers	Analyses Requested / Preservation Codes
~~N-30 AOI-8~~ N-30_4-5-11	4/5/11	1340	X			X		16	Please see Attached Form for List of Analyses Required.
~~N-44D AOI-8~~ N-44D_4-5-11	4/5/11	1215	X			X		16	
~~N-50D AOI-8~~ N-50D_4-5-11	4/5/11	1455	X			X		16	
~~N-19 AOI-8~~ N-19_4-5-11	4/5/11	1355	X			X		16	
~~N-27 AOI-8~~ N-27_4-5-11	4/5/11	1500	X			X		16	
~~N-9 AOI-8~~ N-9_4-5-11	4/5/11	1450	X			X		16	

(6) Preservation Codes: H=HCl T=Thiosulfate N=HNO_3 B=NaOH S=H_2SO_4 O=Other

Temperature of samples upon receipt (if requested)

Remarks: * Lab to filter all samples*

Attachment of Analyses Required has 2 (15) pages labeled.

Sample ID is well, underscore date (with dashes) (15)

(7) **Turnaround Time Requested** (TAT) (please circle): (Normal) Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg) TX TRRP-13
Type II (Tier II) MA MCP CT RCP
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)

SDG Complete? (Yes) No

Site-specific QC (MS/MSD/Dup)? Yes (No)
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / (No)

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
[signature]	4/5/11	1715	Fridge	4/5/11	1715
[signature] / AQUATERRA	4/6/11	HH	[signature]	4/6/11	1445
[signature]	4/6/11	1605			
			[signature]	4/6/11	1605

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

acct#10132 Cap#1240831
Sample# 6250842-53

Attachment
pg. 1 of 2

San Refinery (Deep well sampling)

Table 1
Constituents of Concern for Groundwater
[redacted] Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene Dibromide	106-93-4
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Metals	CAS No.
Arsenic (Total & Dissolved)	7440-38-2
Cobalt (Total & Dissolved)	7440-48-4
Iron (Total & Dissolved)	7439-89-6
Lead (Total & Dissolved)	7439-92-1
Manganese (Total & Dissolved)	7439-96-5

Misc Parameters	CAS No.
Ammonia	7664-41-7
Chloride	16887-00-6
Fluoride	7782-41-4
Nitrate	84145-82-4
Nitrite	1594-56-5
Sulfate	18785-72-3
Sulfide	-
Total Alkalinity	-
Bicarbonate	71-52-3
Total Organic Carbon	7440-44-0
Total Dissolved Solids	CASID10052

* requested methods were confirmed via email with T. Okrefsky

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

WARRANTY AND LIMITS OF LIABILITY - In accepting analytical work, we warrant the accuracy of test results for the sample as submitted. THE FOREGOING EXPRESS WARRANTY IS EXCLUSIVE AND IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WE DISCLAIM ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR PARTICULAR PURPOSE AND WARRANTY OF MERCHANTABILITY. IN NO EVENT SHALL LANCASTER LABORATORIES BE LIABLE FOR INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFIT OR GOODWILL REGARDLESS OF (A) THE NEGLIGENCE (EITHER SOLE OR CONCURRENT) OF LANCASTER LABORATORIES AND (B) WHETHER LANCASTER LABORATORIES HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH DAMAGES. We accept no legal responsibility for the purposes for which the client uses the test results. No purchase order or other order for work shall be accepted by Lancaster Laboratories which includes any conditions that vary from the Standard Terms and Conditions, and Lancaster hereby objects to any conflicting terms contained in any acceptance or order submitted by client.

Lancaster Laboratories

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Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

April 20, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 04/07/2011
Group Number: 1241118
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-305D_04062011 Grab Water	6252781
S-305D_04062011 Filtered Grab Water	6252782
S-46D_04062011 Grab Water	6252783
S-46D_04062011 Filtered Grab Water	6252784
S-294D_04062011 Grab Water	6252785
S-294D_04062011 Filtered Grab Water	6252786
N-13_04062011 Grab Water	6252787
N-13_04062011 Filtered Grab Water	6252788
N-21_04062011 Grab Water	6252789
N-21_04062011 Filtered Grab Water	6252790
N-4_04062011 Grab Water	6252791
N-4_04062011 Filtered Grab Water	6252792
S-264_04062011 Grab Water	6252793
S-264_04062011 Filtered Grab Water	6252794
S-80D_04062011 Grab Water	6252795
S-80D_04062011 Filtered Grab Water	6252796
S-119D_04062011 Grab Water	6252797
S-119D_04062011 Filtered Grab Water	6252798
S-38D_04062011 Grab Water	6252799
S-38D_04062011 Filtered Grab Water	6252800
N-38D_04062011 Grab Water	6252801
N-38D_04062011 Filtered Grab Water	6252802

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

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Analysis Report

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Robert Heisey
Senior Specialist

Lancaster Laboratories

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Analysis Report

Sample Description: S-305D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-305D_04062011

LLI Sample # WW 6252781
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 14:55 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S305D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0170	0.0050	0.0023	1
01754	Iron	7439-89-6	103	0.200	0.0522	1
07058	Manganese	7439-96-5	1.87	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.322	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	70.1	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	484	50.0	15.0	50
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	14.8	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	294	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	294	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,140	120	38.8	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-305D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-305D_04062011

LLI Sample # WW 6252781
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 14:55 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S305D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	2.3	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F110983AA	04/09/2011 00:56	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F110983AA	04/09/2011 00:56	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 09:40	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 09:00	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/15/2011 23:02	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/15/2011 23:02	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/15/2011 23:02	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:24	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:24	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130601B	04/12/2011 17:09	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11097130601B	04/07/2011 23:07	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130601B	04/07/2011 23:07	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130601B	04/07/2011 23:07	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130601B	04/12/2011 17:09	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11103049502B	04/13/2011 11:10	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021201B	04/12/2011 09:01	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-305D_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-305D_04062011

LLI Sample # WW 6252782
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 14:55 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0166	0.0050	0.0023	1
01754	Iron	7439-89-6	67.5	0.200	0.0522	1
07058	Manganese	7439-96-5	1.84	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0396	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/15/2011 23:24	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/15/2011 23:24	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/15/2011 23:24	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:25	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:25	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-46D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-46D_04062011

LLI Sample # WW 6252783
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 13:40 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-46D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0267	0.0050	0.0023	1
01754	Iron	7439-89-6	57.5	0.200	0.0522	1
07058	Manganese	7439-96-5	17.6	0.0250	0.0042	5
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.128	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0098	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	78.6	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	231	20.0	6.0	20
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	10.3	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	290	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	290	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	751	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-46D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-46D_04062011

LLI Sample # WW 6252783
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 13:40 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-46D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.80	0.80	0.27	5
	Reporting limits were raised due to interference from the sample matrix.					
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	5.4	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F110983AA	04/09/2011 01:17	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F110983AA	04/09/2011 01:17	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 10:05	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 09:30	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/15/2011 23:28	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/15/2011 23:28	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/18/2011 12:46	Joanne M Gates	5
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:31	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:31	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130601B	04/12/2011 17:23	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11097130601B	04/07/2011 23:22	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130601B	04/07/2011 23:22	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130601B	04/07/2011 23:22	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130601B	04/12/2011 17:23	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11103049502B	04/13/2011 11:32	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021201B	04/12/2011 09:01	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	5

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **S-46D_04062011 Grab Water**
Philadelphia Refinery AOI-11
COC: 258161 S-46D_04062011

LLI Sample # WW 6252783
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 13:40 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-46D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-46D_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-46D_04062011

LLI Sample # WW 6252784
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 13:40 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0197	0.0050	0.0023	1
01754	Iron	7439-89-6	33.3	0.200	0.0522	1
07058	Manganese	7439-96-5	16.4	0.0250	0.0042	5
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0346	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/15/2011 23:40	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/15/2011 23:40	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/18/2011 12:49	Joanne M Gates	5
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:32	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:32	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-294D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-294D_04062011

LLI Sample # WW 6252785
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 12:05 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S294D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	68.1	0.200	0.0522	1
07058	Manganese	7439-96-5	8.12	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0043	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	88.1	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	331	50.0	15.0	50
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	3.5	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	235	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	235	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	862	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-294D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-294D_04062011

LLI Sample # WW 6252785
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 12:05 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S294D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	0.22	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F110983AA	04/09/2011 01:39	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F110983AA	04/09/2011 01:39	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 10:30	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 10:00	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/15/2011 23:44	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/15/2011 23:44	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/15/2011 23:44	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:13	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:13	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130601B	04/12/2011 17:37	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11097130601B	04/07/2011 23:37	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130601B	04/07/2011 23:37	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130601B	04/07/2011 23:37	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130601B	04/12/2011 17:37	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11103049502B	04/13/2011 11:55	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021201B	04/12/2011 09:01	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-294D_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-294D_04062011

LLI Sample # WW 6252786
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 12:05 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	60.5	0.200	0.0522	1
07058	Manganese	7439-96-5	8.21	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/15/2011 23:48	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/15/2011 23:48	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/15/2011 23:48	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:34	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:34	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: N-13_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-13_04062011

LLI Sample # WW 6252787
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 09:30 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-13-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	3	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0076	0.0050	0.0023	1
01754	Iron	7439-89-6	26.1	0.200	0.0522	1
07058	Manganese	7439-96-5	1.45	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0123	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0118	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	68.0	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	6.9	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	10.4	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	265	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	265	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	390	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-13_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-13_04062011

LLI Sample # WW 6252787
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 09:30 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-13-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	3.1	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F110983AA	04/09/2011 02:01	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F110983AA	04/09/2011 02:01	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 10:55	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 10:30	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/15/2011 23:52	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/15/2011 23:52	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/15/2011 23:52	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:36	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:36	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130602A	04/12/2011 18:32	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11097130602A	04/07/2011 23:51	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130602A	04/07/2011 23:51	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130602A	04/07/2011 23:51	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130602A	04/12/2011 17:51	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11103049502B	04/13/2011 12:02	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021202A	04/12/2011 09:03	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-13_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-13_04062011

LLI Sample # WW 6252788
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 09:30 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	8.88	0.200	0.0522	1
07058	Manganese	7439-96-5	1.37	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0024	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/15/2011 23:55	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/15/2011 23:55	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/15/2011 23:55	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:38	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:38	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-21_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-21_04062011

LLI Sample # WW 6252789
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 08:30 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-21-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	20	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	120	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	2	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0391	0.0050	0.0023	1
01754	Iron	7439-89-6	62.4	0.200	0.0522	1
07058	Manganese	7439-96-5	0.650	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0057	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0017	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	47.6	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	703	100	30.0	100
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	13.2	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	< 2.0	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	< 2.0	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	1,040	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-21_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-21_04062011

LLI Sample # WW 6252789
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 08:30 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-21-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	1.7	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F110983AA	04/09/2011 02:23	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F110983AA	04/09/2011 02:23	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 11:20	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 11:00	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/15/2011 23:59	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/15/2011 23:59	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/15/2011 23:59	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:40	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:40	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130602A	04/12/2011 19:40	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11097130602A	04/08/2011 00:36	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 00:36	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 00:36	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130602A	04/12/2011 19:54	Ashley M Adams	100
00273	Total Organic Carbon	SM20 5310 C	1	11103049502B	04/13/2011 12:09	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021202A	04/12/2011 09:03	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: N-21_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-21_04062011

LLI Sample # WW 6252790
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 08:30 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0361	0.0050	0.0023	1
01754	Iron	7439-89-6	54.3	0.200	0.0522	1
07058	Manganese	7439-96-5	0.606	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0043	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:02	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:02	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/16/2011 00:02	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:41	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:41	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: N-4_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-4_04062011

LLI Sample # WW 6252791
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 10:20 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-4--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	2	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	3	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	11.7	0.200	0.0522	1
07058	Manganese	7439-96-5	3.08	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0019	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	56.0	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	53.8	10.0	3.0	10
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	6.6	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	627	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	627	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	756	60.0	19.4	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: N-4_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-4_04062011

LLI Sample # WW 6252791
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 10:20 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-4--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	1.1	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F110983AA	04/09/2011 02:44	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F110983AA	04/09/2011 02:44	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11098WAF026	04/11/2011 11:45	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11098WAF026	04/10/2011 16:10	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 12:30	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:06	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:06	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/16/2011 00:06	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:43	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:43	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130602A	04/14/2011 14:16	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11097130602A	04/08/2011 00:50	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 00:50	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 00:50	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130602A	04/12/2011 20:08	Ashley M Adams	10
00273	Total Organic Carbon	SM20 5310 C	1	11103049502B	04/13/2011 12:17	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021202A	04/12/2011 09:03	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-4_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-4_04062011

LLI Sample # WW 6252792
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 10:20 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	2.85	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:10	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:10	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/16/2011 00:10	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:45	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:45	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-264_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-264_04062011

LLI Sample # WW 6252793
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 13:45 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-264

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	5	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0444	0.0050	0.0023	1
01754	Iron	7439-89-6	46.7	0.200	0.0522	1
07058	Manganese	7439-96-5	7.84	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0086	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0062	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	89.3	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	105	20.0	6.0	20
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	12.0	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	308	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	308	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	645	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-264_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-264_04062011

LLI Sample # WW 6252793
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 13:45 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-264

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	2.2	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F110983AA	04/09/2011 03:06	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F110983AA	04/09/2011 03:06	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11101WAD026	04/12/2011 07:07	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11101WAD026	04/11/2011 17:20	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 13:00	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:14	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:14	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/16/2011 00:14	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:47	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:47	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130602A	04/12/2011 20:21	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11097130602A	04/08/2011 01:05	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 01:05	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 01:05	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130602A	04/12/2011 20:21	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11103049502B	04/13/2011 12:24	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021202A	04/12/2011 09:03	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-264_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-264_04062011

LLI Sample # WW 6252794
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 13:45 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0290	0.0050	0.0023	1
01754	Iron	7439-89-6	6.94	0.200	0.0522	1
07058	Manganese	7439-96-5	7.42	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:25	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:25	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/16/2011 00:25	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:52	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:52	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-80D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-80D_04062011

LLI Sample # WW 6252795
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 12:00 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-80D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	44.5	0.200	0.0522	1
07058	Manganese	7439-96-5	11.8	0.0250	0.0042	5
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	78.0	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	461	50.0	15.0	50
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	5.3	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	142	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	142	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	945	60.0	19.4	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-80D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-80D_04062011

LLI Sample # WW 6252795
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 12:00 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-80D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111021AA	04/12/2011 13:00	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111021AA	04/12/2011 13:00	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11101WAD026	04/12/2011 07:34	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11101WAD026	04/11/2011 17:20	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 13:30	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:29	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:29	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/18/2011 12:52	Joanne M Gates	5
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:54	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:54	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130602A	04/12/2011 20:35	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11097130602A	04/08/2011 01:20	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 01:20	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 01:20	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130602A	04/12/2011 20:35	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11103049502B	04/13/2011 12:32	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021202A	04/12/2011 09:03	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-80D_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-80D_04062011

LLI Sample # WW 6252796
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 12:00 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	44.0	0.200	0.0522	1
07058	Manganese	7439-96-5	11.8	0.0250	0.0042	5
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:32	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:32	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/18/2011 12:56	Joanne M Gates	5
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:56	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:56	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-119D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-119D_04062011

LLI Sample # WW 6252797
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 14:15 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S119D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0079	0.0050	0.0023	1
01754	Iron	7439-89-6	31.1	0.200	0.0522	1
07058	Manganese	7439-96-5	0.287	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0051	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0012	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	140	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	145	50.0	15.0	50
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	1.4	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	66.7	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	66.7	2.0	0.46	1
	SM20 2540 C		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	458	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-119D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-119D_04062011

LLI Sample # WW 6252797
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 14:15 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S119D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111021AA	04/12/2011 13:22	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111021AA	04/12/2011 13:22	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11101WAD026	04/12/2011 08:00	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11101WAD026	04/11/2011 17:20	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 14:00	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:36	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:36	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/16/2011 00:36	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:57	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:57	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130602A	04/13/2011 03:40	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11097130602A	04/08/2011 02:33	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 02:33	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 02:33	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130602A	04/13/2011 03:40	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11103049502B	04/13/2011 12:39	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021202A	04/12/2011 09:03	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-119D_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-119D_04062011

LLI Sample # WW 6252798
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 14:15 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0074	0.0050	0.0023	1
01754	Iron	7439-89-6	29.4	0.200	0.0522	1
07058	Manganese	7439-96-5	0.282	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0046	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:40	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:40	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/16/2011 00:40	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 07:59	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 07:59	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-38D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-38D_04062011

LLI Sample # WW 6252799
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 15:20 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-38D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	4	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	2.79	0.200	0.0522	1
07058	Manganese	7439-96-5	0.291	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0024	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	4.1	2.0	1.0	5
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	< 1.0	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	127	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	127	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	150	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-38D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-38D_04062011

LLI Sample # WW 6252799
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 15:20 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-38D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111021AA	04/12/2011 13:44	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111021AA	04/12/2011 13:44	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11101WAD026	04/12/2011 08:26	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11101WAD026	04/11/2011 17:20	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 14:31	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:43	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:43	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/16/2011 00:43	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 08:01	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 08:01	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11097130602A	04/08/2011 02:48	Nicole M Kepley	5
01504	Fluoride	EPA 300.0	1	11097130602A	04/08/2011 02:48	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 02:48	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 02:48	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130602A	04/13/2011 03:53	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501A	04/14/2011 04:29	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021202A	04/12/2011 09:03	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-38D_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 S-38D_04062011

LLI Sample # WW 6252800
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 15:20 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	< 0.0050	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	110981848003	04/16/2011 00:47	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	110981848003	04/16/2011 00:47	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	110981848003	04/16/2011 00:47	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	110986050004A	04/12/2011 08:03	Choon Y Tian	1
06035	Lead	SW-846 6020	1	110986050004A	04/12/2011 08:03	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	110981848003	04/11/2011 09:47	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	110986050004	04/11/2011 09:50	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-38D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-38D_04062011

LLI Sample # WW 6252801
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 09:25 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-38D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	4	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	37.0	0.200	0.0522	1
07058	Manganese	7439-96-5	0.861	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0135	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0327	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	8.7	2.0	1.0	5
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	0.63	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	40.6	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	1,090	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	1,090	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	818	120	38.8	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-38D_04062011 Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-38D_04062011

LLI Sample # WW 6252801
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 09:25 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

N-38D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	85.1	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111021AA	04/12/2011 14:06	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111021AA	04/12/2011 14:06	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	11101WAD026	04/12/2011 08:52	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	11101WAD026	04/11/2011 17:20	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 15:01	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111011848001	04/15/2011 11:23	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111011848001	04/15/2011 11:23	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111011848001	04/15/2011 11:23	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111016050001A	04/15/2011 04:06	David K Beck	1
06035	Lead	SW-846 6020	1	111016050001A	04/15/2011 04:06	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848001	04/11/2011 13:50	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050001	04/11/2011 14:30	James L Mertz	1
00224	Chloride	EPA 300.0	1	11097130602A	04/08/2011 03:03	Nicole M Kepley	5
01504	Fluoride	EPA 300.0	1	11097130602A	04/08/2011 03:03	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 03:03	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11097130602A	04/08/2011 03:03	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11097130602A	04/13/2011 04:07	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501A	04/14/2011 04:51	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11104020202B	04/14/2011 10:10	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11102021202A	04/12/2011 09:03	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11103023001A	04/13/2011 12:20	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11103022101A	04/13/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: N-38D_04062011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258161 N-38D_04062011

LLI Sample # WW 6252802
LLI Group # 1241118
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/06/2011 09:25 by JRW

Submitted: 04/07/2011 17:45
Reported: 04/20/2011 11:42

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	0.356	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0023	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848001	04/15/2011 11:26	John W Yanzuk II	1
01754	Iron	SW-846 6010B	1	111011848001	04/15/2011 11:26	John W Yanzuk II	1
07058	Manganese	SW-846 6010B	1	111011848001	04/15/2011 11:26	John W Yanzuk II	1
06025	Arsenic	SW-846 6020	1	111016050001A	04/15/2011 04:09	David K Beck	1
06035	Lead	SW-846 6020	1	111016050001A	04/15/2011 04:09	David K Beck	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848001	04/11/2011 13:50	James L Mertz	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050001	04/11/2011 14:30	James L Mertz	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241118
Reported: 04/20/11 at 11:42 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F110983AA	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793								
Benzene	< 1	1.	0.5	ug/l	96	99	79-120	3	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	89	92	70-130	3	30
Ethylbenzene	< 1	1.	0.5	ug/l	96	99	79-120	3	30
Isopropylbenzene	< 2	2.	0.5	ug/l	97	98	77-120	0	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	90	92	76-120	2	30
Toluene	< 1	1.	0.5	ug/l	97	97	79-120	0	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	93	95	74-120	2	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	94	97	75-120	4	30
Xylene (Total)	< 1	1.	0.5	ug/l	95	97	80-120	3	30
Batch number: F111021AA	Sample number(s): 6252795,6252797,6252799,6252801								
Benzene	< 1	1.	0.5	ug/l	102	97	79-120	5	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	95	94	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	98	96	79-120	3	30
Isopropylbenzene	< 2	2.	0.5	ug/l	97	93	77-120	4	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	89	92	76-120	4	30
Toluene	< 1	1.	0.5	ug/l	100	95	79-120	5	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	95	92	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	95	92	75-120	4	30
Xylene (Total)	< 1	1.	0.5	ug/l	95	91	80-120	4	30
Batch number: 11098WAF026	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791								
Chrysene	< 5	5.	1	ug/l	91	93	82-112	2	30
Fluorene	< 5	5.	1	ug/l	92	94	82-113	2	30
Naphthalene	< 5	5.	1	ug/l	89	92	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	96	95	83-112	2	30
Pyrene	< 5	5.	1	ug/l	92	95	80-115	2	30
Batch number: 11101WAD026	Sample number(s): 6252793,6252795,6252797,6252799,6252801								
Chrysene	< 5	5.	1	ug/l	95	94	82-112	1	30
Fluorene	< 5	5.	1	ug/l	90	97	82-113	7	30
Naphthalene	< 5	5.	1	ug/l	86	103	77-107	18	30
Phenanthrene	< 5	5.	1	ug/l	89	94	83-112	6	30
Pyrene	< 5	5.	1	ug/l	102	106	80-115	4	30
Batch number: 111020015A	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797,6252799,6252801								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	96	60-140	0	20
Batch number: 110981848003	Sample number(s): 6252781-6252800								
Cobalt	< 0.0050	0.0050	0.0023	mg/l	103		90-110		
Iron	< 0.200	0.200	0.0522	mg/l	104		90-112		
Manganese	< 0.0050	0.0050	0.00084	mg/l	101		90-110		
Batch number: 110986050004A	Sample number(s): 6252781-6252800								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241118
Reported: 04/20/11 at 11:42 AM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Arsenic	< 0.0020	0.0020	0.00095	mg/l	95		86-111		
Lead	< 0.0010	0.0010	0.00005	mg/l	101		90-115		
			2						
Batch number: 111011848001	Sample number(s): 6252801-6252802								
Cobalt	< 0.0050	0.0050	0.0023	mg/l	104		90-110		
Iron	< 0.200	0.200	0.0522	mg/l	107		90-112		
Manganese	< 0.0050	0.0050	0.00084	mg/l	104		90-110		
Batch number: 111016050001A	Sample number(s): 6252801-6252802								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	99		86-111		
Lead	< 0.0010	0.0010	0.00005	mg/l	105		90-115		
			2						
Batch number: 11097130601B	Sample number(s): 6252781,6252783,6252785								
Chloride	< 0.40	0.40	0.20	mg/l	98	95	90-110	3	20
Fluoride	< 0.10	0.10	0.080	mg/l	94	98	90-110	4	20
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	93	94	90-110	1	20
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	92	96	90-110	5	20
Sulfate	< 1.0	1.0	0.30	mg/l	95	96	89-110	2	20
Batch number: 11097130602A	Sample number(s): 6252787,6252789,6252791,6252793,6252795,6252797,6252799,6252801								
Chloride	< 0.40	0.40	0.20	mg/l	104		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	95		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	100		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	102		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	105		89-110		
Batch number: 11103049502B	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	100		91-113		
Batch number: 11104049501A	Sample number(s): 6252799,6252801								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	101		91-113		
Batch number: 11102021201B	Sample number(s): 6252781,6252783,6252785								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	103		80-120		
Batch number: 11102021202A	Sample number(s): 6252787,6252789,6252791,6252793,6252795,6252797,6252799,6252801								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	99		80-120		
Batch number: 11103022101A	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797,6252799,6252801								
Ammonia Nitrogen	< 0.60	0.60	0.20	mg/l	95	95	85-105	1	5
Batch number: 11103023001A	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797,6252799,6252801								
Sulfide	< 0.16	0.16	0.054	mg/l	104		90-110		
Batch number: 11104020202B	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797,6252799,6252801								
Alkalinity to pH 4.5	< 2.0	2.0	0.46	mg/l as CaCO3	99		98-103		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241118
Reported: 04/20/11 at 11:42 AM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111020015A	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797,6252799, 6252801 UNSPK: P250846 BKG: P253801								
Ethylene dibromide	91		65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 110981848003	Sample number(s): 6252781-6252800 UNSPK: 6252781 BKG: 6252781								
Cobalt	100	101	87-112	0	20	0.0170	0.0173	2 (1)	20
Iron	93 (2)	146 (2)	75-125	1	20	103	104	0	20
Manganese	100	106	75-125	1	20	1.87	1.89	1	20
Batch number: 110986050004A	Sample number(s): 6252781-6252800 UNSPK: 6252785 BKG: 6252785								
Arsenic	97	99	75-125	1	20	0.0043	0.0040	7 (1)	20
Lead	100	103	83-120	3	20	< 0.0010	< 0.0010	4 (1)	20
Batch number: 111011848001	Sample number(s): 6252801-6252802 UNSPK: P254677 BKG: P254677								
Cobalt	101	94	87-112	7	20	< 0.0050	< 0.0050	0 (1)	20
Iron	86	90	75-125	1	20	1.73	1.69	2	20
Manganese	102	99	75-125	2	20	0.299	0.293	2	20
Batch number: 111016050001A	Sample number(s): 6252801-6252802 UNSPK: P254291 BKG: P254291								
Arsenic	99	100	75-125	1	20	< 0.0020	< 0.0020	13 (1)	20
Lead	106	109	83-120	3	20	< 0.0010	< 0.0010	10 (1)	20
Batch number: 11097130601B	Sample number(s): 6252781,6252783,6252785 UNSPK: P251891 BKG: P251891								
Chloride	101		90-110			571	565	1	20
Fluoride	133*		90-110			0.63	< 0.50	200* (1)	20
Nitrate Nitrogen	133*		90-110			0.59	0.66	11 (1)	20
Nitrite Nitrogen	117*		90-110			< 10.0	< 10.0	0 (1)	20
Sulfate	106		90-110			111	110	1	20
Batch number: 11097130602A	Sample number(s): 6252787,6252789,6252791,6252793,6252795,6252797,6252799,6252801 UNSPK: 6252787 BKG: 6252787								
Chloride	120*		90-110			68.0	69.7	3	20
Fluoride	90		90-110			< 0.50	< 0.50	0 (1)	20
Nitrate Nitrogen	100		90-110			< 0.50	< 0.50	0 (1)	20
Nitrite Nitrogen	87*		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	119*		90-110			6.9	6.9	0 (1)	20
Batch number: 11103049502B	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797 UNSPK: 6252781 BKG: 6252781								
Total Organic Carbon	99		63-142			14.8	14.4	3	3
Batch number: 11104049501A	Sample number(s): 6252799,6252801 UNSPK: 6252799 BKG: 6252799								
Total Organic Carbon	107		63-142			< 1.0	< 1.0	0 (1)	3

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241118
Reported: 04/20/11 at 11:42 AM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 11102021201B	Sample number(s): 6252781,6252783,6252785 UNSPK: P253316 BKG: 6252781								
Total Dissolved Solids	102		62-135			1,140	1,150	0	9
Batch number: 11102021202A	Sample number(s): 6252787,6252789,6252791,6252793,6252795,6252797,6252799,6252801 UNSPK: P254468 BKG: P254468								
Total Dissolved Solids	107		62-135			2,940	2,770	6	9
Batch number: 11103022101A	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797,6252799, 6252801 BKG: P252424								
Ammonia Nitrogen						29.5	29.9	1	2
Batch number: 11103023001A	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797,6252799, 6252801 UNSPK: P252213 BKG: P252213								
Sulfide	108	98	69-133	10*	5	< 0.16	< 0.16	0 (1)	5
Batch number: 11104020202B	Sample number(s): 6252781,6252783,6252785,6252787,6252789,6252791,6252793,6252795,6252797,6252799, 6252801 UNSPK: P252511 BKG: 6252799								
Alkalinity to pH 4.5	93	93	73-121	0	5	127	128	0	5
Alkalinity to pH 8.3						< 2.0	< 2.0	0 (1)	5

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: F110983AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6252781	101	101	94	100
6252783	102	102	98	105
6252785	102	100	98	103
6252787	102	99	94	98
6252789	99	98	100	102
6252791	100	97	96	97
6252793	103	101	100	99
Blank	102	101	99	96
LCS	100	100	100	103
LCSD	99	100	98	101
Limits:	80-116	77-113	80-113	78-113

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111021AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241118
Reported: 04/20/11 at 11:42 AM

Surrogate Quality Control

6252795	105	101	100	99
6252797	103	101	100	98
6252799	105	100	100	97
6252801	105	100	102	98
Blank	103	102	100	97
LCS	102	100	101	105
LCSD	102	100	101	105
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11098WAF026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6252781	95	97	92
6252783	86	86	77
6252785	99	99	93
6252787	89	89	79
6252789	98	97	92
6252791	96	97	90
Blank	98	98	85
LCS	98	98	88
LCSD	97	98	89
Limits:	52-120	63-114	34-118

Analysis Name: PAHs by 8270
Batch number: 11101WAD026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6252793	98	105	91
6252795	99	98	97
6252797	88	92	77
6252799	98	95	87
6252801	95	103	111
Blank	96	97	97
LCS	97	100	102
LCSD	97	102	110
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111020015A

	1,1,2,2-Tetrachloroethane
6252781	97
6252783	88
6252785	90
6252787	122
6252789	96
6252791	83
6252793	84
6252795	92
6252797	93
6252799	90

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241118
Reported: 04/20/11 at 11:42 AM

Surrogate Quality Control

6252801	88
Blank	95
DUP	87
LCS	94
LCSD	94
MS	89
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1241118 Sample # 6252781-802

COC # 258161

Please print. Instructions on reverse side correspond with circled numbers. Cooler temp 0.8-1.3°C

(1) Client: Aquaterra Technologies Inc. Acct. #:

Project Name/#: San-Philly Refinery AOI-11 PWSID #:

Project Manager: Tiffani Doerr P.O.#:

Sampler: JR Williams/Mine Hinderliter Quote #:

Name of state where samples were collected: Pa

(4) Matrix — Check if Applicable: ☐ Potable ☐ NPDES

(5) Analyses Requested — Preservation Codes

See Attached Form For Analyses Requested.

For Lab Use Only

FSC:

SCR#:

Preservation Codes

H=HCl T=Thiosulfate

N=HNO_3 B=NaOH

S=H_2SO_4 O=Other

Lab to filter all samples.

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Soil	Water	Other	Total # of Containers	Remarks
S-305D_04062011	4/6/11	1455	X			X		16	
S-46D-04062011	4/6/11	1340	X			X		16	
S-294D-04062011	4/6/11	1205	X			X		16	labeled Bottle: S-294D AOI-2
N-13_04062011	4/6/11	0930	X			X		16	labeled Bottle: N-13 AOI-8
N-21-04062011	4/6/11	0830	X			X		16	labeled Bottle: N-21 AOI-8
N-4_04062011	4/6/11	1020	X			X		16	labeled Bottle: N-4 AOI-8
S-264_04062011	4/6/11	1345	X			X		16	
S-80D-04062011	4/6/11	1200	X			X		16	labeled Bottle: S-80D AOI-1
S-1190-04062011	4/6/11	1415	X			X		16	
S-38D-04062011	4/6/11	1520	X			X		16	

(7) **Turnaround Time Requested** (TAT) (please circle): (Normal) Rush

(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)

Date results are needed:

Rush results requested by (please circle): Phone Fax E-mail

Phone #: Fax #:

E-mail address:

(8) **Data Package Options** (please circle if required)

Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)

TX TRRP-13
MA MCP CT RCP

SDG Complete? (Yes) No

Site-specific QC (MS/MSD/Dup)? Yes (No)

(If yes, indicate QC sample and submit triplicate volume.)

Internal COC Required? Yes / (No)

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
[signature]	4/6/11	1700	Fridge	4/6/11	1700
[signature]	4-7-11	15:05	[signature]	4/7/11	1505
[signature]	4/7/11	1745			
			[signature]	4/7/11	1745

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766

Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management 2102.05

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

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Acct. # 10132 Group# 124118 Sample # 6252781-802

COC # 258160

Please print. Instructions on reverse side correspond with circled numbers. Cooler temp 0.8-1.3°C

For Lab Use Only
FSC:
SCR#:

(1)
Client: Aquaterra Technologies Inc. Acct. #:
Project Name/#: Sun-Philly Refinery AOI-11 PWSID #:
Project Manager: Tiffani Doerr P.O.#:
Sampler: JR Williams / Mike Hindorff Quote #:
Name of state where samples were collected: PA

(4) Matrix — Check if Applicable: ☐ Potable ☐ NPDES

(5) Analyses Requested — Preservation Codes

See Attached Form For Analyses Requested.

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

lab filters all samples

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Soil	Water	Other	Total # of Containers	Remarks
N-38D_04062011	4/6/11	0925	X			X		16	labeled Bottle: N-38D AOI-8

(7) **Turnaround Time Requested** (TAT) (please circle): (Normal) Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
SDG Complete? (Yes) No
Site-specific QC (MS/MSD/Dup)? Yes (No)
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / (No)

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
[signature]	4/6/11	1700	Fridge	4/6/11	1700
[signature]	4-7-11	15:05	[signature]	4/7/11	1505
[signature]	4/7/11	1745			
			[signature]	4/7/11	1745

Acct#10132
Cp# 1241118
sample# 6252781-802

Attached
Analyses Request
E

Table 1
Constituents of Concern for Groundwater
AOI 11 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene Dibromide	106-93-4
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Metals	CAS No.
Arsenic (Total & Dissolved)	7440-38-2
Cobalt (Total & Dissolved)	7440-48-4
Iron (Total & Dissolved)	7439-89-6
Lead (Total & Dissolved)	7439-92-1
Manganese (Total & Dissolved)	7439-96-5

Misc Parameters	CAS No.
Ammonia	7664-41-7
Chloride	16887-00-6
Fluoride	7782-41-4
Nitrate	84145-82-4
Nitrite	1594-56-5
Sulfate	18785-72-3
Sulfide	-
Total Alkalinity	-
Bicarbonate	71-52-3
Total Organic Carbon	7440-44-0
Total Dissolved Solids	CASID10052

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

April 22, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 04/08/2011
Group Number: 1241306
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-72D_04072011 Grab Water	6253801
S-72D_04072011 Filtered Grab Water	6253802
BF-108_04072011 Grab Water	6253803
BF-108_04072011 Filtered Grab Water	6253804
BF-90D_04072011 Grab Water	6253805
BF-90D_04072011 Filtered Grab Water	6253806
S-302D_04072011 Grab Water	6253807
S-302D_04072011 Filtered Grab Water	6253808
S-280D_04072011 Grab Water	6253809
S-280D_04072011 Filtered Grab Water	6253810
S-59D_04072011 Grab Water	6253811
S-59D_04072011 Filtered Grab Water	6253812
S-38D2_04072011 Grab Water	6253813
S-38D2_04072011 Filtered Grab Water	6253814
S-22_04072011 Grab Water	6253815
S-22_04072011 Filtered Grab Water	6253816
S-8_04072011 Grab Water	6253817
S-8_04072011 Filtered Grab Water	6253818
S-284D_04072011 Grab Water	6253819
S-284D_04072011 Filtered Grab Water	6253820
S-69D_04072011 Grab Water	6253821
S-69D_04072011 Filtered Grab Water	6253822

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

Lancaster Laboratories

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Analysis Report

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Robert Heisey
Senior Specialist

Lancaster Laboratories

2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Analysis Report

Sample Description: S-72D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-72D_04072011

LLI Sample # WW 6253801
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 08:45 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-72D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	62.2	0.200	0.0522	1
07058	Manganese	7439-96-5	3.95	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	87.9	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	247	20.0	6.0	20
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	3.2	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	206	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	206	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	662	60.0	19.4	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-72D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-72D_04072011

LLI Sample # WW 6253801
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 08:45 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-72D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	5.8	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111013AA	04/12/2011 00:19	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111013AA	04/12/2011 00:19	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11102WAA026	04/13/2011 00:42	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	11102WAA026	04/12/2011 12:45	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 15:31	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 11:30	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 11:30	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 11:30	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 08:42	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 08:42	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/13/2011 12:17	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11098130602A	04/08/2011 21:54	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 21:54	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 21:54	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/13/2011 12:17	Ashley M Adams	20
00273	Total Organic Carbon	SM20 5310 C	1	11104049501A	04/14/2011 06:03	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11105020201A	04/15/2011 06:38	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11105020201A	04/15/2011 06:38	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11105020201A	04/15/2011 06:38	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-72D_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-72D_04072011

LLI Sample # WW 6253802
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 08:45 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	48.6	0.200	0.0522	1
07058	Manganese	7439-96-5	4.02	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 11:34	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 11:34	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 11:34	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 08:53	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 08:53	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: BF-108_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 BF-108_04072011

LLI Sample # WW 6253803
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 10:35 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

BF108

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	55	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	1.06	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	37.5	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	16.3	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	3.8	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	265	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	265	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	335	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: BF-108_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 BF-108_04072011

LLI Sample # WW 6253803
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 10:35 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

BF108

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	0.75	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111013AA	04/12/2011 00:40	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111013AA	04/12/2011 00:40	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11102WAA026	04/13/2011 01:07	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	11102WAA026	04/12/2011 12:45	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 16:31	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 11:10	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 11:10	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 11:10	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 08:55	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 08:55	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/13/2011 13:12	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11098130602A	04/08/2011 22:40	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 22:40	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 22:40	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/13/2011 12:58	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 06:10	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: BF-108_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 BF-108_04072011

LLI Sample # WW 6253804
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 10:35 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	1.07	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 11:44	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 11:44	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 11:44	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:00	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:00	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: BF-90D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 BF-90D_04072011

LLI Sample # WW 6253805
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 12:10 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

BF90D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	1.46	0.200	0.0522	1
07058	Manganese	7439-96-5	0.190	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0025	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	25.8	2.0	1.0	5
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	14.3	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	13.5	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	242	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	242	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	339	30.0	9.7	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: BF-90D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 BF-90D_04072011

LLI Sample # WW 6253805
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 12:10 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

BF90D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	0.84	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111013AA	04/12/2011 01:02	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111013AA	04/12/2011 01:02	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11102WAA026	04/13/2011 01:32	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	11102WAA026	04/12/2011 12:45	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 17:02	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 11:48	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/18/2011 20:57	John P Hook	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 11:48	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:02	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:02	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/08/2011 22:56	Nicole M Kepley	5
01504	Fluoride	EPA 300.0	1	11098130602A	04/08/2011 22:56	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 22:56	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 22:56	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/13/2011 13:25	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 06:32	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: BF-90D_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 BF-90D_04072011

LLI Sample # WW 6253806
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 12:10 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	0.167	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 11:51	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 11:51	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/18/2011 21:01	John P Hook	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:04	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:04	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-302D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-302D_04072011

LLI Sample # WW 6253807
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 13:30 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S302D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.010	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	77.4	0.200	0.0522	1
07058	Manganese	7439-96-5	4.04	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	82.9	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	410	50.0	15.0	50
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	8.5	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	270	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	270	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	944	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-302D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-302D_04072011

LLI Sample # WW 6253807
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 13:30 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S302D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	11.6	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111013AA	04/12/2011 01:24	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111013AA	04/12/2011 01:24	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11102WAA026	04/13/2011 01:58	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	11102WAA026	04/12/2011 12:45	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 19:33	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 11:54	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 11:54	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 11:54	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:05	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:05	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/13/2011 13:39	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11098130602A	04/08/2011 23:11	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 23:11	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 23:11	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/13/2011 13:39	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 06:54	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-302D_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-302D_04072011

LLI Sample # WW 6253808
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 13:30 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	67.2	0.200	0.0522	1
07058	Manganese	7439-96-5	4.14	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 11:57	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 11:57	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 11:57	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:07	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:07	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-280D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-280D_04072011

LLI Sample # WW 6253809
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 14:40 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S280D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	23.5	0.200	0.0522	1
07058	Manganese	7439-96-5	0.709	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0153	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	45.4	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	4.5	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	228	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	228	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	249	30.0	9.7	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-280D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-280D_04072011

LLI Sample # WW 6253809
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 14:40 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S280D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	14.7	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111014AA	04/11/2011 19:05	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111014AA	04/11/2011 19:05	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11102WAA026	04/13/2011 02:23	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	11102WAA026	04/12/2011 12:45	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	111020015A	04/14/2011 20:03	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111020015A	04/12/2011 19:10	JoElla L Rice	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:01	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 12:01	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:01	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:09	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:09	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/13/2011 13:53	Nicole M Kepley	10
01504	Fluoride	EPA 300.0	1	11098130602A	04/08/2011 23:58	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 23:58	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/08/2011 23:58	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/08/2011 23:58	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 07:01	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-280D_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-280D_04072011

LLI Sample # WW 6253810
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 14:40 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	9.42	0.200	0.0522	1
07058	Manganese	7439-96-5	0.694	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0025	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:04	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 12:04	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:04	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:11	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:11	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-59D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-59D_04072011

LLI Sample # WW 6253811
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 12:00 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-59D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	2	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0127	0.0050	0.0023	1
01754	Iron	7439-89-6	15.6	0.200	0.0522	1
07058	Manganese	7439-96-5	3.01	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0551	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0015	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	179	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	8.7	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	7.3	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	438	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	438	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	676	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-59D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-59D_04072011

LLI Sample # WW 6253811
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 12:00 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-59D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	3.2	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111014AA	04/11/2011 19:26	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111014AA	04/11/2011 19:26	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAF026	04/14/2011 18:05	Joseph M Gambler	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAF026	04/13/2011 18:00	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111030009A	04/14/2011 22:03	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111030009A	04/13/2011 14:00	Kelli M Barto	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:07	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 12:07	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:07	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:12	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:12	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/13/2011 14:34	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11098130602A	04/09/2011 00:14	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 00:14	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 00:14	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/09/2011 00:14	Nicole M Kepley	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 07:08	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-59D_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-59D_04072011

LLI Sample # WW 6253812
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 12:00 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0119	0.0050	0.0023	1
01754	Iron	7439-89-6	2.43	0.200	0.0522	1
07058	Manganese	7439-96-5	2.91	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0133	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:11	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/18/2011 21:04	John P Hook	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:11	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:14	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:14	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-38D2_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-38D2_04072011

LLI Sample # WW 6253813
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 08:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S38D2

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	2	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0099	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	3.06	0.200	0.0522	1
07058	Manganese	7439-96-5	6.67	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	38.2	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	12.8	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	2.6	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	258	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	258	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	337	30.0	9.7	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-38D2_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-38D2_04072011

LLI Sample # WW 6253813
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 08:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S38D2

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	< 0.60	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111014AA	04/11/2011 19:48	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111014AA	04/11/2011 19:48	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAF026	04/15/2011 02:19	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAF026	04/13/2011 18:00	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	111030009A	04/14/2011 22:33	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111030009A	04/13/2011 14:00	Kelli M Barto	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:14	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/18/2011 21:08	John P Hook	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:14	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:16	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:16	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/13/2011 14:48	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11098130602A	04/09/2011 00:30	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 00:30	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 00:30	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/09/2011 00:30	Nicole M Kepley	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 07:16	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-38D2_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-38D2_04072011

LLI Sample # WW 6253813
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 08:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S38D2

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-38D2_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-38D2_04072011

LLI Sample # WW 6253814
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 08:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	1.65	0.200	0.0522	1
07058	Manganese	7439-96-5	6.73	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:24	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/18/2011 21:19	John P Hook	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:24	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:21	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:21	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-22_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-22_04072011

LLI Sample # WW 6253815
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 10:55 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

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CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	20	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	5	1	0.5	1
10943	Isopropylbenzene	98-82-8	10	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	75	1	0.5	1
10943	Toluene	108-88-3	43	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	9	2	0.5	1
10943	Xylene (Total)	1330-20-7	110	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0069	0.0050	0.0023	1
01754	Iron	7439-89-6	36.3	0.200	0.0522	1
07058	Manganese	7439-96-5	0.371	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0029	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0039	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	41.3	4.0	2.0	10
01504	Fluoride	16984-48-8	0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	13.4	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	210	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	210	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	300	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-22_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-22_04072011

LLI Sample # WW 6253815
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 10:55 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S--22

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	1.8	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111014AA	04/11/2011 20:09	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111014AA	04/11/2011 20:09	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAB026	04/14/2011 03:52	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAB026	04/13/2011 13:30	Olivia I Santiago	1
07879	EDB in Wastewater	SW-846 8011	1	111030009A	04/14/2011 23:03	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111030009A	04/13/2011 14:00	Kelli M Barto	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:28	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 12:28	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:28	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:23	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:23	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/13/2011 15:01	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11098130602A	04/09/2011 00:45	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 00:45	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 00:45	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/09/2011 00:45	Nicole M Kepley	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 07:23	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-22_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-22_04072011

LLI Sample # WW 6253816
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 10:55 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	2.94	0.200	0.0522	1
07058	Manganese	7439-96-5	0.293	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:31	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/18/2011 21:23	John P Hook	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:31	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:25	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:25	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-8_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-8_04072011

LLI Sample # WW 6253817
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 09:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

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CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	30	1	0.5	1
10943	Toluene	108-88-3	8	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 500	500	100	10
07805	Fluorene	86-73-7	< 500	500	100	10
07805	Naphthalene	91-20-3	< 500	500	100	10
07805	Phenanthrene	85-01-8	< 500	500	100	10
07805	Pyrene	129-00-0	< 500	500	100	10
Reporting limits were raised due to interference from the sample matrix.						
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0719	0.0050	0.0023	1
01754	Iron	7439-89-6	155	0.200	0.0522	1
07058	Manganese	7439-96-5	7.41	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0453	0.0020	0.00095	1
06035	Lead	7439-92-1	2.59	0.0100	0.00052	10
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	98.3	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	13.0	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	136	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	136	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	333	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-8_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-8_04072011

LLI Sample # WW 6253817
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 09:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

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CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500NH3 B/C modified**		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	20.4	1.8	0.60	3

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111014AA	04/11/2011 20:31	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111014AA	04/11/2011 20:31	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAB026	04/14/2011 04:18	Linda M Hartenstine	10
07807	BNA Water Extraction	SW-846 3510C	1	11103WAB026	04/13/2011 13:30	Olivia I Santiago	1
07879	EDB in Wastewater	SW-846 8011	1	111030009A	04/14/2011 23:33	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111030009A	04/13/2011 14:00	Kelli M Barto	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:34	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/16/2011 12:34	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:34	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:27	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:34	Choon Y Tian	10
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/13/2011 15:15	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11098130602A	04/09/2011 01:01	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 01:01	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 01:01	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/09/2011 01:01	Nicole M Kepley	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 07:30	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	3

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-8_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-8_04072011

LLI Sample # WW 6253818
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 09:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	1.14	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:38	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/18/2011 21:27	John P Hook	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:38	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:28	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:28	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-284D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-284D_04072011

LLI Sample # WW 6253819
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 13:15 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S284D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0099	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	2.58	0.200	0.0522	1
07058	Manganese	7439-96-5	0.972	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	59.3	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	157	20.0	6.0	20
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	4.9	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	327	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	327	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	531	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-284D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-284D_04072011

LLI Sample # WW 6253819
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 13:15 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S284D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	22.3	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111014AA	04/11/2011 20:53	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111014AA	04/11/2011 20:53	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAB026	04/14/2011 04:45	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAB026	04/13/2011 13:30	Olivia I Santiago	1
07879	EDB in Wastewater	SW-846 8011	1	111030009A	04/15/2011 00:03	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111030009A	04/13/2011 14:00	Kelli M Barto	1
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:41	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/18/2011 21:30	John P Hook	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:41	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:30	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:30	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602A	04/13/2011 15:29	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11098130602A	04/09/2011 01:17	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 01:17	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602A	04/09/2011 01:17	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602A	04/13/2011 15:29	Nicole M Kepley	20
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 07:37	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021201B	04/14/2011 10:07	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-284D_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-284D_04072011

LLI Sample # WW 6253820
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 13:15 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	1.22	0.200	0.0522	1
07058	Manganese	7439-96-5	0.979	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848004	04/16/2011 12:45	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848004	04/18/2011 21:34	John P Hook	1
07058	Manganese	SW-846 6010B	1	111011848004	04/16/2011 12:45	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111016050003A	04/12/2011 09:32	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111016050003A	04/12/2011 09:32	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848004	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111016050003	04/11/2011 19:40	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-69D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-69D_04072011

LLI Sample # WW 6253821
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 14:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-69D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	5	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	3.00	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	94.0	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	21.4	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	4.2	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	326	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	326	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	493	30.0	9.7	1

*=This limit was used in the evaluation of the final result

Sample Description: S-69D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-69D_04072011

LLI Sample # WW 6253821
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 14:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-69D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
	TDS was initially analyzed on 4/14/11 with a result of 242 mg/l. Due to the disparity with the total alkalinity result, TDS was reanalyzed in duplicate on 4/19/11, five days past the hold time. In addition to the result above, the second TDS result is 490 mg/l.					
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	2.6	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111014AA	04/11/2011 21:15	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111014AA	04/11/2011 21:15	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAB026	04/14/2011 05:11	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAB026	04/13/2011 13:30	Olivia I Santiago	1
07879	EDB in Wastewater	SW-846 8011	1	111030009A	04/15/2011 01:35	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111030009A	04/13/2011 14:00	Kelli M Barto	1
07052	Cobalt	SW-846 6010B	1	111011848005	04/17/2011 08:23	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848005	04/17/2011 08:23	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848005	04/17/2011 08:23	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111026050002A	04/13/2011 11:32	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111026050002A	04/13/2011 11:32	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848005	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111026050002	04/12/2011 20:30	Mirit S Shenouda	1
00224	Chloride	EPA 300.0	1	11098130602B	04/13/2011 15:42	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11098130602B	04/09/2011 01:32	Nicole M Kepley	5
00368	Nitrate Nitrogen	EPA 300.0	1	11098130602B	04/09/2011 01:32	Nicole M Kepley	5
01506	Nitrite Nitrogen	EPA 300.0	1	11098130602B	04/09/2011 01:32	Nicole M Kepley	5
00228	Sulfate	EPA 300.0	1	11098130602B	04/09/2011 01:32	Nicole M Kepley	5
00273	Total Organic Carbon	SM20 5310 C	1	11104049501B	04/14/2011 07:45	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-69D_04072011 Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-69D_04072011

LLI Sample # WW 6253821
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 14:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

S-69D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11106020201A	04/16/2011 05:46	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	2	11109021202B	04/19/2011 09:25	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11104023001A	04/14/2011 11:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11104022101A	04/14/2011 15:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-69D_04072011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 258157 S-69D_04072011

LLI Sample # WW 6253822
LLI Group # 1241306
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/07/2011 14:50 by JRW

Submitted: 04/08/2011 14:10
Reported: 04/22/2011 13:58

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	2.94	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111011848005	04/17/2011 09:00	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111011848005	04/17/2011 09:00	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111011848005	04/17/2011 09:00	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111026050002A	04/13/2011 12:19	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111026050002A	04/13/2011 12:19	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111011848005	04/11/2011 19:40	Mirit S Shenouda	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111026050002	04/12/2011 20:30	Mirit S Shenouda	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241306
Reported: 04/22/11 at 01:58 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F111013AA	Sample number(s): 6253801,6253803,6253805,6253807								
Benzene	< 1	1.	0.5	ug/l	98	96	79-120	2	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	94	91	70-130	2	30
Ethylbenzene	< 1	1.	0.5	ug/l	96	95	79-120	0	30
Isopropylbenzene	< 2	2.	0.5	ug/l	95	95	77-120	0	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	91	88	76-120	2	30
Toluene	< 1	1.	0.5	ug/l	95	94	79-120	2	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	97	95	74-120	2	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	96	93	75-120	3	30
Xylene (Total)	< 1	1.	0.5	ug/l	92	92	80-120	1	30
Batch number: F111014AA	Sample number(s): 6253809,6253811,6253813,6253815,6253817,6253819,6253821								
Benzene	< 1	1.	0.5	ug/l	97	97	79-120	0	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	94	95	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	94	95	79-120	1	30
Isopropylbenzene	< 2	2.	0.5	ug/l	94	94	77-120	0	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	88	93	76-120	5	30
Toluene	< 1	1.	0.5	ug/l	94	95	79-120	1	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	94	95	74-120	1	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	94	93	75-120	1	30
Xylene (Total)	< 1	1.	0.5	ug/l	93	93	80-120	1	30
Batch number: 11102WAA026	Sample number(s): 6253801,6253803,6253805,6253807,6253809								
Chrysene	< 5	5.	1	ug/l	96	94	82-112	2	30
Fluorene	< 5	5.	1	ug/l	97	96	82-113	1	30
Naphthalene	< 5	5.	1	ug/l	96	94	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	99	97	83-112	3	30
Pyrene	< 5	5.	1	ug/l	96	94	80-115	2	30
Batch number: 11103WAB026	Sample number(s): 6253815,6253817,6253819,6253821								
Chrysene	< 5	5.	1	ug/l	97	102	82-112	5	30
Fluorene	< 5	5.	1	ug/l	96	94	82-113	2	30
Naphthalene	< 5	5.	1	ug/l	93	93	77-107	0	30
Phenanthrene	< 5	5.	1	ug/l	95	96	83-112	2	30
Pyrene	< 5	5.	1	ug/l	100	104	80-115	3	30
Batch number: 11103WAF026	Sample number(s): 6253811,6253813								
Chrysene	< 5	5.	1	ug/l	91	102	82-112	12	30
Fluorene	< 5	5.	1	ug/l	91	100	82-113	9	30
Naphthalene	< 5	5.	1	ug/l	83	99	77-107	17	30
Phenanthrene	< 5	5.	1	ug/l	90	97	83-112	8	30
Pyrene	< 5	5.	1	ug/l	92	106	80-115	14	30
Batch number: 111020015A	Sample number(s): 6253801,6253803,6253805,6253807,6253809								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	96	60-140	0	20
Batch number: 111030009A	Sample number(s): 6253811,6253813,6253815,6253817,6253819,6253821								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241306
Reported: 04/22/11 at 01:58 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	96	60-140	0	20
Batch number: 111011848004	Sample number(s): 6253801-6253820								
Cobalt	< 0.0050	0.0050	0.0023	mg/l	102		90-110		
Iron	< 0.200	0.200	0.0522	mg/l	100		90-112		
Manganese	< 0.0050	0.0050	0.00084	mg/l	102		90-110		
Batch number: 111011848005	Sample number(s): 6253821-6253822								
Cobalt	< 0.0050	0.0050	0.0023	mg/l	102		90-110		
Iron	< 0.200	0.200	0.0522	mg/l	103		90-112		
Manganese	< 0.0050	0.0050	0.00084	mg/l	101		90-110		
Batch number: 111016050003A	Sample number(s): 6253801-6253820								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	99		86-111		
Lead	< 0.0010	0.0010	0.00005 2	mg/l	99		90-115		
Batch number: 111026050002A	Sample number(s): 6253821-6253822								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	88		86-111		
Lead	< 0.0010	0.0010	0.00005 2	mg/l	96		90-115		
Batch number: 11098130602A	Sample number(s): 6253801,6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819								
Chloride	< 0.40	0.40	0.20	mg/l	102		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	98		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	99		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	100		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	99		89-110		
Batch number: 11098130602B	Sample number(s): 6253821								
Chloride	< 0.40	0.40	0.20	mg/l	102		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	98		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	99		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	100		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	99		89-110		
Batch number: 11104049501A	Sample number(s): 6253801								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	101		91-113		
Batch number: 11104049501B	Sample number(s): 6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819,6253821								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	101		91-113		
Batch number: 11104021201B	Sample number(s): 6253801,6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	101		80-120		
Batch number: 11104022101A	Sample number(s): 6253801,6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819,6253821								
Ammonia Nitrogen	< 0.60	0.60	0.20	mg/l	95	95	85-105	0	5
Batch number: 11104023001A	Sample number(s): 6253801,6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253819,6253822								

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(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241306
Reported: 04/22/11 at 01:58 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Sulfide	< 0.16 1	0.16	0.054	mg/l	99		90-110		
Batch number: 11105020201A	Sample number(s): 6253801								
Alkalinity to pH 4.5	< 2.0	2.0	0.46	mg/l as CaCO3	99		98-103		
Batch number: 11106020201A	Sample number(s): 6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819,6253821								
Alkalinity to pH 4.5	< 2.0	2.0	0.46	mg/l as CaCO3	100		98-103		
Batch number: 11109021202B	Sample number(s): 6253821								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	108		80-120		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111020015A	Sample number(s): 6253801,6253803,6253805,6253807,6253809 UNSPK: P250846 BKG: 6253801								
Ethylene dibromide	91		65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 111030009A	Sample number(s): 6253811,6253813,6253815,6253817,6253819,6253821 UNSPK: P250619								
Ethylene dibromide	96	83	65-135	10	20				
Batch number: 111011848004	Sample number(s): 6253801-6253820 UNSPK: 6253803 BKG: 6253803								
Cobalt	99	99	87-112	0	20	< 0.0050	< 0.0050	8 (1)	20
Iron	99	99	75-125	1	20	< 0.200	< 0.200	43* (1)	20
Manganese	97	97	75-125	0	20	1.06	1.04	2	20
Batch number: 111011848005	Sample number(s): 6253821-6253822 UNSPK: 6253821 BKG: 6253821								
Cobalt	97	98	87-112	0	20	< 0.0050	< 0.0050	2 (1)	20
Iron	100	101	75-125	0	20	< 0.200	< 0.200	5 (1)	20
Manganese	95 (2)	90 (2)	75-125	1	20	3.00	2.93	2	20
Batch number: 111016050003A	Sample number(s): 6253801-6253820 UNSPK: 6253801 BKG: 6253801								
Arsenic	169*	97	75-125	54*	20	< 0.0020	< 0.0020	0 (1)	20
Lead	175*	98	83-120	56*	20	< 0.0010	< 0.0010	0 (1)	20
Batch number: 111026050002A	Sample number(s): 6253821-6253822 UNSPK: 6253821 BKG: 6253821								
Arsenic	107	104	75-125	2	20	< 0.0020	< 0.0020	0 (1)	20
Lead	107	103	83-120	3	20	< 0.0010	< 0.0010	0 (1)	20
Batch number: 11098130602A	Sample number(s): 6253801,6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819 UNSPK: 6253801 BKG: 6253801								
Chloride	108		90-110			87.9	87.8	0	20
Fluoride	83*		90-110			< 0.50	< 0.50	0 (1)	20
Nitrate Nitrogen	94		90-110			< 0.50	< 0.50	0 (1)	20

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(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241306
Reported: 04/22/11 at 01:58 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Nitrite Nitrogen	84*		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	111*		90-110			247	249	1	20
Batch number: 11098130602B	Sample number(s): 6253821 UNSPK: 6253821 BKG: 6253821								
Chloride	110		90-110			94.0	94.7	1	20
Fluoride	50*		90-110			< 0.50	< 0.50	0 (1)	20
Nitrate Nitrogen	50*		90-110			< 0.50	< 0.50	0 (1)	20
Nitrite Nitrogen	42*		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	34*		90-110			21.4	20.8	3 (1)	20
Batch number: 11104049501A	Sample number(s): 6253801 UNSPK: P252799 BKG: P252799								
Total Organic Carbon	107		63-142			< 1.0	< 1.0	0 (1)	3
Batch number: 11104049501B	Sample number(s): 6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819,6253821 UNSPK: 6253803 BKG: 6253803								
Total Organic Carbon	103		63-142			3.8	3.9	2 (1)	3
Batch number: 11104021201B	Sample number(s): 6253801,6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819 UNSPK: P254463 BKG: 6253819								
Total Dissolved Solids	100		62-135			531	530	0	9
Batch number: 11104022101A	Sample number(s): 6253801,6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819, 6253821 BKG: P252921								
Ammonia Nitrogen						7.3	7.2	2	2
Batch number: 11104023001A	Sample number(s): 6253801,6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253819,6253821 UNSPK: P252511 BKG: P252511								
Sulfide	66*	83	69-133	23*	5	< 0.16	< 0.16	0 (1)	5
Batch number: 11105020201A	Sample number(s): 6253801 UNSPK: P252926 BKG: P252926								
Alkalinity to pH 4.5	101		73-121			135	136	0	5
Alkalinity to pH 8.3						< 2.0	< 2.0	0 (1)	5
Batch number: 11106020201A	Sample number(s): 6253803,6253805,6253807,6253809,6253811,6253813,6253815,6253817,6253819,6253821 UNSPK: 6253813 BKG: 6253813								
Alkalinity to pH 4.5	103		73-121			258	271	5	5
Alkalinity to pH 8.3						< 2.0	< 2.0	0 (1)	5
Batch number: 11109021202B	Sample number(s): 6253821 UNSPK: P259422 BKG: 6253821								
Total Dissolved Solids	111	107	62-135	2	12	493	490	1	9

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

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(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241306
Reported: 04/22/11 at 01:58 PM

Surrogate Quality Control

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111013AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6253801	104	101	102	98
6253803	104	99	100	97
6253805	104	100	100	96
6253807	104	99	100	100
Blank	102	100	102	98
LCS	102	100	100	104
LCSD	101	100	101	104
Limits:	80-116	77-113	80-113	78-113

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111014AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6253809	102	100	99	98
6253811	102	98	102	101
6253813	103	99	100	104
6253815	101	98	102	110
6253817	104	100	99	100
6253819	102	98	101	99
6253821	104	100	100	97
Blank	103	100	101	98
LCS	101	100	100	104
LCSD	102	99	100	104
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11102WAA026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6253801	101	103	87
6253803	100	104	91
6253805	104	103	90
6253807	101	103	80
6253809	103	103	83
Blank	105	107	97
LCS	101	103	90
LCSD	97	100	89
Limits:	52-120	63-114	34-118

Analysis Name: PAHs by 8270
Batch number: 11103WAB026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6253815	94	98	70
6253817	62	73	56
6253819	89	95	82
6253821	88	103	85
Blank	84	92	96
LCS	84	99	94

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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241306
Reported: 04/22/11 at 01:58 PM

Surrogate Quality Control

LCSD	85	95	96
Limits:	52-120	63-114	34-118

Analysis Name: PAHs by 8270
Batch number: 11103WAF026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6253811	78	89	84
6253813	85	96	97
Blank	88	91	92
LCS	80	89	89
LCSD	90	95	97
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111020015A

	1,1,2,2-Tetrachloroethane
6253801	86
6253803	79
6253805	76
6253807	81
6253809	86
Blank	95
DUP	87
LCS	94
LCSD	94
MS	89
Limits:	46-136

Analysis Name: EDB in Wastewater
Batch number: 111030009A

	1,1,2,2-Tetrachloroethane
6253811	85
6253813	90
6253815	79
6253817	67
6253819	73
6253821	84
Blank	91
LCS	91
LCSD	93
MS	93
MSD	84
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1241306 Sample # 6253801-22

COC # 258157

Please print. Instructions on reverse side correspond with circled numbers. Cooler temp 0.8-5.2°C

(1)
Client: Aquaterra Technologies Inc. Acct. #:
Project Name/#: Sun-Philly Refinery AOI-11 PWSID #:
Project Manager: Tiffani Doerr P.O.#:
Sampler: JRWilliams / Mike Hindelang Quote #:
Name of state where samples were collected: Pa

(5) Analyses Requested — Preservation Codes

See Attached Form For Analyses Requested.

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

*Lab filters all samples

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix: Soil	Water	Other	(4) Total # of Containers	Remarks
S-72D_04072011	4/7/11	0845	X			X		16	LANCASTER will ANALYZE S-8
BF-108_04072011	4/7/11	1035	X			X		16	FOR ALL ANALYSES EXCEPT
BF-90D_04072011	4/7/11	1210	X			X		16	SULFIDE. TS 4-11-11
S-302D_04072011	4/7/11	1330	X			X		16	S8 ~~ref.~~ MISSING
S-280D_04072011	4/7/11	1440	X			X		16	1 amber, 1 NaOH, ZnAc (500ml)
S-59D_04072011	4/7/11	1200	X			X		16	1L H_2SO_4, 1 500ml HNO_3
S-38D2-04072011	4/7/11	0850	X			X		16	
S-22_04072011	4/7/11	1055	X			X		16	
S-8_04072011	4/7/11	0950	X			X		12	insufficient ~~insufficient~~ water
S-2840-04072011	4/7/11	1315	X			X		16	

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg) TX TRRP-13
Type II (Tier II) MA MCP CT RCP
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
SDG Complete? Yes No
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
	4/7/11	1700	Sample Fridge	4/7/11	1700
Ryan Stahl	4/8/11	1108	P. Lefever	4/8/11	1108
P. Lefever	4/8/11	1410			

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1241306 Sample # 6253801-22

COC # 258158

Please print. Instructions on reverse side correspond with circled numbers. Cooler temp 0.8-5.2°C

For Lab Use Only
FSC:
SCR#:

(1) Client: Aquaterra Technologies Inc. Acct. #:
Project Name/#: San-Phillg Refinery AOI-11 PWSID #:
Project Manager: Tiffani Oaser P.O.#:
Sampler: JR Williams / Mike Hinderling Quote #:
Name of state where samples were collected: PA

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix: Soil	Water	Other	(4) Total # of Containers	(5) Analyses Requested / Preservation Codes	Remarks
S-69D_04072011	4/7/11	1450	X			X		16	See Attached Form For Analyses Requested	* Lab filters all samples

Matrix: Check if Applicable ☐ Potable ☐ NPDES

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg) TX TRRP-13
Type II (Tier II) MA MCP CT RCP
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
SDG Complete? Yes No
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

(9) Relinquished by:	Date	Time	Received by:	Date	Time
	4/7/11	1700	Sample Fridge	4/7/11	1700
	4/8/11	1108		4/8/11	1108
J. Pelerin 4/8/11 1410					
				4/8/11	1410

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766
Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

April 20, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 04/11/2011
Group Number: 1241584
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-74D2SRTF_04082011 Grab Water	6255412
S-74D2SRTF_04082011 Filt Grab Water	6255413
S-74D1SRTF_04082011 Grab Water	6255414
S-74D1SRTF_04082011 Filt Grab Water	6255415
S-76DSRTF_04082011 Grab Water	6255416
S-76DSRTF_04082011 Filt Grab Water	6255417
S-106DSRTF_04082011 Grab Water	6255418
S-106DSRTF_04082011 Filt Grab Water	6255419
S-120DSRTF_04082011 Grab Water	6255420
S-120DSRTF_04082011 Filt Grab Water	6255421

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

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Analysis Report

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Robert Heisey
Senior Specialist

Lancaster Laboratories

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Analysis Report

Sample Description: S-74D2SRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-74D2SRTF

LLI Sample # WW 6255412
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 12:30 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D2-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0099	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	26.4	0.200	0.0522	1
07058	Manganese	7439-96-5	0.278	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0040	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0013	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	35.5	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	6.6	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	545	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	545	2.0	0.46	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-74D2SRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-74D2SRTF

LLI Sample # WW 6255412
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 12:30 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D2-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	606	60.0	19.4	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	13.1	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111033AA	04/13/2011 18:44	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111033AA	04/13/2011 18:44	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAL026	04/15/2011 15:05	Chad A Moline	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAL026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111030009A	04/15/2011 10:36	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111030009A	04/13/2011 14:00	Kelli M Barto	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 13:48	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 13:48	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 13:48	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:26	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:26	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/14/2011 19:01	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11103196601A	04/13/2011 21:11	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 21:11	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 21:11	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/13/2011 21:11	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 07:27	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **S-74D2SRTF_04082011 Grab Water**
Philadelphia Refinery AOI-11
COC: 258152 S-74D2SRTF

LLI Sample # WW 6255412
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 12:30 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D2-

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-74D2SRTF_04082011 Filt Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-74D2SRTF

LLI Sample # WW 6255413
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 12:30 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	0.239	0.200	0.0522	1
07058	Manganese	7439-96-5	0.257	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 13:51	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 13:51	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 13:51	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:29	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:29	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-74D1SRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-74D1SRTF

LLI Sample # WW 6255414
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 13:20 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D1-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0279	0.0050	0.0023	1
01754	Iron	7439-89-6	44.0	0.200	0.0522	1
07058	Manganese	7439-96-5	0.214	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0189	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	44.5	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	6.9	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	297	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	297	2.0	0.46	1

*=This limit was used in the evaluation of the final result

Sample Description: S-74D1SRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-74D1SRTF

LLI Sample # WW 6255414
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 13:20 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D1-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	303	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	24.1	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111033AA	04/13/2011 19:06	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111033AA	04/13/2011 19:06	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAL026	04/15/2011 15:30	Chad A Moline	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAL026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 04:31	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:02	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:02	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:02	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:15	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:15	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/14/2011 19:42	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11103196601A	04/13/2011 21:52	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 21:52	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 21:52	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/13/2011 21:52	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 07:49	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: **S-74D1SRTF_04082011 Grab Water**
Philadelphia Refinery AOI-11
COC: 258152 S-74D1SRTF

LLI Sample # WW 6255414
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 13:20 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

74D1-

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-74D1SRTF_04082011 Filt Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-74D1SRTF

LLI Sample # WW 6255415
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 13:20 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0255	0.0050	0.0023	1
01754	Iron	7439-89-6	7.18	0.200	0.0522	1
07058	Manganese	7439-96-5	0.200	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:05	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:05	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:05	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:34	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:34	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-76DSRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-76DSRTF

LLI Sample # WW 6255416
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 11:10 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

76D--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	1.91	0.200	0.0522	1
07058	Manganese	7439-96-5	3.83	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	32.4	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	1.7	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	214	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	214	2.0	0.46	1

*=This limit was used in the evaluation of the final result

Sample Description: S-76DSRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-76DSRTF

LLI Sample # WW 6255416
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 11:10 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

76D--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	267	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	2.3	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111033AA	04/13/2011 19:28	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111033AA	04/13/2011 19:28	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAL026	04/15/2011 15:55	Chad A Moline	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAL026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 05:01	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 13:27	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 13:27	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 13:27	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:36	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:36	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/14/2011 19:56	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11103196601A	04/13/2011 22:06	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 22:06	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 22:06	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/13/2011 22:06	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 08:11	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **S-76DSRTF_04082011 Grab Water**
Philadelphia Refinery AOI-11
COC: 258152 S-76DSRTF

LLI Sample # WW 6255416
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 11:10 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

76D--

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-76DSRTF_04082011 Filt Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-76DSRTF

LLI Sample # WW 6255417
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 11:10 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	1.62	0.200	0.0522	1
07058	Manganese	7439-96-5	3.90	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:09	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:09	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:09	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:38	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:38	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: S-106DSRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-106DSRTF

LLI Sample # WW 6255418
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 09:00 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

106-D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	300	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0115	0.0050	0.0023	1
01754	Iron	7439-89-6	31.8	0.200	0.0522	1
07058	Manganese	7439-96-5	1.06	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0051	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	48.9	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	36.8	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	9.7	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	416	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	416	2.0	0.46	1

*=This limit was used in the evaluation of the final result

Sample Description: S-106DSRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-106DSRTF

LLI Sample # WW 6255418
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 09:00 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

106-D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	494	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	14.7	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111033AA	04/13/2011 19:50	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111033AA	04/13/2011 19:50	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAL026	04/15/2011 16:20	Chad A Moline	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAL026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 05:31	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:12	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:12	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:12	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:40	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:40	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/14/2011 20:09	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11103196601A	04/13/2011 22:47	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 22:47	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 22:47	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/13/2011 22:47	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 08:18	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: **S-106DSRTF_04082011 Grab Water**
Philadelphia Refinery AOI-11
COC: 258152 S-106DSRTF

LLI Sample # WW 6255418
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 09:00 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

106-D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-106DSRTF_04082011 Filt Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-106DSRTF

LLI Sample # WW 6255419
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 09:00 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	0.0112	0.0050	0.0023	1
01754	Iron	7439-89-6	0.787	0.200	0.0522	1
07058	Manganese	7439-96-5	1.03	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:16	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:16	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:16	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:41	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:41	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-120DSRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-120DSRTF

LLI Sample # WW 6255420
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 10:10 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

120D-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	6	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	37	1	0.5	1
10943	Toluene	108-88-3	2	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	39.1	0.200	0.0522	1
07058	Manganese	7439-96-5	1.88	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0113	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0045	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	25.5	2.0	1.0	5
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	11.0	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	364	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	364	2.0	0.46	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-120DSRTF_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-120DSRTF

LLI Sample # WW 6255420
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 10:10 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

120D-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	400	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	9.2	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111033AA	04/13/2011 20:11	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111033AA	04/13/2011 20:11	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAL026	04/15/2011 16:44	Chad A Moline	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAL026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 06:01	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:19	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:19	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:19	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:43	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:43	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/13/2011 23:01	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11103196601A	04/13/2011 23:01	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:01	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:01	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/13/2011 23:01	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 08:25	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **S-120DSRTF_04082011 Grab Water**
Philadelphia Refinery AOI-11
COC: 258152 S-120DSRTF

LLI Sample # WW 6255420
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 10:10 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

120D-

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: S-120DSRTF_04082011 Filt Grab Water
Philadelphia Refinery AOI-11
COC: 258152 S-120DSRTF

LLI Sample # WW 6255421
LLI Group # 1241584
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 10:10 by SS

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 13:49

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	1.72	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:23	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:23	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:23	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:45	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:45	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241584
Reported: 04/20/11 at 01:49 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F111033AA	Sample number(s): 6255412,6255414,6255416,6255418,6255420								
Benzene	< 1	1.	0.5	ug/l	98	95	79-120	3	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	97	94	70-130	3	30
Ethylbenzene	< 1	1.	0.5	ug/l	100	95	79-120	5	30
Isopropylbenzene	< 2	2.	0.5	ug/l	100	95	77-120	5	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	91	87	76-120	4	30
Toluene	< 1	1.	0.5	ug/l	98	95	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	97	91	74-120	6	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	97	93	75-120	4	30
Xylene (Total)	< 1	1.	0.5	ug/l	96	92	80-120	4	30
Batch number: 11103WAL026	Sample number(s): 6255412,6255414,6255416,6255418,6255420								
Chrysene	< 5	5.	1	ug/l	96		82-112		
Fluorene	< 5	5.	1	ug/l	96		82-113		
Naphthalene	< 5	5.	1	ug/l	99		77-107		
Phenanthrene	< 5	5.	1	ug/l	100		83-112		
Pyrene	< 5	5.	1	ug/l	102		80-115		
Batch number: 111030009A	Sample number(s): 6255412								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	96	60-140	0	20
Batch number: 111040023A	Sample number(s): 6255414,6255416,6255418,6255420								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	96	60-140	0	20
Batch number: 111031848004	Sample number(s): 6255412-6255421								
Cobalt	< 0.0050	0.0050	0.0023	mg/l	104		90-110		
Iron	< 0.200	0.200	0.0522	mg/l	98		90-112		
Manganese	< 0.0050	0.0050	0.00084	mg/l	102		90-110		
Batch number: 111036050003A	Sample number(s): 6255412-6255421								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	105		86-111		
Lead	< 0.0010	0.0010	0.00005 2	mg/l	103		90-115		
Batch number: 11103196601A	Sample number(s): 6255412,6255414,6255416,6255418,6255420								
Chloride	< 0.40	0.40	0.20	mg/l	105		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	109		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	104		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	107		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	106		89-110		
Batch number: 11105049501B	Sample number(s): 6255412,6255414,6255416,6255418,6255420								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	104		91-113		
Batch number: 11104021202A	Sample number(s): 6255412,6255414,6255416,6255418,6255420								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	94		80-120		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241584
Reported: 04/20/11 at 01:49 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 11105022101A	Sample number(s): 6255412,6255414,6255416,6255418,6255420								
Ammonia Nitrogen	< 0.60	0.60	0.20	mg/l	96	95	85-105	1	5
Batch number: 11105023001A	Sample number(s): 6255412,6255414,6255416,6255418,6255420								
Sulfide	< 0.16	0.16	0.054	mg/l	100		90-110		
Batch number: 11108020201A	Sample number(s): 6255412,6255414,6255416,6255418,6255420								
Alkalinity to pH 4.5	< 2.0	2.0	0.46	mg/l as CaCO3	100		98-103		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 11103WAL026	Sample number(s): 6255412,6255414,6255416,6255418,6255420 UNSPK: P254498								
Chrysene	96	93	78-116	8	30				
Fluorene	95	96	71-123	13	30				
Naphthalene	97	98	73-113	13	30				
Phenanthrene	100	101	72-121	13	30				
Pyrene	101	102	77-117	13	30				
Batch number: 111030009A	Sample number(s): 6255412 UNSPK: P250619								
Ethylene dibromide	96	83	65-135	10	20				
Batch number: 111040023A	Sample number(s): 6255414,6255416,6255418,6255420 UNSPK: P253628								
Ethylene dibromide	74	77	65-135	0	20				
Batch number: 111031848004	Sample number(s): 6255412-6255421 UNSPK: 6255416 BKG: 6255416								
Cobalt	100	101	87-112	1	20	< 0.0050	< 0.0050	200* (1)	20
Iron	92	97	75-125	2	20	1.91	1.82	5	20
Manganese	92 (2)	107 (2)	75-125	2	20	3.83	3.80	1	20
Batch number: 111036050003A	Sample number(s): 6255412-6255421 UNSPK: 6255414 BKG: 6255414								
Arsenic	101	97	75-125	1	20	0.0189	0.0180	5	20
Lead	105	103	83-120	3	20	< 0.0010	< 0.0010	200* (1)	20
Batch number: 11103196601A	Sample number(s): 6255412,6255414,6255416,6255418,6255420 UNSPK: 6255412 BKG: 6255412								
Chloride	121*		90-110			35.5	35.3	1	20
Fluoride	97		90-110			< 0.50	< 0.50	0 (1)	20
Nitrate Nitrogen	98		90-110			< 0.50	< 0.50	0 (1)	20
Nitrite Nitrogen	105		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	98		90-110			< 5.0	< 5.0	0 (1)	20
Batch number: 11105049501B	Sample number(s): 6255412,6255414,6255416,6255418,6255420 UNSPK: 6255412 BKG: 6255412								
Total Organic Carbon	105		63-142			6.6	6.5	1	3
Batch number: 11104021202A	Sample number(s): 6255412,6255414,6255416,6255418,6255420 UNSPK: P254338 BKG: P254338								
Total Dissolved Solids	105		62-135			1,290	1,290	0	9

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241584
Reported: 04/20/11 at 01:49 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 11105022101A	Sample number(s): 6255412,6255414,6255416,6255418,6255420 BKG: 6255420								
Ammonia Nitrogen						9.2	9.6	5*	2
Batch number: 11105023001A	Sample number(s): 6255412,6255414,6255416,6255418,6255420 UNSPK: 6255414 BKG: 6255414								
Sulfide	85	84	69-133	1	5	< 0.16	< 0.16	0 (1)	5
Batch number: 11108020201A	Sample number(s): 6255412,6255414,6255416,6255418,6255420 UNSPK: 6255416 BKG: 6255416								
Alkalinity to pH 4.5	100		73-121			214	221	3	5
Alkalinity to pH 8.3						< 2.0	< 2.0	0 (1)	5

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111033AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6255412	102	102	102	93
6255414	100	101	102	94
6255416	102	102	100	93
6255418	101	100	100	96
6255420	100	99	103	97
Blank	101	99	102	92
LCS	100	102	102	99
LCSD	100	101	102	99
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11103WAL026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6255412	103	110	103
6255414	107	109	109
6255416	109	109	103
6255418	107	109	92
6255420	108	105	100
Blank	107	109	97
LCS	109	111	98
MS	106	109	95
MSD	108	111	97
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241584
Reported: 04/20/11 at 01:49 PM

Surrogate Quality Control

Batch number: 111030009A

	1,1,2,2-Tetrachloroethane
6255412	84
Blank	91
LCS	91
LCSD	93
MS	93
MSD	84
Limits:	46-136

Analysis Name: EDB in Wastewater
Batch number: 111040023A

	1,1,2,2-Tetrachloroethane
6255414	85
6255416	88
6255418	79
6255420	106
Blank	98
LCS	95
LCSD	97
MS	80
MSD	78
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only 12-21 TJB

Acct. # 10132 Group# 1241588 4 Sample # 625547 ~~55~~

COC # 258152

Please print. Instructions on reverse side correspond with circled numbers.

(1) Client: SUN-AQUATERRA Acct. #:

Project Name/#: PHILA REF AOI-11 PWSID #:

Project Manager: T. DOERR P.O.#:

Sampler: S. SYKES Quote #:

Name of state where samples were collected: PA

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix (4) Soil	Water	Other	Total # of Containers	(5) Analyses Requested / Preservation Codes ✱
S-7402SRTF_04082011	4/8/11	1230	X			X		16	X
S-7401SRTF_04082011	4/8/11	1320	X			X		16	X
S-76DSRTF_04082011	4/8/11	1110	X			X		16	X
S-106DSRTF_04082011	4/8/11	900	X			X		16	X
S-120DSRTF_04082011	4/8/11	1010	X			X		16	X

Matrix: Potable / NPDES Check if Applicable

Remarks

✱ Lab to filter Samples

✱ See attached list for analyses

temp 1.0-1.5°C

LANCASTER WILL ANALYZE NITRITE + NITRATE PAST HOLD PER T. DOERR.
TJS 4-12-11

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg) TX TRRP-13
Type II (Tier II) MA MCP CT RCP
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

SDG Complete? Yes No

Relinquished by:	Date	Time	Received by:	Date	Time
AQUATERRA	4/8/11	1530	Sample Fridge	4/8/11	1530
AGT	4/11/11	1238		4/11/11	1255
Aquaterra	4/11/11	1255		4/12/11	0825
	4/12/11	1615			
				4/12/11	1615

(9)

acct 10130 grp 124158 # 62554 12-21 TD

Table 1
Constituents of Concern for Groundwater
AOI 11 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene Dibromide	106-93-4
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Metals	CAS No.
Arsenic (Total & Dissolved)	7440-38-2
Cobalt (Total & Dissolved)	7440-48-4
Iron (Total & Dissolved)	7439-89-6
Lead (Total & Dissolved)	7439-92-1
Manganese (Total & Dissolved)	7439-96-5

Misc Parameters	CAS No.
Ammonia	7664-41-7
Chloride	16887-00-6
Fluoride	7782-41-4
Nitrate	84145-82-4
Nitrite	1594-56-5
Sulfate	18785-72-3
Sulfide	-
Total Alkalinity	-
Bicarbonate	71-52-3
Total Organic Carbon	7440-44-0
Total Dissolved Solids	CASID10052

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Lancaster Laboratories

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Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

April 20, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 04/11/2011
Group Number: 1241585
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
B-134D_04082011 Grab Water	6255422
B-134D_04082011 Filtered Grab Water	6255423
B-48D_04082011 Grab Water	6255424
B-48D_04082011 Filtered Grab Water	6255425
C-50D_04082011 Grab Water	6255426
C-50D_04082011 Filtered Grab Water	6255427
C-129D_04082011 Grab Water	6255428
C-129D_04082011 Filtered Grab Water	6255429
B-133D_04082011 Grab Water	6255430
B-133D_04082011 Filtered Grab Water	6255431
C-134D_04082011 Grab Water	6255432
C-134D_04082011 Filtered Grab Water	6255433

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

Lancaster Laboratories

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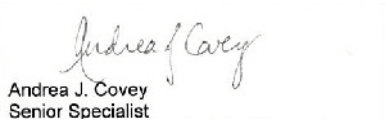
Analysis Report

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,



Andrea J. Covey
Senior Specialist

Lancaster Laboratories

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Analysis Report

Sample Description: B-134D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-134D

LLI Sample # WW 6255422
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 12:15 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B134D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	36.6	0.200	0.0522	1
07058	Manganese	7439-96-5	0.245	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0039	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	52.6	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	7.7	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	301	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	301	2.0	0.46	1

*=This limit was used in the evaluation of the final result

Sample Description: B-134D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-134D

LLI Sample # WW 6255422
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 12:15 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B134D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	297	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	30.5	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111033AA	04/13/2011 20:33	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111033AA	04/13/2011 20:33	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAL026	04/15/2011 17:09	Chad A Moline	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAL026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 06:32	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:26	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:26	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:26	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:47	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:47	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/14/2011 20:23	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11103196601A	04/13/2011 23:14	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:14	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:14	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/13/2011 23:14	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 08:32	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: **B-134D_04082011 Grab Water**
Philadelphia Refinery AOI-11
COC: 257060 B-134D

LLI Sample # WW 6255422
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 12:15 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B134D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: B-134D_04082011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-134D

LLI Sample # WW 6255423
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 12:15 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	7.17	0.200	0.0522	1
07058	Manganese	7439-96-5	0.229	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:30	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:30	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:30	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:49	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:49	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: B-48D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-48D

LLI Sample # WW 6255424
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 10:40 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B-48D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	4	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.028	0.028	0.0095	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	35.1	0.200	0.0522	1
07058	Manganese	7439-96-5	2.11	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	72.3	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	5.5	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	272	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	272	2.0	0.46	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-48D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-48D

LLI Sample # WW 6255424
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 10:40 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B-48D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	429	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	6.7	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111033AA	04/13/2011 20:55	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111033AA	04/13/2011 20:55	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAM026	04/15/2011 02:46	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAM026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 07:02	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:33	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:33	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:33	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:51	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:51	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/14/2011 20:37	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11103196601A	04/13/2011 23:28	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:28	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:28	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/13/2011 23:28	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 08:40	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-48D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-48D

LLI Sample # WW 6255424
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 10:40 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B-48D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-48D_04082011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-48D

LLI Sample # WW 6255425
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 10:40 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	9.31	0.200	0.0522	1
07058	Manganese	7439-96-5	2.05	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:43	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:43	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:43	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:56	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:56	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: C-50D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-50D

LLI Sample # WW 6255426
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 08:50 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C-50D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0095	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	52.7	0.200	0.0522	1
07058	Manganese	7439-96-5	3.05	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0445	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	199	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	17.5	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	397	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	397	2.0	0.46	1

*=This limit was used in the evaluation of the final result

Sample Description: C-50D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-50D

LLI Sample # WW 6255426
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 08:50 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C-50D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	666	60.0	19.4	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	16.4	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111033AA	04/13/2011 21:17	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111033AA	04/13/2011 21:17	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAM026	04/15/2011 03:12	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAM026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 07:32	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:47	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:47	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:47	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 09:58	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 09:58	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/14/2011 21:18	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11103196601A	04/13/2011 23:42	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:42	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:42	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/13/2011 23:42	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 08:47	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: C-50D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-50D

LLI Sample # WW 6255426
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 08:50 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C-50D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: C-50D_04082011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-50D

LLI Sample # WW 6255427
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 08:50 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	8.21	0.200	0.0522	1
07058	Manganese	7439-96-5	2.89	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0028	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:50	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:50	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:50	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 10:00	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 10:00	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: C-129D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-129D

LLI Sample # WW 6255428
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 09:50 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C129D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.028	0.028	0.0095	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	19.9	0.200	0.0522	1
07058	Manganese	7439-96-5	0.140	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0110	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	47.8	4.0	2.0	10
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	6.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	8.3	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	398	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	398	2.0	0.46	1

*=This limit was used in the evaluation of the final result

Sample Description: C-129D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-129D

LLI Sample # WW 6255428
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 09:50 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C129D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	350	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	44.9	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111033AA	04/13/2011 21:38	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111033AA	04/13/2011 21:38	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAM026	04/15/2011 03:38	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAM026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 08:02	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:54	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:54	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:54	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 10:02	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 10:02	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/14/2011 21:32	Ashley M Adams	10
01504	Fluoride	EPA 300.0	1	11103196601A	04/13/2011 23:55	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:55	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/13/2011 23:55	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/13/2011 23:55	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 08:55	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-129D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-129D

LLI Sample # WW 6255428
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 09:50 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C129D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-129D_04082011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-129D

LLI Sample # WW 6255429
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 09:50 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	0.115	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 14:57	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 14:57	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 14:57	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 10:03	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 10:03	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-133D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-133D

LLI Sample # WW 6255430
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 13:05 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B133D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	35.3	0.200	0.0522	1
07058	Manganese	7439-96-5	0.220	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0095	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	67.3	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	7.2	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	296	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	296	2.0	0.46	1

*=This limit was used in the evaluation of the final result

Sample Description: B-133D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-133D

LLI Sample # WW 6255430
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 13:05 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B133D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	328	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	28.0	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111042AA	04/14/2011 20:37	Daniel H Heller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111042AA	04/14/2011 20:37	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAM026	04/15/2011 04:04	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAM026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 08:32	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 15:01	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 15:01	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 15:01	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 10:05	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 10:05	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601A	04/14/2011 21:45	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11103196601A	04/14/2011 00:09	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601A	04/14/2011 00:09	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601A	04/14/2011 00:09	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601A	04/14/2011 00:09	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049501B	04/15/2011 09:02	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: B-133D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-133D

LLI Sample # WW 6255430
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 13:05 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B133D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: B-133D_04082011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257060 B-133D

LLI Sample # WW 6255431
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 13:05 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	11.1	0.200	0.0522	1
07058	Manganese	7439-96-5	0.197	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848004	04/17/2011 15:04	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848004	04/17/2011 15:04	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848004	04/17/2011 15:04	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050003A	04/15/2011 10:07	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050003A	04/15/2011 10:07	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848004	04/14/2011 09:40	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050003	04/14/2011 09:35	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-134D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-134D

LLI Sample # WW 6255432
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 14:25 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C134D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	8.10	0.200	0.0522	1
07058	Manganese	7439-96-5	0.374	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0107	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0011	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	79.2	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The holding time was not met. The sample was submitted to the laboratory outside of the holding time.					
00228	Sulfate	14808-79-8	7.2	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	23.4	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	239	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	45.2	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	149	2.0	0.46	1

*=This limit was used in the evaluation of the final result

Sample Description: C-134D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-134D

LLI Sample # WW 6255432
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 14:25 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C134D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	312	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	0.56	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	26.4	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	D111042AA	04/14/2011 21:00	Daniel H Heller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D111042AA	04/14/2011 21:00	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAM026	04/15/2011 04:30	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAM026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111040023A	04/16/2011 10:02	Tyler O Griffin	1
07786	EDB Extraction	SW-846 8011	1	111040023A	04/15/2011 10:00	Edwin Ortiz	1
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 07:23	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 07:23	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 07:23	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 07:57	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 07:57	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196601B	04/14/2011 21:59	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11103196601B	04/14/2011 00:23	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196601B	04/14/2011 00:23	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196601B	04/14/2011 00:23	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196601B	04/14/2011 00:23	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11105049502A	04/15/2011 09:46	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201A	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11104021202A	04/14/2011 10:11	Yolunder Y Bunch	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-134D_04082011 Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-134D

LLI Sample # WW 6255432
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 14:25 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

C134D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00230	Sulfide	SM20 4500 S2 D	1	11105023001A	04/15/2011 11:15	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11105022101A	04/15/2011 14:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: C-134D_04082011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257060 C-134D

LLI Sample # WW 6255433
LLI Group # 1241585
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/08/2011 14:25 by JRW

Submitted: 04/11/2011 16:15
Reported: 04/20/2011 15:34

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	< 0.200	0.200	0.0522	1
07058	Manganese	7439-96-5	< 0.0050	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0064	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 07:26	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 07:26	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 07:26	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 07:59	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 07:59	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241585
Reported: 04/20/11 at 03:34 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: D111042AA	Sample number(s): 6255430,6255432								
Benzene	< 1	1.	0.5	ug/l	86		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	88		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	85		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	84		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	102		76-120		
Toluene	< 1	1.	0.5	ug/l	85		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	85		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	86		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	84		80-120		
Batch number: F111033AA	Sample number(s): 6255422,6255424,6255426,6255428								
Benzene	< 1	1.	0.5	ug/l	98	95	79-120	3	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	97	94	70-130	3	30
Ethylbenzene	< 1	1.	0.5	ug/l	100	95	79-120	5	30
Isopropylbenzene	< 2	2.	0.5	ug/l	100	95	77-120	5	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	91	87	76-120	4	30
Toluene	< 1	1.	0.5	ug/l	98	95	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	97	91	74-120	6	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	97	93	75-120	4	30
Xylene (Total)	< 1	1.	0.5	ug/l	96	92	80-120	4	30
Batch number: 11103WAL026	Sample number(s): 6255422								
Chrysene	< 5	5.	1	ug/l	96		82-112		
Fluorene	< 5	5.	1	ug/l	96		82-113		
Naphthalene	< 5	5.	1	ug/l	99		77-107		
Phenanthrene	< 5	5.	1	ug/l	100		83-112		
Pyrene	< 5	5.	1	ug/l	102		80-115		
Batch number: 11103WAM026	Sample number(s): 6255424,6255426,6255428,6255430,6255432								
Chrysene	< 5	5.	1	ug/l	99	100	82-112	1	30
Fluorene	< 5	5.	1	ug/l	97	100	82-113	4	30
Naphthalene	< 5	5.	1	ug/l	98	94	77-107	5	30
Phenanthrene	< 5	5.	1	ug/l	100	97	83-112	3	30
Pyrene	< 5	5.	1	ug/l	102	103	80-115	1	30
Batch number: 111040023A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	96	60-140	0	20
Batch number: 111031848004	Sample number(s): 6255422-6255431								
Cobalt	< 0.0050	0.0050	0.0023	mg/l	104		90-110		
Iron	< 0.200	0.200	0.0522	mg/l	98		90-112		
Manganese	< 0.0050	0.0050	0.00084	mg/l	102		90-110		
Batch number: 111031848005	Sample number(s): 6255432-6255433								
Cobalt	< 0.0050	0.0050	0.0023	mg/l	105		90-110		
Iron	< 0.200	0.200	0.0522	mg/l	106		90-112		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241585
Reported: 04/20/11 at 03:34 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Manganese	< 0.0050	0.0050	0.00084	mg/l	104		90-110		
Batch number: 111036050003A	Sample number(s): 6255422-6255431								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	105		86-111		
Lead	< 0.0010	0.0010	0.00005 2	mg/l	103		90-115		
Batch number: 111036050004A	Sample number(s): 6255432-6255433								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	110		86-111		
Lead	< 0.0010	0.0010	0.00005 2	mg/l	106		90-115		
Batch number: 11103196601A	Sample number(s): 6255422,6255424,6255426,6255428,6255430								
Chloride	< 0.40	0.40	0.20	mg/l	105		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	109		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	104		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	107		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	106		89-110		
Batch number: 11103196601B	Sample number(s): 6255432								
Chloride	< 0.40	0.40	0.20	mg/l	105		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	109		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	104		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	107		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	106		89-110		
Batch number: 11105049501B	Sample number(s): 6255422,6255424,6255426,6255428,6255430								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	104		91-113		
Batch number: 11105049502A	Sample number(s): 6255432								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	102		91-113		
Batch number: 11104021202A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	94		80-120		
Batch number: 11105022101A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432								
Ammonia Nitrogen	< 0.60	0.60	0.20	mg/l	96	95	85-105	1	5
Batch number: 11105023001A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432								
Sulfide	< 0.16	0.16	0.054	mg/l	100		90-110		
Batch number: 11108020201A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432								
Alkalinity to pH 4.5	< 2.0	2.0	0.46	mg/l as CaCO3	100		98-103		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: D111042AA	Sample number(s): 6255430,6255432 UNSPK: P253673								
Benzene	104	104	80-126	0	30				

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241585
Reported: 04/20/11 at 03:34 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
1,2-Dichloroethane	103	104	66-141	0	30				
Ethylbenzene	105	104	71-134	1	30				
Isopropylbenzene	105	103	75-128	2	30				
Methyl Tertiary Butyl Ether	101	98	72-126	3	30				
Toluene	105	104	80-125	1	30				
1,2,4-Trimethylbenzene	102	103	72-130	1	30				
1,3,5-Trimethylbenzene	105	105	72-131	0	30				
Xylene (Total)	102	102	79-125	0	30				
Batch number: 11103WAL026	Sample number(s): 6255422 UNSPK: P254498								
Chrysene	96	93	78-116	8	30				
Fluorene	95	96	71-123	13	30				
Naphthalene	97	98	73-113	13	30				
Phenanthrene	100	101	72-121	13	30				
Pyrene	101	102	77-117	13	30				
Batch number: 111040023A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432 UNSPK: P253628								
Ethylene dibromide	74	77	65-135	0	20				
Batch number: 111031848004	Sample number(s): 6255422-6255431 UNSPK: P255416 BKG: P255416								
Cobalt	100	101	87-112	1	20	< 0.0050	< 0.0050	200* (1)	20
Iron	92	97	75-125	2	20	1.91	1.82	5	20
Manganese	92 (2)	107 (2)	75-125	2	20	3.83	3.80	1	20
Batch number: 111031848005	Sample number(s): 6255432-6255433 UNSPK: P256333 BKG: P256333								
Cobalt	102	102	87-112	0	20	< 0.0050	< 0.0050	0 (1)	20
Iron	80 (2)	148 (2)	75-125	2	20	37.2	39.6	6	20
Manganese	100	102	75-125	2	20	0.261	0.272	4	20
Batch number: 111036050003A	Sample number(s): 6255422-6255431 UNSPK: P255414 BKG: P255414								
Arsenic	101	97	75-125	1	20	0.0189	0.0180	5	20
Lead	105	103	83-120	3	20	< 0.0010	< 0.0010	200* (1)	20
Batch number: 111036050004A	Sample number(s): 6255432-6255433 UNSPK: P256327 BKG: P256327								
Arsenic	115	110	75-125	4	20	< 0.0020	< 0.0020	0 (1)	20
Lead	107	109	83-120	2	20	< 0.0010	< 0.0010	35* (1)	20
Batch number: 11103196601A	Sample number(s): 6255422,6255424,6255426,6255428,6255430 UNSPK: P255412 BKG: P255412								
Chloride	121*		90-110			35.5	35.3	1	20
Fluoride	97		90-110			< 0.50	< 0.50	0 (1)	20
Nitrate Nitrogen	98		90-110			< 0.50	< 0.50	0 (1)	20
Nitrite Nitrogen	105		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	98		90-110			< 5.0	< 5.0	0 (1)	20
Batch number: 11103196601B	Sample number(s): 6255432 UNSPK: 6255432 BKG: 6255432								
Chloride	105		90-110			79.2	77.1	3	20
Fluoride	72*		90-110			< 0.50	< 0.50	0 (1)	20
Nitrate Nitrogen	90		90-110			< 0.50	< 0.50	0 (1)	20
Nitrite Nitrogen	84*		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	94		90-110			7.2	7.3	1 (1)	20
Batch number: 11105049501B	Sample number(s): 6255422,6255424,6255426,6255428,6255430 UNSPK: P255412 BKG:								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241585
Reported: 04/20/11 at 03:34 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
	P255412								
Total Organic Carbon	105		63-142			6.6	6.5	1	3
Batch number: 11105049502A	Sample number(s): 6255432 UNSPK: 6255432 BKG: 6255432								
Total Organic Carbon	95		63-142			23.4	23.6	1	3
Batch number: 11104021202A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432 UNSPK: P254338 BKG: P254338								
Total Dissolved Solids	105		62-135			1,290	1,290	0	9
Batch number: 11105022101A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432 BKG: P255420								
Ammonia Nitrogen						9.2	9.6	5*	2
Batch number: 11105023001A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432 UNSPK: P255414 BKG: P255414								
Sulfide	85	84	69-133	1	5	< 0.16	< 0.16	0 (1)	5
Batch number: 11108020201A	Sample number(s): 6255422,6255424,6255426,6255428,6255430,6255432 UNSPK: P255416 BKG: P255416								
Alkalinity to pH 4.5	100		73-121			214	221	3	5
Alkalinity to pH 8.3						< 2.0	< 2.0	0 (1)	5

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: D111042AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6255430	96	97	100	102
6255432	95	98	102	102
Blank	97	97	101	99
LCS	96	98	100	101
MS	96	98	102	105
MSD	96	98	100	102
Limits:	80-116	77-113	80-113	78-113

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111033AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6255422	102	102	102	96
6255424	99	101	99	98
6255426	99	97	101	96
6255428	102	102	101	96
Blank	101	99	102	92
LCS	100	102	102	99

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241585
Reported: 04/20/11 at 03:34 PM

Surrogate Quality Control

LCSD	100	101	102	99
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270
Batch number: 11103WAL026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6255422	111	106	106
Blank	107	109	97
LCS	109	111	98
MS	106	109	95
MSD	108	111	97
Limits:	52-120	63-114	34-118

Analysis Name: PAHs by 8270
Batch number: 11103WAM026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6255424	90	96	96
6255426	89	97	97
6255428	88	101	100
6255430	92	96	95
6255432	87	91	95
Blank	86	94	93
LCS	90	97	95
LCSD	85	96	93
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111040023A

	1,1,2,2-Tetrachloroethane
6255422	78
6255424	85
6255426	79
6255428	84
6255430	88
6255432	74
Blank	98
LCS	95
LCSD	97
MS	80
MSD	78
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1241585 Sample # 6255422-33

COC # 257060

Please print. Instructions on reverse side correspond with circled numbers.

(1) Client: Aquaterra Technologies Inc Acct. #:

Project Name/#: Sun-Philly Refinery AOI-11 PWSID #:

Project Manager: Tiffani Doerr P.O.#:

Sampler: JR Williams/Shawn Sykes Quote #:

Name of state where samples were collected: Pa

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix (4) Soil	Water	Other	Total # of Containers	(5) Analyses Requested / Preservation Codes	Remarks
B-134D-04082011	4/8/11	1215	X			X		16	See Attached Form For Analyses Requested	~~MISSING 1/3 PG~~ (18)
B-48D-04082011	4/8/11	1040	X			X		16		
C-50D-04082011	4/8/11	0850	X			X		16		temp 1.0-1.5°C
C-129D-04082011	4/8/11	0950	X			X		16		
B-133D-04082011	4/8/11	1305	X			X		16		LANCASTER WILL ANALYZE NITRITE & NITRATE PAST HOLD PER T. DOERR, TS 4-12-11
C-134D-04082011	4/8/11	1425	X			X		16		

Matrix: Check if Applicable: ☐ Potable ☐ NPDES

* Lab filters all samples

(7) **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
SDG Complete? Yes No
Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No

Relinquished by:	Date	Time	Received by:	Date	Time
Aquaterra	4/8/11	1530	Sample Tridge	4/8/11	1530
Aqr	4/11/11	1238		4/11/11	1285
Aquaterra	4/11/11	1255		4/12/11	1255
	4/15/11	1615			
				4/11/11	1615

(9)

Lancaster Laboratories, Inc., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (717) 656-6766

Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management
2102.05

acct 10132 grp 1241585 # 6255422-33

Table 1
Constituents of Concern for Groundwater
AOI 11 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene Dibromide	106-93-4
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Metals	CAS No.
Arsenic (Total & Dissolved)	7440-38-2
Cobalt (Total & Dissolved)	7440-48-4
Iron (Total & Dissolved)	7439-89-6
Lead (Total & Dissolved)	7439-92-1
Manganese (Total & Dissolved)	7439-96-5

Misc Parameters	CAS No.
Ammonia	7664-41-7
Chloride	16887-00-6
Fluoride	7782-41-4
Nitrate	84145-82-4
Nitrite	1594-56-5
Sulfate	18785-72-3
Sulfide	-
Total Alkalinity	-
Bicarbonate	71-52-3
Total Organic Carbon	7440-44-0
Total Dissolved Solids	CASID10052

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

April 21, 2011

Project: SUN: Philadelphia Refinery AOI-11

Submittal Date: 04/12/2011
Group Number: 1241791
PO Number: PHILADELPHIA
State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
W-13_04112011 Grab Water	6256325
W-13_04112011 Filtered Grab Water	6256326
W-19_04112011 Grab Water	6256327
W-19_04112011 Filtered Grab Water	6256328
W-26_04112011 Grab Water	6256329
W-26_04112011 Filtered Grab Water	6256330
W-9_04112011 Grab Water	6256331
W-9_04112011 Filtered Grab Water	6256332
B-132D_04112011 Grab Water	6256333
B-132D_04112011 Filtered Grab Water	6256334
A-21D_04112011 Grab Water	6256335
A-21D_04112011 Filtered Grab Water	6256336
A-13D_04112011 Grab Water	6256337
A-13D_04112011 Filtered Grab Water	6256338
A-19D_04112011 Grab Water	6256339
A-19D_04112011 Filtered Grab Water	6256340

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC COPY TO	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
ELECTRONIC COPY TO	LLI	Attn: EDD Group

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Analysis Report

ELECTRONIC COPY TO	Langan	Attn: Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio

Questions? Contact your Client Services Representative
Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Chad A. Moline
Group Leader

Lancaster Laboratories

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Analysis Report

Sample Description: W-13_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-13_04112011

LLI Sample # WW 6256325
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 10:40 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-13-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	67.0	0.200	0.0522	1
07058	Manganese	7439-96-5	1.70	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0036	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0049	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	18.4	2.0	1.0	5
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	13.5	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	539	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	539	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	466	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-13_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-13_04112011

LLI Sample # WW 6256325
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 10:40 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-13-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	34.9	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111044AA	04/14/2011 19:00	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111044AA	04/14/2011 19:00	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAM026	04/15/2011 05:49	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAM026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111060003A	04/20/2011 22:55	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111060003A	04/17/2011 10:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 07:41	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 07:41	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 07:41	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:04	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:04	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196901A	04/13/2011 09:44	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11103196901A	04/13/2011 09:44	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 09:44	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 09:44	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196901A	04/13/2011 09:44	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11108049502A	04/18/2011 04:58	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11105021202B	04/15/2011 10:14	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023002A	04/15/2011 13:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11108022101A	04/18/2011 16:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-13_04112011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-13_04112011

LLI Sample # WW 6256326
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 10:40 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	27.3	0.200	0.0522	1
07058	Manganese	7439-96-5	1.55	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 07:44	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 07:44	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 07:44	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:06	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:06	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-19_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-19_04112011

LLI Sample # WW 6256327
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 12:00 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-19-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.030	0.030	0.0098	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	83.2	0.200	0.0522	1
07058	Manganese	7439-96-5	0.629	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	63.5	20.0	10.0	50
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	295	50.0	15.0	50
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	14.0	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	343	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	343	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	804	60.0	19.4	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-19_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-19_04112011

LLI Sample # WW 6256327
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 12:00 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-19-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	32.1	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111044AA	04/14/2011 19:21	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111044AA	04/14/2011 19:21	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAM026	04/15/2011 06:15	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAM026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111060003A	04/20/2011 23:25	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111060003A	04/17/2011 10:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 07:48	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 07:48	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 07:48	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 07:46	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 07:46	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196901A	04/18/2011 11:06	Ashley M Adams	50
01504	Fluoride	EPA 300.0	1	11103196901A	04/13/2011 11:25	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 11:25	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 11:25	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196901A	04/18/2011 11:06	Ashley M Adams	50
00273	Total Organic Carbon	SM20 5310 C	1	11108049502A	04/18/2011 05:05	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11105021202B	04/15/2011 10:14	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023002A	04/15/2011 13:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11108022101A	04/18/2011 16:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-19_04112011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-19_04112011

LLI Sample # WW 6256328
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 12:00 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	59.4	0.200	0.0522	1
07058	Manganese	7439-96-5	0.602	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 07:51	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 07:51	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 07:51	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:08	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:08	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: W-26_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-26_04112011

LLI Sample # WW 6256329
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 12:50 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-26-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	68.6	0.200	0.0522	1
07058	Manganese	7439-96-5	2.76	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0086	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	22.1	2.0	1.0	5
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	14.4	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	234	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	234	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	319	30.0	9.7	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: W-26_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-26_04112011

LLI Sample # WW 6256329
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 12:50 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-26-

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	3.4	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111044AA	04/14/2011 19:43	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111044AA	04/14/2011 19:43	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11103WAM026	04/15/2011 06:41	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11103WAM026	04/14/2011 08:00	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111060003A	04/20/2011 23:55	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111060003A	04/17/2011 10:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 07:55	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 07:55	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 07:55	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:10	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:10	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196901A	04/13/2011 11:53	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11103196901A	04/13/2011 11:53	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 11:53	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 11:53	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196901A	04/13/2011 11:53	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11108049502B	04/18/2011 05:56	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11105021202B	04/15/2011 10:14	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023002A	04/15/2011 13:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11108022101A	04/18/2011 16:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-26_04112011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-26_04112011

LLI Sample # WW 6256330
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 12:50 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	40.4	0.200	0.0522	1
07058	Manganese	7439-96-5	2.72	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0022	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 07:58	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 07:58	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 07:58	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:11	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:11	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-9_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-9_04112011

LLI Sample # WW 6256331
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 11:20 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-9--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	0.9	1
07805	Fluorene	86-73-7	< 5	5	0.9	1
07805	Naphthalene	91-20-3	< 5	5	0.9	1
07805	Phenanthrene	85-01-8	< 5	5	0.9	1
07805	Pyrene	129-00-0	< 5	5	0.9	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.028	0.028	0.0095	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	64.4	0.200	0.0522	1
07058	Manganese	7439-96-5	1.98	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0045	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	17.7	2.0	1.0	5
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	13.4	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	350	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	350	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	331	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-9_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-9_04112011

LLI Sample # WW 6256331
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 11:20 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

W-9--

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	24.0	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111044AA	04/14/2011 20:04	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111044AA	04/14/2011 20:04	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11104WAH026	04/15/2011 23:49	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11104WAH026	04/15/2011 06:40	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111060003A	04/21/2011 00:25	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111060003A	04/17/2011 10:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 08:02	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 08:02	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 08:02	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:13	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:13	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196901A	04/13/2011 11:11	Ashley M Adams	5
01504	Fluoride	EPA 300.0	1	11103196901A	04/13/2011 11:11	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 11:11	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 11:11	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196901A	04/13/2011 11:11	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11108049502B	04/18/2011 06:03	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11105021202B	04/15/2011 10:14	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023002A	04/15/2011 13:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11108022101A	04/18/2011 16:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: W-9_04112011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257061 W-9_04112011

LLI Sample # WW 6256332
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 11:20 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	45.1	0.200	0.0522	1
07058	Manganese	7439-96-5	1.95	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0025	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 08:05	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 08:05	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 08:05	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:15	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:15	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-132D_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 B-132D_04112011

LLI Sample # WW 6256333
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 09:40 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B132D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	1	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0097	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	37.2	0.200	0.0522	1
07058	Manganese	7439-96-5	0.261	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0036	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	65.7	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	6.6	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	316	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	316	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	340	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-132D_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 B-132D_04112011

LLI Sample # WW 6256333
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 09:40 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

B132D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	25.4	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111044AA	04/14/2011 20:26	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111044AA	04/14/2011 20:26	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11104WAH026	04/16/2011 00:15	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11104WAH026	04/15/2011 06:40	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111060003A	04/21/2011 00:55	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111060003A	04/17/2011 10:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 07:02	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 07:02	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 07:02	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 10:09	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:17	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196901A	04/13/2011 17:25	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11103196901A	04/13/2011 09:29	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 09:29	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 09:29	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196901A	04/13/2011 09:29	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11108049502B	04/18/2011 06:11	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11105021202B	04/15/2011 10:14	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023002A	04/15/2011 13:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11108022101A	04/18/2011 16:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: B-132D_04112011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257061 B-132D_04112011

LLI Sample # WW 6256334
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 09:40 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	27.0	0.200	0.0522	1
07058	Manganese	7439-96-5	0.268	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 08:09	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 08:09	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 08:09	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:19	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:19	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: A-21D_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 A-21D_04112011

LLI Sample # WW 6256335
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 10:55 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-21D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/l**	**ug/l**	**ug/l**	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	2	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		**ug/l**	**ug/l**	**ug/l**	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	50.5	0.200	0.0522	1
07058	Manganese	7439-96-5	0.724	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0046	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		**mg/l**	**mg/l**	**mg/l**	
00224	Chloride	16887-00-6	54.7	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
	The sample was analyzed two minutes outside of the 48 hour holding time for nitrate nitrogen.					
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
	The sample was analyzed two minutes outside of the 48 hour holding time for nitrite nitrogen.					
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		**mg/l**	**mg/l**	**mg/l**	
00273	Total Organic Carbon	n.a.	8.4	1.0	0.50	1
	SM20 2320 B		**mg/l as CaCO3**	**mg/l as CaCO3**	**mg/l as CaCO3**	
00202	Alkalinity to pH 4.5	n.a.	289	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	289	2.0	0.46	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: A-21D_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 A-21D_04112011

LLI Sample # WW 6256335
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 10:55 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-21D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 2540 C**		**mg/l**	**mg/l**	**mg/l**	
00212	Total Dissolved Solids	n.a.	376	30.0	9.7	1
	SM20 4500 S2 D		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	25.2	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111044AA	04/14/2011 20:47	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111044AA	04/14/2011 20:47	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11104WAH026	04/16/2011 00:42	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11104WAH026	04/15/2011 06:40	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111060003A	04/21/2011 02:25	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111060003A	04/17/2011 10:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 08:19	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 08:19	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 08:19	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:21	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:21	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196901A	04/15/2011 08:45	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11103196901A	04/13/2011 10:57	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 10:57	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 10:57	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196901A	04/13/2011 10:57	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11108049502B	04/18/2011 06:18	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11105021202B	04/15/2011 10:14	Yolunder Y Bunch	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: **A-21D_04112011 Grab Water**
Philadelphia Refinery AOI-11
COC: 257061 A-21D_04112011

LLI Sample # WW 6256335
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 10:55 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-21D

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
00230	Sulfide	SM20 4500 S2 D	1	11105023002A	04/15/2011 13:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11108022101A	04/18/2011 16:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: A-21D_04112011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257061 A-21D_04112011

LLI Sample # WW 6256336
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 10:55 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	34.2	0.200	0.0522	1
07058	Manganese	7439-96-5	0.708	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0021	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 08:22	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 08:22	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 08:22	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:26	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:26	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: A-13D_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 A-13D_04112011

LLI Sample # WW 6256337
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 12:05 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-13D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	4	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.029	0.029	0.0096	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	54.9	0.200	0.0522	1
07058	Manganese	7439-96-5	0.746	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0072	0.0020	0.00095	1
06035	Lead	7439-92-1	0.0026	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	90.8	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	< 5.0	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	6.9	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	307	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	307	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	454	30.0	9.7	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: A-13D_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 A-13D_04112011

LLI Sample # WW 6256337
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 12:05 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-13D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	11.8	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111044AA	04/14/2011 21:09	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111044AA	04/14/2011 21:09	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11104WAH026	04/16/2011 01:08	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11104WAH026	04/15/2011 06:40	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111060003A	04/21/2011 02:55	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111060003A	04/17/2011 10:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 08:26	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 08:26	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 08:26	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:28	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:28	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196901A	04/15/2011 09:13	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11103196901A	04/13/2011 11:39	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 11:39	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 11:39	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196901A	04/13/2011 11:39	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11108049502B	04/18/2011 06:25	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11105021202B	04/15/2011 10:14	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023002A	04/15/2011 13:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11108022101A	04/18/2011 16:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

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Analysis Report

Sample Description: A-13D_04112011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257061 A-13D_04112011

LLI Sample # WW 6256338
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 12:05 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	32.5	0.200	0.0522	1
07058	Manganese	7439-96-5	0.709	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	< 0.0020	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 08:29	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 08:29	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 08:29	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:30	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:30	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: A-19D_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 A-19D_04112011

LLI Sample # WW 6256339
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 13:15 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-19D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane	107-06-2	< 1	1	0.5	1
10943	Ethylbenzene	100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene	98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	43	1	0.5	1
10943	Toluene	108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)	1330-20-7	< 1	1	0.5	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
07805	Chrysene	218-01-9	< 5	5	1	1
07805	Fluorene	86-73-7	< 5	5	1	1
07805	Naphthalene	91-20-3	< 5	5	1	1
07805	Phenanthrene	85-01-8	< 5	5	1	1
07805	Pyrene	129-00-0	< 5	5	1	1
GC Miscellaneous	**SW-846 8011**		ug/l	ug/l	ug/l	
07879	Ethylene dibromide	106-93-4	< 0.028	0.028	0.0095	1
Metals	**SW-846 6010B**		mg/l	mg/l	mg/l	
07052	Cobalt	7440-48-4	0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	48.8	0.200	0.0522	1
07058	Manganese	7439-96-5	3.52	0.0050	0.00084	1
	SW-846 6020		mg/l	mg/l	mg/l	
06025	Arsenic	7440-38-2	0.0291	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1
Wet Chemistry	**EPA 300.0**		mg/l	mg/l	mg/l	
00224	Chloride	16887-00-6	52.2	8.0	4.0	20
01504	Fluoride	16984-48-8	< 0.50	0.50	0.40	5
00368	Nitrate Nitrogen	14797-55-8	< 0.50	0.50	0.25	5
01506	Nitrite Nitrogen	14797-65-0	< 0.50	0.50	0.40	5
00228	Sulfate	14808-79-8	16.1	5.0	1.5	5
	SM20 5310 C		mg/l	mg/l	mg/l	
00273	Total Organic Carbon	n.a.	8.1	1.0	0.50	1
	SM20 2320 B		mg/l as CaCO3	mg/l as CaCO3	mg/l as CaCO3	
00202	Alkalinity to pH 4.5	n.a.	171	2.0	0.46	1
00201	Alkalinity to pH 8.3	n.a.	< 2.0	2.0	0.46	1
01454	Bicarbonate Alkalinity	n.a.	171	2.0	0.46	1
	SM20 2540 C		mg/l	mg/l	mg/l	
00212	Total Dissolved Solids	n.a.	340	30.0	9.7	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: A-19D_04112011 Grab Water
Philadelphia Refinery AOI-11
COC: 257061 A-19D_04112011

LLI Sample # WW 6256339
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 13:15 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

A-19D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Wet Chemistry	**SM20 4500 S2 D**		**mg/l**	**mg/l**	**mg/l**	
00230	Sulfide	18496-25-8	< 0.16	0.16	0.054	1
	SM20 4500NH3 B/C modified		**mg/l**	**mg/l**	**mg/l**	
00221	Ammonia Nitrogen	7664-41-7	1.7	0.60	0.20	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST Leaded Gas 8260	SW-846 8260B	1	F111044AA	04/14/2011 21:31	Kelly E Keller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F111044AA	04/14/2011 21:31	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	11104WAH026	04/16/2011 01:34	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	11104WAH026	04/15/2011 06:40	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	111060003A	04/21/2011 03:25	James H Place	1
07786	EDB Extraction	SW-846 8011	1	111060003A	04/17/2011 10:30	Olivia Arosemena	1
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 08:32	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 08:32	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 08:32	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:32	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:32	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1
00224	Chloride	EPA 300.0	1	11103196901A	04/15/2011 09:28	Ashley M Adams	20
01504	Fluoride	EPA 300.0	1	11103196901A	04/13/2011 12:08	Ashley M Adams	5
00368	Nitrate Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 12:08	Ashley M Adams	5
01506	Nitrite Nitrogen	EPA 300.0	1	11103196901A	04/13/2011 12:08	Ashley M Adams	5
00228	Sulfate	EPA 300.0	1	11103196901A	04/13/2011 12:08	Ashley M Adams	5
00273	Total Organic Carbon	SM20 5310 C	1	11108049502B	04/18/2011 06:33	James S Mathiot	1
00202	Alkalinity to pH 4.5	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00201	Alkalinity to pH 8.3	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
01454	Bicarbonate Alkalinity	SM20 2320 B	1	11108020201B	04/18/2011 06:18	Susan A Engle	1
00212	Total Dissolved Solids	SM20 2540 C	1	11105021202B	04/15/2011 10:14	Yolunder Y Bunch	1
00230	Sulfide	SM20 4500 S2 D	1	11105023002A	04/15/2011 13:30	Michele L Graham	1
00221	Ammonia Nitrogen	SM20 4500NH3 B/C modified	1	11108022101A	04/18/2011 16:00	Luz M Groff	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Sample Description: A-19D_04112011 Filtered Grab Water
Philadelphia Refinery AOI-11
COC: 257061 A-19D_04112011

LLI Sample # WW 6256340
LLI Group # 1241791
Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-11

Collected: 04/11/2011 13:15 by JRW

Submitted: 04/12/2011 17:00
Reported: 04/21/2011 15:18

SUN: Aquaterra Tech.
PO Box 744
West Chester PA 19381

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
Metals Dissolved	**SW-846 6010B**		**mg/l**	**mg/l**	**mg/l**	
07052	Cobalt	7440-48-4	< 0.0050	0.0050	0.0023	1
01754	Iron	7439-89-6	35.3	0.200	0.0522	1
07058	Manganese	7439-96-5	3.48	0.0050	0.00084	1
	SW-846 6020		**mg/l**	**mg/l**	**mg/l**	
06025	Arsenic	7440-38-2	0.0114	0.0020	0.00095	1
06035	Lead	7439-92-1	< 0.0010	0.0010	0.000052	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/12
This sample was filtered in the lab for dissolved metals.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07052	Cobalt	SW-846 6010B	1	111031848005	04/17/2011 08:36	Damary Valentin	1
01754	Iron	SW-846 6010B	1	111031848005	04/17/2011 08:36	Damary Valentin	1
07058	Manganese	SW-846 6010B	1	111031848005	04/17/2011 08:36	Damary Valentin	1
06025	Arsenic	SW-846 6020	1	111036050004A	04/15/2011 08:34	Choon Y Tian	1
06035	Lead	SW-846 6020	1	111036050004A	04/15/2011 08:34	Choon Y Tian	1
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	111031848005	04/14/2011 10:00	Denise K Conners	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	111036050004	04/14/2011 09:58	Denise K Conners	1

*=This limit was used in the evaluation of the final result

Lancaster Laboratories

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Analysis Report

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241791
Reported: 04/21/11 at 03:18 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: F111044AA	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339								
Benzene	< 1	1.	0.5	ug/l	98	98	79-120	0	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	96	98	70-130	2	30
Ethylbenzene	< 1	1.	0.5	ug/l	97	97	79-120	1	30
Isopropylbenzene	< 2	2.	0.5	ug/l	98	98	77-120	0	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	87	91	76-120	5	30
Toluene	< 1	1.	0.5	ug/l	97	96	79-120	1	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	94	96	74-120	2	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	93	96	75-120	3	30
Xylene (Total)	< 1	1.	0.5	ug/l	96	96	80-120	0	30
Batch number: 11103WAM026	Sample number(s): 6256325,6256327,6256329								
Chrysene	< 5	5.	1	ug/l	99	100	82-112	1	30
Fluorene	< 5	5.	1	ug/l	97	100	82-113	4	30
Naphthalene	< 5	5.	1	ug/l	98	94	77-107	5	30
Phenanthrene	< 5	5.	1	ug/l	100	97	83-112	3	30
Pyrene	< 5	5.	1	ug/l	102	103	80-115	1	30
Batch number: 11104WAH026	Sample number(s): 6256331,6256333,6256335,6256337,6256339								
Chrysene	< 5	5.	1	ug/l	101	103	82-112	2	30
Fluorene	< 5	5.	1	ug/l	102	102	82-113	1	30
Naphthalene	< 5	5.	1	ug/l	97	95	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	93	95	83-112	2	30
Pyrene	< 5	5.	1	ug/l	105	104	80-115	1	30
Batch number: 111060003A	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339								
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	96	60-140	4	20
Batch number: 111031848005	Sample number(s): 6256325-6256340								
Cobalt	< 0.0050	0.0050	0.0023	mg/l	105		90-110		
Iron	< 0.200	0.200	0.0522	mg/l	106		90-112		
Manganese	< 0.0050	0.0050	0.00084	mg/l	104		90-110		
Batch number: 111036050004A	Sample number(s): 6256325-6256340								
Arsenic	< 0.0020	0.0020	0.00095	mg/l	110		86-111		
Lead	< 0.0010	0.0010	0.00005 2	mg/l	106		90-115		
Batch number: 11103196901A	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339								
Chloride	< 0.40	0.40	0.20	mg/l	97		90-110		
Fluoride	< 0.10	0.10	0.080	mg/l	98		90-110		
Nitrate Nitrogen	< 0.10	0.10	0.050	mg/l	99		90-110		
Nitrite Nitrogen	< 0.10	0.10	0.080	mg/l	100		90-110		
Sulfate	< 1.0	1.0	0.30	mg/l	101		89-110		

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241791
Reported: 04/21/11 at 03:18 PM

Analysis Name	Blank Result	Blank LOQ**	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 11108049502A	Sample number(s): 6256325,6256327								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	100		91-113		
Batch number: 11108049502B	Sample number(s): 6256329,6256331,6256333,6256335,6256337,6256339								
Total Organic Carbon	< 1.0	1.0	0.50	mg/l	100		91-113		
Batch number: 11105021202B	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339								
Total Dissolved Solids	< 30.0	30.0	9.7	mg/l	96		80-120		
Batch number: 11105023002A	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339								
Sulfide	< 0.16	0.16	0.054	mg/l	100		90-110		
Batch number: 11108020201B	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339								
Alkalinity to pH 4.5	< 2.0	2.0	0.46	mg/l as CaCO3	100		98-103		
Batch number: 11108022101A	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339								
Ammonia Nitrogen	< 0.60	0.60	0.20	mg/l	92	93	85-105	1	5

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 111060003A	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339 BKG: P256276								
Ethylene dibromide						< 0.028	< 0.028	0 (1)	30
Batch number: 111031848005	Sample number(s): 6256325-6256340 UNSPK: 6256333 BKG: 6256333								
Cobalt	102	102	87-112	0	20	< 0.0050	< 0.0050	0 (1)	20
Iron	80 (2)	148 (2)	75-125	2	20	37.2	39.6	6	20
Manganese	100	102	75-125	2	20	0.261	0.272	4	20
Batch number: 111036050004A	Sample number(s): 6256325-6256340 UNSPK: 6256327 BKG: 6256327								
Arsenic	115	110	75-125	4	20	< 0.0020	< 0.0020	0 (1)	20
Lead	107	109	83-120	2	20	< 0.0010	< 0.0010	35* (1)	20
Batch number: 11103196901A	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339 UNSPK: 6256339 BKG: 6256339								
Chloride	101		90-110			52.2	52.3	0	20
Fluoride	89*		90-110			< 0.50	< 0.50	0 (1)	20
Nitrate Nitrogen	92		90-110			< 0.50	< 0.50	0 (1)	20
Nitrite Nitrogen	91		90-110			< 0.50	< 0.50	0 (1)	20
Sulfate	84*		90-110			16.1	15.1	7 (1)	20
Batch number: 11108049502A	Sample number(s): 6256325,6256327 UNSPK: P255731 BKG: P255731								

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241791
Reported: 04/21/11 at 03:18 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike
Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Total Organic Carbon	110		63-142			< 1.0	< 1.0	200* (1)	3
Batch number: 11108049502B	Sample number(s): 6256329,6256331,6256333,6256335,6256337,6256339 UNSPK: P255749 BKG: P255749								
Total Organic Carbon	104		63-142			2.0	1.9	5* (1)	3
Batch number: 11105021202B	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339 UNSPK: P256476 BKG: 6256327								
Total Dissolved Solids	105	108	62-135	2	12	804	792	2	9
Batch number: 11105023002A	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339 UNSPK: 6256327 BKG: 6256327								
Sulfide	84	80	69-133	4	5	< 0.16	< 0.16	0 (1)	5
Batch number: 11108020201B	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339 UNSPK: P255416 BKG: 6256339								
Alkalinity to pH 4.5	100		73-121			171	179	5	5
Alkalinity to pH 8.3						< 2.0	< 2.0	0 (1)	5
Batch number: 11108022101A	Sample number(s): 6256325,6256327,6256329,6256331,6256333,6256335,6256337,6256339 BKG: P256501								
Ammonia Nitrogen						1.6	1.6	0 (1)	2

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water
Batch number: F111044AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6256325	99	99	100	95
6256327	102	99	101	98
6256329	101	99	99	92
6256331	103	101	100	92
6256333	100	101	100	95
6256335	100	100	100	94
6256337	99	100	99	91
6256339	100	101	99	94
Blank	99	100	99	91
LCS	101	100	100	98
LCSD	99	101	99	99
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1241791
Reported: 04/21/11 at 03:18 PM

Surrogate Quality Control

Batch number: 11103WAM026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6256325	90	100	94
6256327	91	96	96
6256329	83	91	91
Blank	86	94	93
LCS	90	97	95
LCSD	85	96	93
Limits:	52-120	63-114	34-118

Analysis Name: PAHs by 8270
Batch number: 11104WAH026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14
6256331	90	100	97
6256333	98	105	97
6256335	94	96	91
6256337	92	104	97
6256339	97	104	94
Blank	92	98	109
LCS	92	100	97
LCSD	89	103	98
Limits:	52-120	63-114	34-118

Analysis Name: EDB in Wastewater
Batch number: 111060003A

	1,1,2,2-Tetrachloroethane
6256325	96
6256327	101
6256329	98
6256331	94
6256333	97
6256335	98
6256337	96
6256339	95
Blank	100
DUP	70
LCS	103
LCSD	103
Limits:	46-136

*- Outside of specification
**-This limit was used in the evaluation of the final result for the blank
(1) The result for one or both determinations was less than five times the LOQ.
(2) The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # 10132 Group# 1241791 Sample # 62563325-40

COC # 257061

Please print. Instructions on reverse side correspond with circled numbers.

(1) Client: Aquaterra Technologies Inc. Acct. #:

Project Name/#: San-Philly Refinery AOI-11 PWSID #:

Project Manager: Tiffani Doerr P.O.#:

Sampler: JR Williams / Mike Hinderling Quote #:

Name of state where samples were collected: Pa

(5) Analyses Requested — Preservation Codes

See Attached Form For Analyses Requested.

For Lab Use Only
FSC:
SCR#:

Preservation Codes
H=HCl T=Thiosulfate
N=HNO_3 B=NaOH
S=H_2SO_4 O=Other

(6) Temperature of samples upon receipt (if requested)

(2) Sample Identification	Date Collected	Time Collected	(3) Grab	Composite	Matrix: Soil	Water	Other	(4) Total # of Containers	Remarks
W-13_04112011	4/11/11	1040	X			X		16	0.4-1.4°C
W-19_04112011	4/11/11	1208	X			X		16	
W-26_04112011	4/11/11	1250	X			X		16	
W-9_04112011	4/11/11	1120	X			X		16	
B-13D_04112011	4/11/11	940	X			X		16	
A-21D_04112011	4/11/11	1055	X			X		16	
A-13D_04112011	4/11/11	1205	X			X		16	
A-19D_04112011	4/11/11	1315	X			X		16	

(7) **Turnaround Time Requested** (TAT) (please circle): (Normal) Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed:
Rush results requested by (please circle): Phone Fax E-mail
Phone #: Fax #:
E-mail address:

(8) **Data Package Options** (please circle if required)
Type I (validation/NJ Reg)
Type II (Tier II)
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)
TX TRRP-13
MA MCP CT RCP
SDG Complete? (Yes) No
Site-specific QC (MS/MSD/Dup)? Yes (No)
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes (No)

(9)

Relinquished by:	Date	Time	Received by:	Date	Time
[signature]	4/11/11	1000	Fridge	4/11/11	1600
[signature]	4/12/11	1415	[signature]	4/12/11	1415
[signature] 4/12/11		1708			
			[signature]	4/12/11	1700

acct# 10132
Gp# 1241791
Sample# 6256325-40

Table 1
Constituents of Concern for Groundwater
AOI 11 Work Plan for Site Characterization
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

VOLATILE ORGANIC COMPOUNDS	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene Dibromide	106-93-4
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Metals	CAS No.
Arsenic (Total & Dissolved)	7440-38-2
Cobalt (Total & Dissolved)	7440-48-4
Iron (Total & Dissolved)	7439-89-6
Lead (Total & Dissolved)	7439-92-1
Manganese (Total & Dissolved)	7439-96-5

Misc Parameters	CAS No.
Ammonia	7664-41-7
Chloride	16887-00-6
Fluoride	7782-41-4
Nitrate	84145-82-4
Nitrite	1594-56-5
Sulfate	18785-72-3
Sulfide	-
Total Alkalinity	-
Bicarbonate	71-52-3
Total Organic Carbon	7440-44-0
Total Dissolved Solids	CASID10052

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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APPENDIX J

Fate and Transport Analysis

APPENDIX J
FATE AND TRANSPORT MODELING PROCEDURES
AOI 11: SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA, PENNSYLVNIA

QUICK DOMENICO MODELING

J.1 RATIONALE AND APPROACH FOR FATE AND TRANSPORT ANALYSIS

Fate and transport simulations were completed for select deep groundwater monitoring wells in AOI 11 to evaluate potential migration pathways/impacts to: 1) the Schuylkill River 2) Delaware River and 3) off-site areas. Modeling to evaluate the potential impact to the Schuylkill River was performed as a conservative measure because, based on the geologic cross sections provided in Appendix D, groundwater in the Farrington Sand unit only appears to have the potential to discharge to the Schuylkill River in the area of AOI 2. North of AOI 2 (AOI 8 area), the Farrington Sand is not present along the river's edge. Along this portion of the refinery boundary with the river, the Farrington Sand has been eroded and replaced with a thick wedge of alluvium that continues to bedrock. South of the AOI 2 area boundary with the river, the Farrington Sand is present at depths greater than the bottom of the Schuylkill River, and more importantly, is hydraulically separated from the River by the presence of the Lower Clay. Based on deep groundwater flow as illustrated in Figure 4 of the SCR/RIR, deep groundwater south of the AOI 2 boundary generally flows towards the southwest and beneath the Schuylkill River.

Modeling was performed to evaluate potential off-site impacts only in the select few areas where the deep groundwater monitoring wells had concentrations that were not non-detect along the refinery boundary.

The approach to fate-and-transport modeling for deep groundwater is summarized below:

1. Wells with COC concentrations above the MSC were evaluated to determine whether the concentrations were delineated to below the MSC by evaluating the data from downgradient well based on the most recent sampling event and stable to decreasing trends in the downgradient well. Wells that were not delineated by downgradient wells were modeled using QD. The maximum

concentrations of COCs detected during the April and June/July 2011 groundwater sampling events were used as source concentrations in the QD models. Only concentrations above the groundwater MSCs were used. The COCs modeled include: benzene, MTBE, chrysene, arsenic and manganese.

2. QD simulations were then run to predict the migration distance to which the concentration falls below the MSC. The predicted distances were then compared to the actual distance between the well and its downgradient property boundary (boundary with the Schuylkill River or off-site boundary). Wells that were not predicted to exceed the MSC at the boundary were not carried forward with additional fate and transport analysis.
3. For those wells that had the potential to exceed the MSC at the boundary with the river, a QD model was prepared using the well-specific concentrations and actual distance to the river boundary to determine the edge criterion.
4. The edge criterion (concentration) was then input into the PADEP SWLOAD model to calculate the mass loading of the COC and to determine if surface water mixing calculations were required.
5. Where required, surface water allocations were calculated using the equation for determining the allowable groundwater concentration in a plume discharging to surface water found in the Act 2 TGM Section IV page 20.
6. The calculated wasteload calculations were then compared to the predicted COC concentration at the boundary with the river.

This rationale and approach is discussed in more detail throughout the following sections.

J.2 QUICK DOMENICO MODEL OVERVIEW

The QD Model is a Microsoft Excel spreadsheet application based on the analytical contaminant transport equation developed by P.A. Domenico in *"An Analytical Model For Multidimensional Transport of a Decaying Contaminant Species,"* Journal of Hydrology, 91 (1987), pp. 49-58. The QD model calculates contaminant concentrations at any down-gradient location after a specified interval of time. The model incorporates the processes of advection, first order decay, retardation, and dispersion to describe fate and transport of compounds.

MODEL LIMITATIONS

Limitations of the QD model include:

- Groundwater flow is assumed to be steady state, and one-dimensional;
- Aquifer properties are assumed to be reasonably uniform;
- Applicable only to unconsolidated aquifers;
- Intended for use primarily with dissolved organic compounds;
- Does not account for the transformation of parent compounds into daughter products as the result of biodegradation;
- Compounds are considered individually, and are assumed to not react with each other; and
- The contaminant source is limited to a single and continuous source concentration.

MODEL INPUT PARAMTERS

In preparation of this report, input values for the QD model were compiled from available site-specific data. When no site-specific data was available, estimated input values from the PADEP spreadsheet "Number Please!2011," which is based on PA Code, Chapter 250, Appendix A, Table 5; or other acceptable literature sources, were utilized. The input parameters are discussed in detail in the following sections and are summarized in the input/output tables J.1 through J.4 in this appendix. An Excel spreadsheet interface developed by Langan was used to construct the QD simulations. This interface allowed the simulation of multiple compounds simultaneously and saved in a single electronic file.

Source Concentration

The maximum COC concentrations (above the MSC) from the April and June/July 2011 deep groundwater sampling events were used as the starting concentrations in the QD simulations.

Distance to Location of Concern (x)

Distance to the Location of Concern (distance) for the current simulations is the distance required for each COCs concentration to fall below its respective MSC

under steady-state plume conditions. The distance is iteratively entered in the QD model until the location where the COC concentration reaches the MSC is identified. This step is performed using a large simulation time of 1×10^{99} days to ensure that the plume has reached steady-state.

Dispersivity

Dispersivity is the tendency of a dissolved plume to "spread out" as it moves down-gradient.

- Longitudinal dispersivity (A_X) occurs in the direction parallel to groundwater flow;
- Transverse dispersivity (A_Y) occurs in the same plane as longitudinal dispersivity but perpendicular to the direction of groundwater flow; and
- Vertical dispersivity (A_Z) occurs in the upward direction, normal to the plane in which longitudinal and transverse dispersivity occur (Vertical dispersivity is usually negligible and is typically omitted from most QD analyses).

Dispersivity estimates are difficult to quantify and are commonly estimated from the following relationships:

1. $A_X = X/10$ (where, X is the distance a contaminant has traveled by advective transport)
2. $A_Y = A_X/10$
3. $A_Z = A_X/20$ to $A_X/100$ (generally, it is recommended that A_Z be a very small number (0.001) unless vertical monitoring can reliably justify a larger number. Additionally, a value of 0.0001 is suggested for un-calibrated or conceptual applications).

As stated above the value for A_Y was estimated to be 10 percent of A_X. A value of 0.0001 was used as a value for A_Z.

Lambda

Lambda is the first order decay constant. It is determined by dividing 0.693 by the half-life of the compound. The value can typically be estimated for shrinking

plumes by evaluating at concentrations versus time or distance. Lambda can also sometimes be estimated for stable plumes by evaluating concentration versus time using the methodology outlined in Buscheck and Alcantar (1995). Important considerations to estimating Lambda from site data include:

1. Are the measured concentrations along the centerline of the plume?
2. Are the measured concentrations the result of the single source area?
3. Are there no remedial systems and/or activities that effected the migration of the plume during the time interval of evaluation?

If the answer is yes to these questions, then the methodologies outlined in Buscheck and Alcantar may be utilized to estimate a site-specific lambda from site data.

Based on review of the available site data, the criteria necessary to calculate a site-specific lambda could not be met; therefore, a default value for lambda (when appropriate and available) was obtained from the PADEP spreadsheet "Number Please!2011" which is based on PA Code, Chapter 250, Appendix A, Table 5.

Source Dimensions

Source width is the maximum width of the area measured perpendicular to the direction of groundwater flow. Source thickness is the thickness of the soils below the water table that contribute contamination to groundwater. In addition to the saturated zone, fluctuation in groundwater elevation may create a smear zone in the unsaturated portion of an aquifer. As an estimate of the thickness of the smear zone, average fluctuation can be used. In the absence of a delineated contaminant plume a source width of 100 ft was used. Source thicknesses were site-specific based upon the actual thickness of the Farrington Sand at each well location as interpreted from soil boring logs.

Hydraulic Conductivity (K)

The hydraulic conductivity of a geologic material is a measure of its ability to transmit water. A hydraulic conductivity of 135 ft/d was used. This value is the average hydraulic conductivity of Farrington Sand as determined by pumping tests completed by the USGS (USGS, 1991).

Hydraulic Gradient

Hydraulic gradient is the change in hydraulic head relative to the distance between head measurement locations. The hydraulic gradient is measured parallel to the direction of ground water flow assuming horizontal flow and a uniform gradient. QD simulations for specific wells used a well-specific gradient estimate.

Porosity (n)

Porosity is measured as the ratio of the volume of void space in a geologic material to the total volume of material. The porosity value used in the fate and transport modeling for AOI 11 was based derived from literature (Freeze and Cherry, 1979) for a gravelly-sand.

Soil Bulk Density (ρ_b)

Soil bulk density is the dry weight of a sample divided by the total volume of the sample in an undisturbed state. Soil bulk density can either be determined by a laboratory or by the equation

$$\rho_b = 2.65 * (1- n).$$

Soil bulk density values used in the fate and transport modeling were based on default value provided in the PADEP EP spreadsheet "Number Please!2011" which is based on PA Code, Chapter 250, Appendix A, Table 5.

Organic Carbon Partition Coefficient (K_{OC})

The organic carbon partition coefficient is chemical specific and is provided in the PADEP EP spreadsheet "Number Please!2011" which is based on PA Code, Chapter 250, Appendix A, Table 5. These values were used in the fate and transport modeling.

Fraction Organic Carbon (f_{oc})

The fraction of organic carbon is the organic carbon content of a soil. A laboratory using ASTM methods can determine this value. Samples for organic

carbon are taken from the same soil horizon in which the contaminant occurs, but outside of the impacted area. Since no site specific fraction of organic carbon data was available for the site, the fate and transport modeling used the model-recommended default concentration of 0.005, which is a conservative value based on the description of site soils.

Time (t)

'Time zero' is the point at which contamination was introduced into the aquifer. Time since 'time zero' is measured in days. The final simulation time of 1×10^{99} days was used to ensure that a steady-state plume was simulated.

QUICK DOMENICO OUTPUT DATA AND RESULTS

The results obtained from the Quick Domenico modeling is the predicted distance each COC has to migrate from the subject well in order for the concentration of each COC modeled to attenuate to its groundwater medium specific concentration (MSC) (Figures J.1 through J.10). Predicted distances for COC migration range from 7.1 feet for chrysene at N-50D to 7,550 feet for manganese at S-302D (Figure J.17).

By comparing the QD predicted migration distance to the distance to the nearest receptor (Schuylkill River) those wells and COCs that have potential to discharge to the receptor can be further evaluated. It must be noted that this is a very conservative assumption since the majority of groundwater flow in the lower sand aquifer flows beneath the Schuylkill River. Based on predicted migration distance and distance to the receptor three wells have been identified, A-21D in AOI5, C-144D in AOI-7, and S-302D in AOI 2 which have potential to discharge manganese to the Schuylkill River due to their proximity to the river and/or high manganese concentration. These three locations will be carried on to the next step which uses another model to calculate the groundwater discharge rate from a cross section of aquifer adjacent to the Schuylkill River. No other wells or COCs were found in to have potential to discharge to the river above their respective groundwater MSC (SWLOAD edge criterion).

J.3 SWLOAD EVALUATION

The Surface Water Load model (SWLOAD) is similar to the Quick Domenico Excel Spreadsheet model. It is used to calculate the cross section of a contaminant plume and estimate the mass of contamination that could potentially be discharged to a surface water body. SWLOAD input parameters are nearly identical to those found in

the Quick Domenico model. Additional input parameters for SWLOAD are the edge criterion, which in this case is the manganese groundwater MSC of 0.3 ug/l and distance to the stream of interest along a groundwater flow path. For the current simulations the lengths of the groundwater flow paths to the Schuylkill River vary from about 10 ft at A-21D to 400 ft at C-144D to 1,000 ft at S-302D. The output from SWLOAD used in this analysis is the volumetric groundwater flow of the dissolved plume predicted to discharge to the Schuylkill River. This discharge flow was used to calculate a site-specific wasteload allocation for manganese at each of these three locations. A wasteload allocation is a screening concentration used to evaluate the potential impact of groundwater concentration on surface water. SWLOAD calculated discharge flow ranges from 0.00284 cubic feet per second (cfs) at A-21D to 0.02492 cfs at S-302D to 0.02667 cfs at C-144D (Tables J.11 through J.13).

J.4 IMPACTS TO SURFACE WATER EVALUATION

The potential manganese impacts to surface water from diffuse flow of groundwater was assessed using the equation for determining the allowable groundwater concentration in a plume discharging to surface water found in the Act 2 TGM Section IV page 20.

$$C_{gw} = C_x + \frac{Y_c \times Q_{sw} \times (C_x - C_{bsw})}{Q_{gw}}$$

Where:

- C_{gw} = the allowable groundwater concentration (ug/l)
- C_x = the water quality objective from PA Code Chapter 93 (ug/l)
- Q_{sw} = the quantity of stream flow above the nonpoint source discharge into surface water (cubic ft per second)
- C_{bsw} = the background concentration in surface water of a contaminant of concern above the nonpoint source discharge (ug/l)
- Q_{gw} = the quality of flow in the groundwater plume discharging to the surface water (cubic ft per second)
- Y_c = partial mixing factor is the fractional portion of the stream that mixes with the discharge

Many organic and inorganic compounds have several PA Water Quality Objectives (WQOs). These WQOs can be used to screen for acute or chronic effects on aquatic life or used to protect human health. In the PA Code Chapter 93 manganese has only

one water quality objective of 1 ug/l. This value was used to calculate a site-specific wasteload allocation for manganese at A-21D, S-302D and C-144D. For this calculation upstream concentrations of manganese were assumed to be zero at each location. A surface-water partial mixing factor of 1.0 was applied under the assumption that mixing occurs across the entire stream width. Surface water flow was defined as ten percent of the $Q_{7\text{-}10}$ surface water flow (or 24 cfs). This value was used per the direction of PADEP. As stated earlier, groundwater flow was calculated by SWLOAD.

Wasteload allocation calculations can be found in Tables J.14 through J.16. A comparison of the calculated wasteload allocation for manganese at all three locations to the corresponding QD predicted groundwater concentration at the edge of the Schuylkill River can be found in Table J.17. The results of this comparison indicates that through the attenuation of manganese in groundwater and the dilution of the groundwater by time it discharges to surface water will not exceed the site-specific wasteload allocations for manganese and therefore will not pose an ecological or human health threat.

J.8 Conclusions

By evaluating groundwater flow and the distribution of COC groundwater impacts across the refinery the COCs that were identified for further screening through fate and transport analysis were chrysene, benzene, methyl tertiary butyl ether, and manganese. To screen and predict the potential for fate and transport in groundwater the Quick Domenico model was used. Ten monitoring wells containing one or two of these compounds, located throughout the refinery, were used as the starting point for Quick Domenico groundwater fate and transport simulations. The results of the Quick Domenico simulations indicate that due to attenuation in groundwater chrysene, benzene and MTBE do not have the potential to migrate far enough to impact surface water receptors. However, Quick Domenico simulations did indicate that manganese concentration at three locations (A-21D, C-144D and S-302D) might have the potential to impact surface water. This result is conservative since the Lower Sand does not discharge to the Schuylkill River.

To further address manganese fate and transport at A-21D, C-144D and S-302D the SWLOAD model was used to calculate groundwater flux to surface water which was then used to derive a site-specific wasteload allocation. The wasteload allocation was then used to screen predicted (using the QD model) manganese groundwater

concentration at the edge of the surface water receptor for the potential for groundwater to impact at each location. The comparison of calculated wasteload allocation to predicted manganese concentrations adjacent to the Schuylkill River indicates that manganese has no potential to impact surface water receptors.

Appendix J
Table J.1
Quick Domenico
AOI-11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				N-50D
Sample Date				See Below
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	45	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	USGS Water Supply Paper 2346
Hydraulic Gradient		ft/ft	0.003	from N-44D/N-50D August 2010 Groundwater Elevations
Porosity		decimal fraction	0.4	Freeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Chrysene	N-50D
Source Concentration (mg/L)		mg/L	0.0050	June-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			490000	Number Please!2011
Sim 2				
Contaminant			Manganese	N-50D
Source Concentration (mg/L)		mg/L	1.0000	April-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC (feet)**
Sim 1 - Chrysene	0.0050	0.0019	0.0019	**7.1**
Sim 2 - Manganese	1.0000	0.300	0.300	**421**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery		
Date:	9/8/2011	Prepared by:	TS
		Contaminant:	Chrysene

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
0	2.00E+02	2.00E+01	1.00E-04	0.00035616	100	45	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^{3})	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.003	0.4	1.7	490000	5.00E-03	10413.5	9.72296E-05

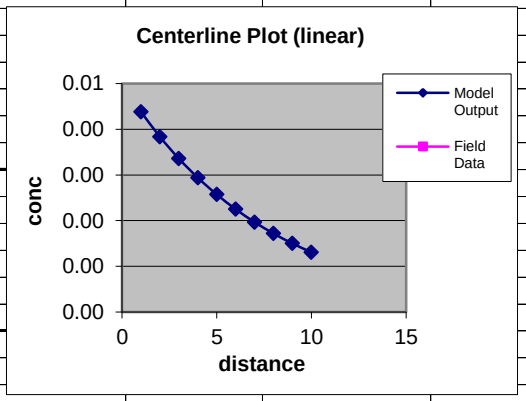
NEW QUICK_DOMENICO.XLS

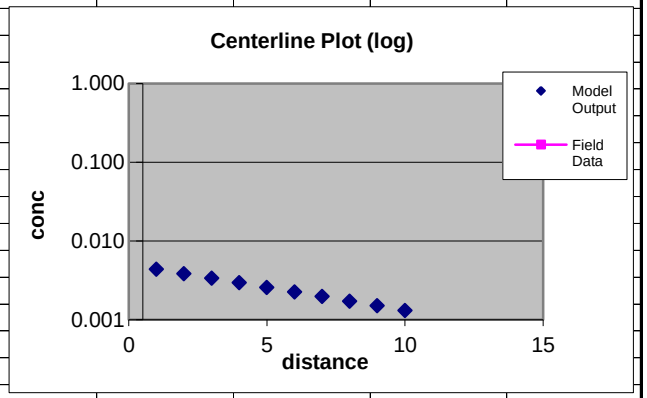
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
7.1	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	7.1	0	0
at	1E+99	days =	0.002
			mg/l





	AREAL MODEL	CALCULATION DOMAIN
	Length (ft)	10
	Width (ft)	100

	1	2	3	4	5	6	7	8	9	10
100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
0	0.004	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.001	0.001
-50	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
-100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Field Data:	Centerline C Concentration
	Distance from Source

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery						
Date:	9/8/2011	Prepared by:	TS				
		Contaminant:	Manganese				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
1	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	45	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^{3})	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.003	0.4	1.7	1E-10	5.00E-03	1	1.0125

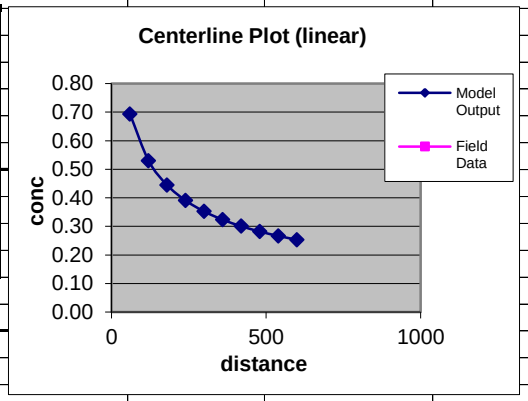
NEW QUICK_DOMENICO.XLS

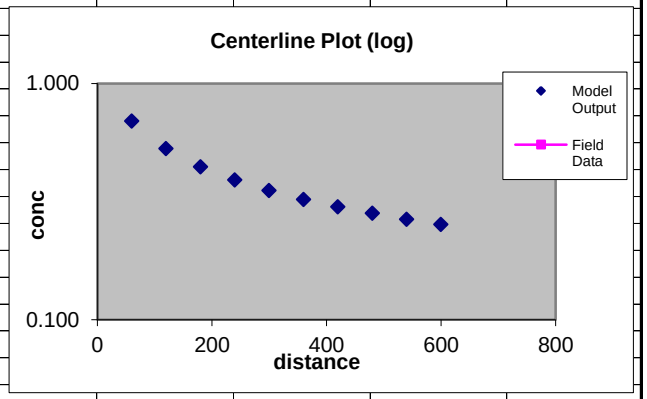
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
420.9838153	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	420.9838153	0	0
at	1E+99	days =	0.300
			mg/l





	AREAL MODEL	CALCULATION DOMAIN
	Length (ft)	600
	Width (ft)	500

	60	120	180	240	300	360	420	480	540	600
500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.002
250	0.000	0.002	0.009	0.020	0.031	0.042	0.051	0.059	0.066	0.072
0	0.693	0.530	0.444	0.390	0.352	0.323	0.300	0.282	0.266	0.253
-250	0.000	0.002	0.009	0.020	0.031	0.042	0.051	0.059	0.066	0.072
-500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.002

Field Data:	Centerline C	Concentration
	Distance from Source	

Appendix J
Table J.2
Quick Domenico
AOI 11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				N-44D
Sample Date				Jun-11
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	40	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	U.S. Geological Survey water-supply paper -- 2346.
Hydraulic Gradient		ft/ft	0.003	from N-44D/N-50D August 2010 Groundwater Contours
Porosity		decimal fraction	0.4	Freeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Arsenic	N-44D
Source Concentration (mg/L)		mg/L	0.0622	June-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011
Sim 2				
Contaminant			Manganese	N-44D
Source Concentration (mg/L)		mg/L	0.6050	June-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC**
Sim 1 - Arsenic	0.0622	0.0100	0.0100	**1530.0**
Sim 2 - Manganese	0.6050	0.300	0.300	**140**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery						
Date:	9/8/2011	Prepared by:	TS				
		Contaminant:	Arsenic				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
0	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	40	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.003	0.4	1.7	1E-10	5.00E-03	1	1.0125

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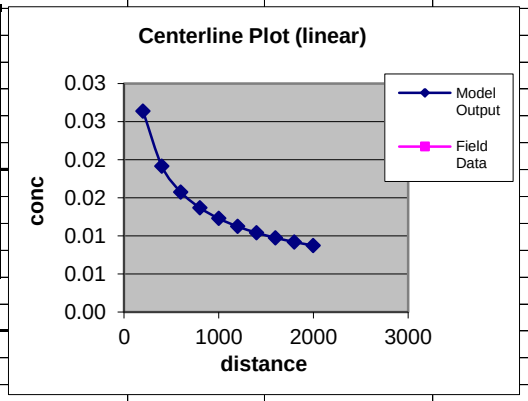
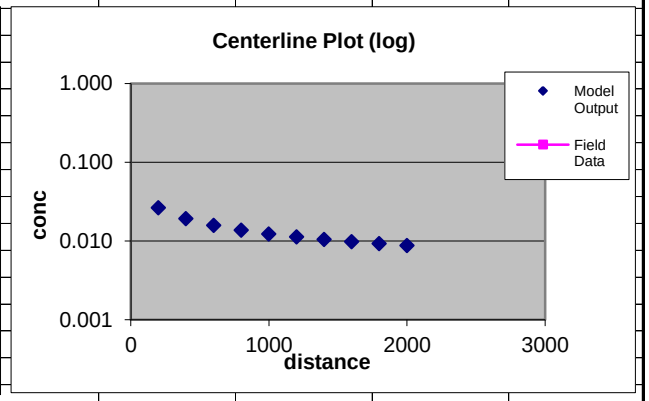
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
1530	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	1530	0	0
at	1E+99	days =	0.010 mg/l





	AREAL MODEL	CALCULATION DOMAIN
	Length (ft)	2000
	Width (ft)	500

	200	400	600	800	1000	1200	1400	1600	1800	2000
500	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002
250	0.001	0.003	0.004	0.005	0.006	0.006	0.006	0.006	0.006	0.006
0	0.026	0.019	0.016	0.014	0.012	0.011	0.010	0.010	0.009	0.009
-250	0.001	0.003	0.004	0.005	0.006	0.006	0.006	0.006	0.006	0.006
-500	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002

Field Data: Centerline C Concentration
Distance from Source

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery						
Date:	9/8/2011	Prepared by:	TS				
		Contaminant:	Manganese				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
1	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	40	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^{3})	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.003	0.4	1.7	1E-10	5.00E-03	1	1.0125

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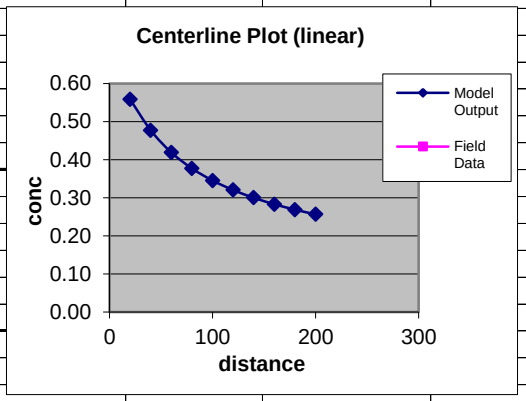
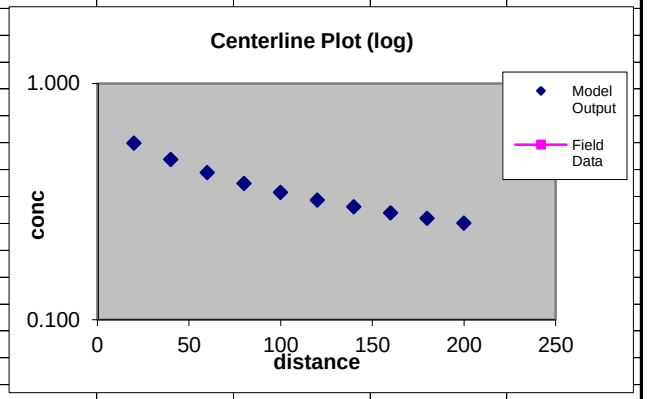
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
140.0741504	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	140.0741504	0	0
at	1E+99	days =	0.300 mg/l





	AREAL MODEL	CALCULATION DOMAIN
	Length (ft)	200
	Width (ft)	200

	20	40	60	80	100	120	140	160	180	200
200	0.000	0.000	0.001	0.002	0.005	0.009	0.013	0.018	0.022	0.027
100	0.023	0.064	0.092	0.112	0.124	0.133	0.139	0.143	0.145	0.146
0	0.558	0.477	0.419	0.377	0.345	0.320	0.300	0.283	0.269	0.256
-100	0.023	0.064	0.092	0.112	0.124	0.133	0.139	0.143	0.145	0.146
-200	0.000	0.000	0.001	0.002	0.005	0.009	0.013	0.018	0.022	0.027

Field Data: Centerline C Concentration
Distance from Source

Appendix J
Table J.3
Quick Domenico
AOI 11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				N-38D
Sample Date				Apr-11
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	40	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	USGS Water Supply Paper 2346
Hydraulic Gradient		ft/ft	0.003	from N-44D/N-50DD August 2010 Groundwater Elevations
Porosity		decimal fraction	0.4	Freeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Manganese	N-38D
Source Concentration (mg/L)		mg/L	0.3560	April-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC**
Sim 1 - Manganese	0.3560	0.3000	0.3004	**31.1**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery										
Date:	9/8/2011	Prepared by:	TS								
		Contaminant:	Manganese								
SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)				
0	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	40	1E+99				
Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)				
1.35E+02	0.003	0.4	1.7	1E-10	5.00E-03	1	1.0125				

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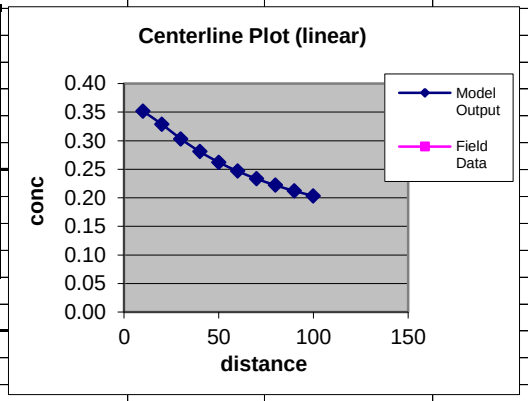
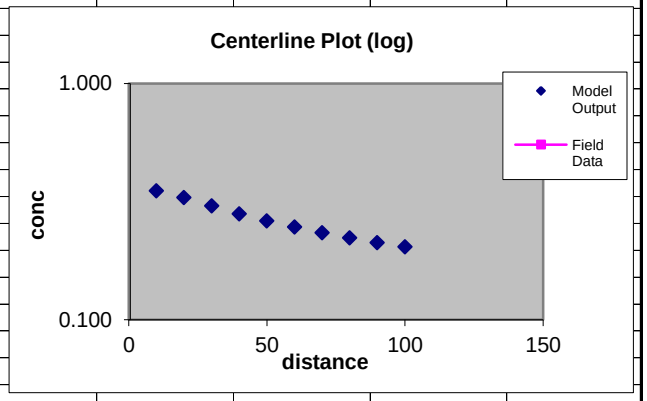
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
31.1	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	31.1	0	0
at	1E+99	days =	**0.300** mg/l





AREAL MODEL CALCULATION DOMAIN

Length (ft) 100

Width (ft) 150

	10	20	30	40	50	60	70	80	90	100
150	0.000	0.000	0.001	0.002	0.005	0.007	0.010	0.014	0.017	0.020
75	0.038	0.067	0.084	0.094	0.102	0.107	0.110	0.112	0.114	0.115
0	0.352	0.329	0.303	0.281	0.262	0.247	0.233	0.222	0.212	0.203
-75	0.038	0.067	0.084	0.094	0.102	0.107	0.110	0.112	0.114	0.115
-150	0.000	0.000	0.001	0.002	0.005	0.007	0.010	0.014	0.017	0.020

Field Data: Centerline C Concentration

Distance from Source

Appendix J
Table J.4
Quick Domenico
AOI-11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				S-106D
Sample Date				Apr-11
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	75	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	USGS Water Supply Paper 2346
Hydraulic Gradient		ft/ft	0.0016	from S-106D/S-120D August 2010 Groundwater Elevations
Porosity		decimal fraction	0.4	Freeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			MTBE	S-106D
Source Concentration (mg/L)		mg/L	0.3000	April-11
Lambda (per day)		day^{-1}	0.002	Number Please!2011
KOC			12	Number Please!2011
Sim 2				
Contaminant			Manganese	S-106D
Source Concentration (mg/L)		mg/L	1.0300	April-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC (feet)**
Sim 1 - MTBE	0.3000	0.0200	0.0200	**504.0**
Sim 2 - Manganese	1.0300	0.300	0.300	**447**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery							
Date:	9/8/2011	Prepared by:	TS					
		Contaminant:	MTBE					

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
0	2.00E+02	2.00E+01	1.00E-04	0.00189041	100	75	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.0016	0.4	1.7	12	5.00E-03	1.255	0.430278884

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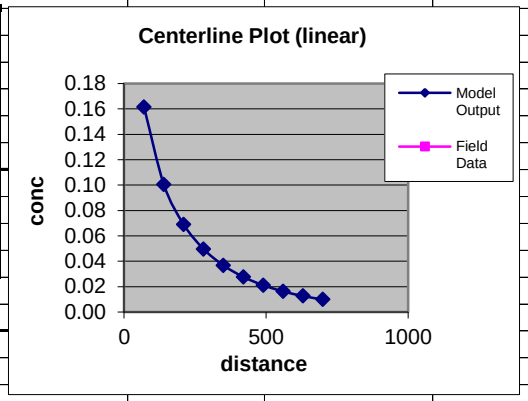
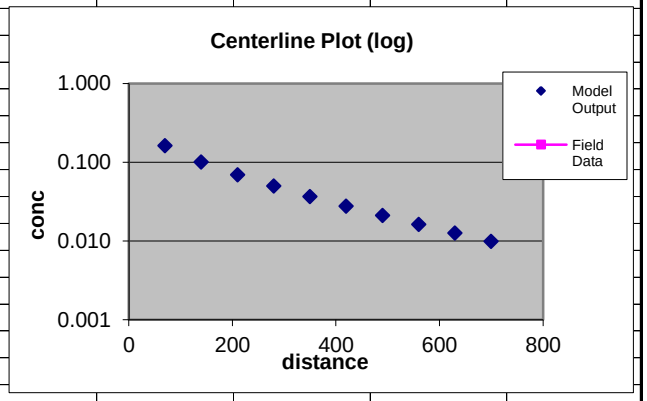
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
504	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	504	0	0
at	1E+99	days =	0.020 mg/l





AREAL MODEL	CALCULATION DOMAIN
Length (ft)	700
Width (ft)	300

	70	140	210	280	350	420	490	560	630	700
300	0.000	0.000	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002
150	0.007	0.018	0.020	0.020	0.017	0.015	0.012	0.010	0.008	0.007
0	0.161	0.100	0.069	0.050	0.037	0.028	0.021	0.016	0.013	0.010
-150	0.007	0.018	0.020	0.020	0.017	0.015	0.012	0.010	0.008	0.007
-300	0.000	0.000	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002

Field Data:	Centerline C Concentration
	Distance from Source

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery						
Date:	9/8/2011	Prepared by:	TS				
		Contaminant:	Manganese				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
1	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	75	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^{3})	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.0016	0.4	1.7	1E-10	5.00E-03	1	0.54

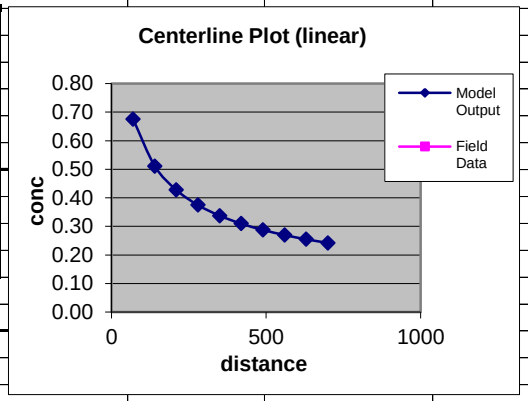
NEW QUICK_DOMENICO.XLS

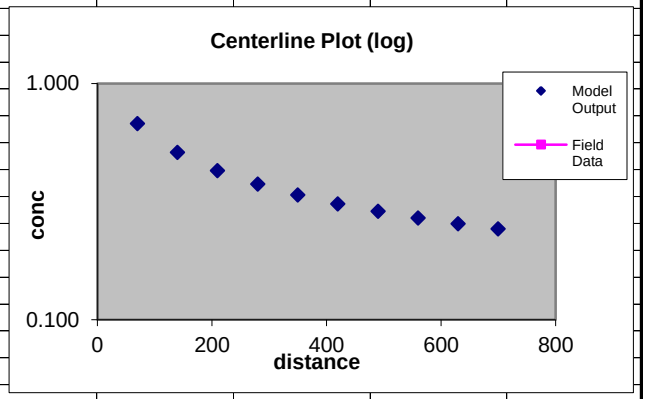
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
447	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	447	0	0
at	1E+99	days =	**0.300** mg/l





AREAL MODEL CALCULATION DOMAIN

Length (ft)	700
Width (ft)	300

	70	140	210	280	350	420	490	560	630	700
300	0.000	0.000	0.003	0.009	0.016	0.024	0.032	0.039	0.045	0.051
150	0.030	0.090	0.127	0.147	0.158	0.164	0.166	0.166	0.165	0.164
0	0.675	0.511	0.427	0.374	0.337	0.309	0.287	0.270	0.255	0.242
-150	0.030	0.090	0.127	0.147	0.158	0.164	0.166	0.166	0.165	0.164
-300	0.000	0.000	0.003	0.009	0.016	0.024	0.032	0.039	0.045	0.051

Field Data: Centerline C Concentration
Distance from Source

Appendix J
Table J.5
Quick Domenico
AOI 11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				S-120D
Sample Date				Apr-11
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	75	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	USGS Water Supply Paper 2346
Hydraulic Gradient		ft/ft	0.0016	from S-106D/S-120D August 2010 Groundwater Elevations
Porosity		decimal fraction	0.4	Freeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			MTBE	S-120D
Source Concentration (mg/L)		mg/L	0.0370	April-11
Lambda (per day)		day^{-1}	0.002	Number Please!2011
KOC			12	Number Please!2011
Sim 2				
Contaminant			Manganese	S-120D
Source Concentration (mg/L)		mg/L	1.7200	April-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC (feet)**
Sim 1 - MTBE	0.0370	0.0200	0.0200	**69.5**
Sim 2 - Manganese	1.7200	0.300	0.300	**1285**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery							
Date:	9/8/2011	Prepared by:	TS					
		Contaminant:	MTBE					

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
0	2.00E+02	2.00E+01	1.00E-04	0.00189041	100	75	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.0016	0.4	1.7	12	5.00E-03	1.255	0.430278884

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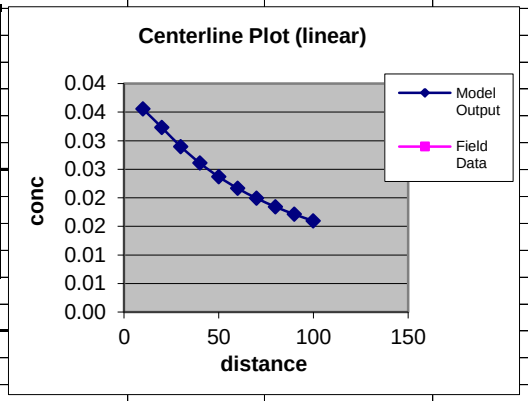
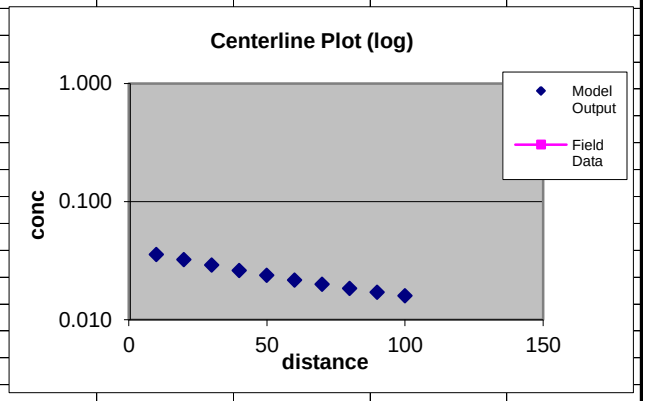
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
69.5	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	69.5	0	0
at	1E+99	days =	0.020 mg/l





	AREAL MODEL	CALCULATION DOMAIN
	Length (ft)	100
	Width (ft)	100

	10	20	30	40	50	60	70	80	90	100
100	0.000	0.001	0.003	0.003	0.004	0.005	0.005	0.005	0.006	0.006
50	0.018	0.017	0.017	0.016	0.016	0.015	0.014	0.014	0.013	0.012
0	0.036	0.032	0.029	0.026	0.024	0.022	0.020	0.018	0.017	0.016
-50	0.018	0.017	0.017	0.016	0.016	0.015	0.014	0.014	0.013	0.012
-100	0.000	0.001	0.003	0.003	0.004	0.005	0.005	0.005	0.006	0.006

Field Data: Centerline C Concentration
Distance from Source

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery						
Date:	9/8/2011	Prepared by:	TS				
		Contaminant:	**Manganese**				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
2	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	75	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.0016	0.4	1.7	1E-10	5.00E-03	1	0.54

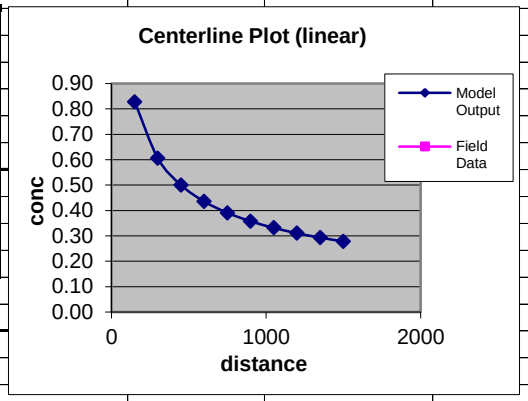
NEW QUICK_DOMENICO.XLS

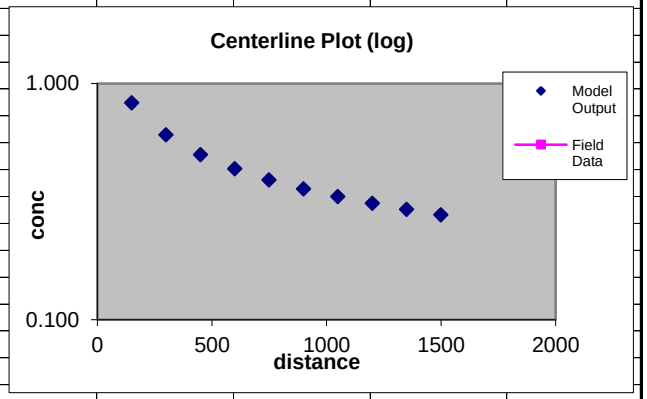
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
1285	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	1285	0	0
at	1E+99	days =	**0.300**
			mg/l





	AREAL MODEL	CALCULATION DOMAIN
	Length (ft)	1500
	Width (ft)	300

	150	300	450	600	750	900	1050	1200	1350	1500
300	0.001	0.018	0.046	0.071	0.091	0.105	0.116	0.124	0.129	0.133
150	0.161	0.252	0.275	0.277	0.271	0.263	0.255	0.247	0.239	0.231
0	0.828	0.605	0.500	0.435	0.391	0.358	0.332	0.310	0.293	0.278
-150	0.161	0.252	0.275	0.277	0.271	0.263	0.255	0.247	0.239	0.231
-300	0.001	0.018	0.046	0.071	0.091	0.105	0.116	0.124	0.129	0.133

Field Data: Centerline C Concentration
Distance from Source

Appendix J
Table J.6
Quick Domenico
AOI-11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				C-144D
Sample Date				Apr-11
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	20	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	USGS Water Supply Paper 2346
Hydraulic Gradient		ft/ft	0.0018	from C-144D/C-50D August 2010 Groundwater Elevations
Porosity		decimal fraction	0.4	Feeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Manganese	C-144D
Source Concentration (mg/L)		mg/L	2.8900	April-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC (feet)**
Sim 1 - Manganese	2.8900	0.3000	0.3000	**3672.0**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery						
Date:	9/8/2011	Prepared by:	TS				
		Contaminant:	Manganese				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
3	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	20	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.0018	0.4	1.7	1E-10	5.00E-03	1	0.6075

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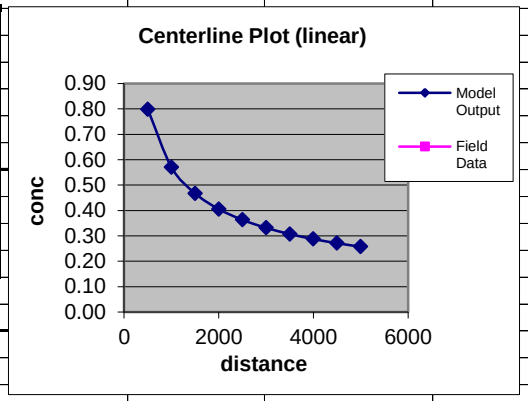
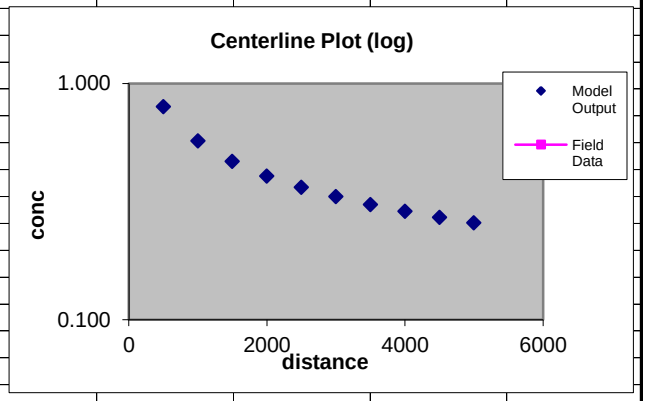
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
3672	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	3672	0	0
at	1E+99	days =	0.300 mg/l





	AREAL MODEL	CALCULATION DOMAIN
	Length (ft)	5000
	Width (ft)	300

	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
300	0.092	0.190	0.223	0.232	0.232	0.229	0.223	0.217	0.211	0.206
150	0.466	0.433	0.389	0.353	0.325	0.302	0.284	0.268	0.255	0.243
0	0.799	0.571	0.467	0.406	0.363	0.332	0.307	0.287	0.271	0.257
-150	0.466	0.433	0.389	0.353	0.325	0.302	0.284	0.268	0.255	0.243
-300	0.092	0.190	0.223	0.232	0.232	0.229	0.223	0.217	0.211	0.206

Field Data:	Centerline C	Concentration
	Distance from Source	

Appendix J
Table J.7
Quick Domenico
AOI-11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				C-50D
Sample Date				Jul-11
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	60	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	USGS Water Supply Paper 2346
Hydraulic Gradient		ft/ft	0.0018	from C-114D/C-50D August 2010 Groundwater Contours
Porosity		decimal fraction	0.4	Freeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Manganese	C-50D
Source Concentration (mg/L)		mg/L	2.9700	July-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC (feet)**
Sim 1 - Manganese	2.9700	0.3000	0.3000	**3880.0**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery						
Date:	9/8/2011	Prepared by:	TS				
		Contaminant:	Manganese				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
3	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	60	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.0018	0.4	1.7	1E-10	5.00E-03	1	0.6075

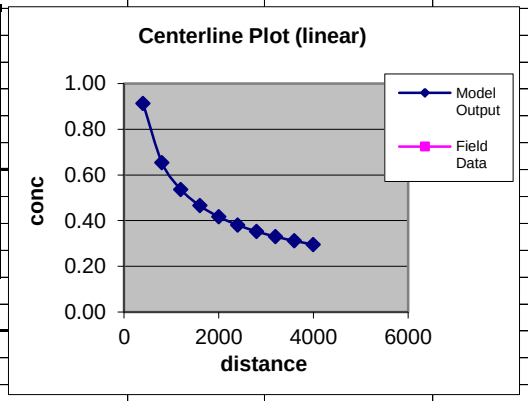
NEW QUICK_DOMENICO.XLS

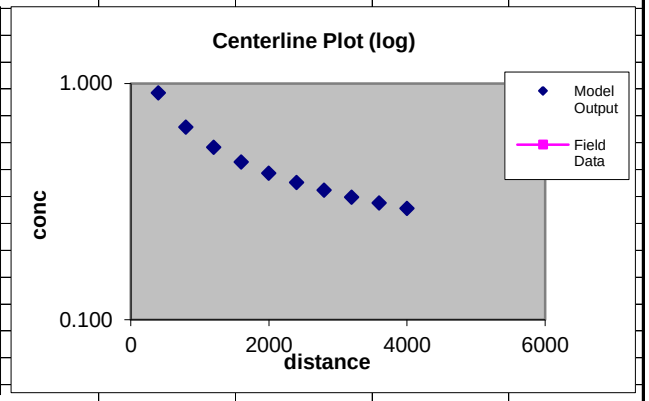
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
3880	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	3880	0	0
at	1E+99	days =	0.300 mg/l





AREAL MODEL CALCULATION DOMAIN

Length (ft) 4000

Width (ft) 400

	400	800	1200	1600	2000	2400	2800	3200	3600	4000
400	0.008	0.057	0.104	0.135	0.155	0.167	0.174	0.177	0.179	0.180
200	0.279	0.356	0.356	0.342	0.325	0.310	0.295	0.283	0.271	0.261
0	0.913	0.654	0.536	0.465	0.417	0.381	0.353	0.330	0.311	0.295
-200	0.279	0.356	0.356	0.342	0.325	0.310	0.295	0.283	0.271	0.261
-400	0.008	0.057	0.104	0.135	0.155	0.167	0.174	0.177	0.179	0.180

Field Data: Centerline C Concentration

Distance from Source

Appendix J
Table J.8
Quick Domenico
AOI-11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				S-302D
Sample Date				Apr-11
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	25	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	USGS Water Supply Paper 2346
Hydraulic Gradient		ft/ft	0.0009	from S-302D/S-72D August 2010 Groundwater Elevations
Porosity		decimal fraction	0.4	Freeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Manganese	S-302D
Source Concentration (mg/L)		mg/L	4.1400	April-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC (feet)**
Sim 1 - Manganese	4.1400	0.3000	0.3001	**7550.0**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery										
Date:	9/8/2011	Prepared by:	TS								
		Contaminant:	Manganese								
SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)				
4	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	25	1E+99				
Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)				
1.35E+02	0.0009	0.4	1.7	1E-10	5.00E-03	1	0.30375				

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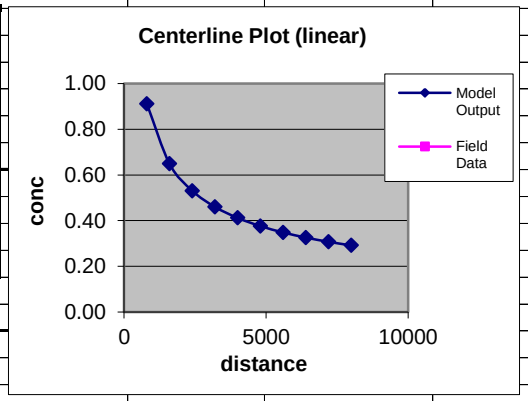
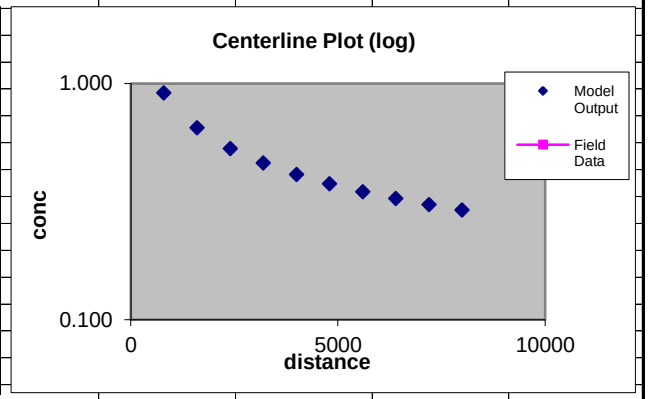
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
7550	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	7550	0	0
at	1E+99	days =	0.300 mg/l





	AREAL MODEL	CALCULATION DOMAIN									
	Length (ft)	8000									
	Width (ft)	500									
	800	1600	2400	3200	4000	4800	5600	6400	7200	8000	
500	0.020	0.094	0.146	0.174	0.189	0.197	0.200	0.200	0.199	0.197	
250	0.352	0.401	0.384	0.361	0.339	0.320	0.303	0.289	0.276	0.265	
0	0.911	0.649	0.531	0.460	0.412	0.376	0.348	0.326	0.307	0.292	
-250	0.352	0.401	0.384	0.361	0.339	0.320	0.303	0.289	0.276	0.265	
-500	0.020	0.094	0.146	0.174	0.189	0.197	0.200	0.200	0.199	0.197	
Field Data:	Centerline C	Concentration									
	Distance from Source										

Appendix J
Table J.9
Quick Domenico
AOI-11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				A-21D
Sample Date				Apr-11
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	15	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	USGS Water Supply Paper 2346
Hydraulic Gradient		ft/ft	0.0009	from A-21D/A-19D August 2010 Groundwater Elevations
Porosity		decimal fraction	0.4	Freeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Manganese	A-21D
Source Concentration (mg/L)		mg/L	0.7080	Apr-11
Lambda (per day)		day^{-1}	0.000	Number Please!2011
KOC			1E-10	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC (feet)**
Sim 1 - Manganese	0.7080	0.3000	0.3001	**200.0**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery						
Date:	9/8/2011	Prepared by:	TS				
		Contaminant:	Manganese				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
1	2.00E+02	2.00E+01	1.00E-04	2.7397E-13	100	15	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^{3})	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.0009	0.4	1.7	1E-10	5.00E-03	1	0.30375

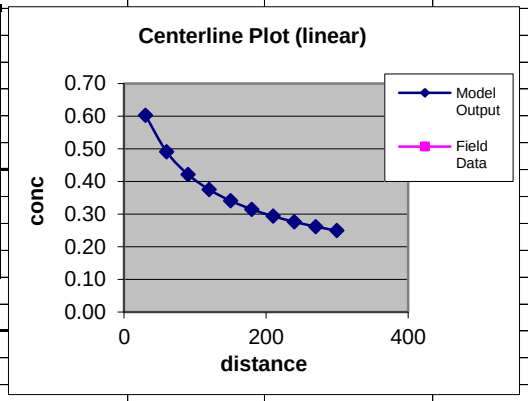
NEW QUICK_DOMENICO.XLS

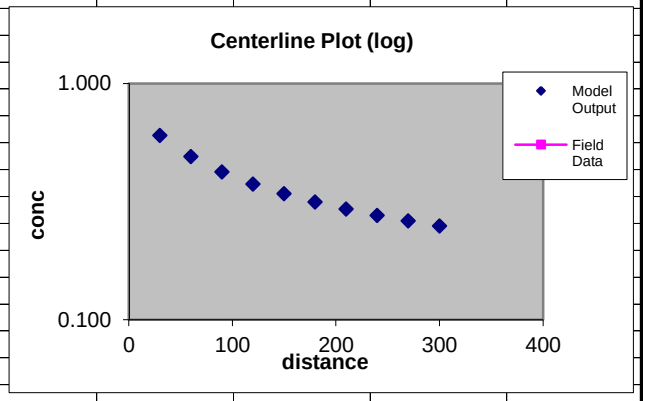
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
200	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	200	0	0
at	1E+99	days =	0.300 mg/l





	AREAL MODEL	CALCULATION DOMAIN
	Length (ft)	300
	Width (ft)	200

	30	60	90	120	150	180	210	240	270	300
200	0.000	0.001	0.004	0.011	0.018	0.026	0.034	0.041	0.047	0.053
100	0.053	0.108	0.139	0.156	0.165	0.169	0.171	0.171	0.170	0.169
0	0.603	0.490	0.422	0.375	0.341	0.315	0.294	0.276	0.262	0.249
-100	0.053	0.108	0.139	0.156	0.165	0.169	0.171	0.171	0.170	0.169
-200	0.000	0.001	0.004	0.011	0.018	0.026	0.034	0.041	0.047	0.053

Field Data:	Centerline C	Concentration
	Distance from Source	

Appendix J
Table J.10
Quick Domenico
AOI-11 - Fate and Transport Model Input and Output
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Project	AOI 11 SUNOCO Philadelphia Refinery
Prepared by	TS
Date Prepared	9/8/2011

Generic Input Parameters				Data Source
Source Identification (or Well ID)				S-38D2
Sample Date				Jun-11
Source Width		ft	100	Delineated LNAPL (100' if no plume is present)
Source Thickness		ft	40	SCR Cross Section
Longitudinal Dispersivity	A_x	ft	200	From CCR QD Simulations
Transverse Dispersivity	A_y	ft	20.0	0.1 x Longitudinal Dispersivity (QD User's Guide)
Vertical Dispersivity	A_z	ft	0.0001	negligible QD User's Guide
Hydraulic Conductivty	k	ft/day	135	USGS Water Supply Paper 2346
Hydraulic Gradient		ft/ft	0.0005	from S-38D2/S-119D August 2010 Groundwater Elevations
Porosity		decimal fraction	0.4	Freeze and Cherry, 1979
Soil Bulk Density	p_b	g/cm3	1.7	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	steady-state

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Benzene	A-21D
Source Concentration (mg/L)		mg/L	0.1100	Jun-11
Lambda (per day)		day^{-1}	0.001	Number Please!2011
KOC			58	Number Please!2011

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	**Starting Concentration (mg/L)**	**GW MSC[1] Non-Residential (mg/L)**	**Predicted Concentration (mg/L)**	**Predicted Distance to Meet Non-Residential GW MSC (feet)**
Sim 1 - Benzene	0.1100	0.0050	0.0050	**340.0**

[1] ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

Project:	AOI 11 SUNOCO Philadelphia Refinery						
Date:	9/8/2011	Prepared by:	TS				
		Contaminant:	Benzene				

SOURCE CONC (MG/L)	Ax (ft)	Ay (ft)	Az (ft) >=.001	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days) (days)
0	2.00E+02	2.00E+01	1.00E-04	0.0009589	100	40	1E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^3)	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.0005	0.4	1.7	58	5.00E-03	2.2325	0.075587906

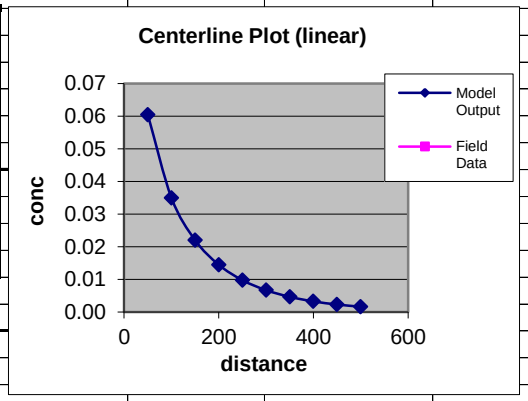
NEW QUICK_DOMENICO.XLS

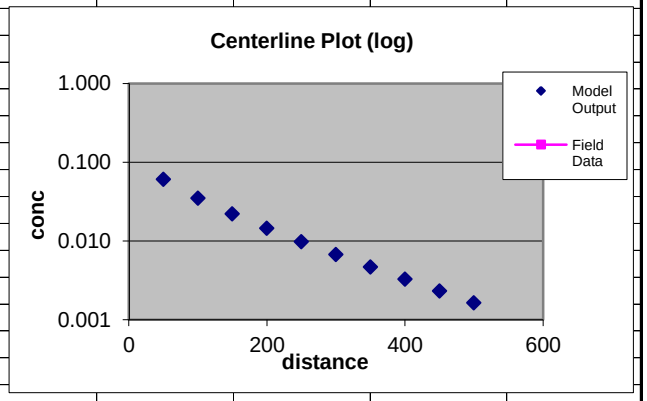
SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES" P.A. Domenico (1987) Modified to Include Retardation

Point Concentration

x(ft)	y(ft)	z(ft)
340	0	0

	x(ft)	y(ft)	z(ft)
Conc. At	340	0	0
at	1E+99	days =	0.005 mg/l





AREAL MODEL CALCULATION DOMAIN

Length (ft)	500
Width (ft)	200

	50	100	150	200	250	300	350	400	450	500
200	0.000	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001
100	0.011	0.013	0.011	0.008	0.006	0.005	0.003	0.002	0.002	0.001
0	0.060	0.035	0.022	0.014	0.010	0.007	0.005	0.003	0.002	0.002
-100	0.011	0.013	0.011	0.008	0.006	0.005	0.003	0.002	0.002	0.001
-200	0.000	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001

Field Data: Centerline C Concentration

Distance from Source

METHOD FOR ESTIMATNG FLOW, AVERAGE CONCENTRATION AND MASS LOADING TO SURFACE WATER FROM GROUNDWATER

PA DEPARTMENT
OF ENVIRONMENTAL PROTECTION
SWLOAD5B.XLS
A METHOD FOR ESTIMATING
COMTAMINANT LOADING TO SURFACE
WATER
based on
P.A. Domenico (1987)
Modified to Include Retardation

Project:	A-21D / AOI-11														
Date:	9/8/2011														
Contaminant:	Manganese			Prepared by:		TS									
SOURCE CONC (units)	Ax (ft)	Ay (ft)	Az (ft)	LAMBDA day-1	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days)								
mg/l	>.0001	>.0001	>=.0001												
0.708	200	20	1.00E-04	1.00E-10	100	15	1.00E+99								
Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^{3})	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)								
1.35E+02	0.0009	0.4	1.7	1.00E-10	5.00E-03	1	0.30375								
				-67.5	-54	-40.5	-27	-13.5	0	13.5	27	40.5	54	67.5	
Edge Criterion (mg/l)		0.3	0	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
Higest modeled conc.		0.69921	-1.5	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
			-3	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
SURFACE WATER LOADING GRID			-4.5	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
Distance to Stream (ft)		10	-6	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
Plume View Width (ft)		135	-7.5	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
Plume View Depth (ft)		15	-9	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
			-10.5	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
			-12	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
PENTOX NEEDED			-13.5	0.135077	0.2978841	0.483283	0.6194073	0.6833972	0.6992071	0.6833972	0.6194073	0.4832833	0.297884	0.135077	
			-15	0.067539	0.1489421	0.241642	0.3097036	0.3416986	0.3496036	0.3416986	0.3097036	0.2416416	0.148942	0.067539	
				Average Groundwater Concentration				0.4458	mg/l						
				Plume Flow				0.00284	cfs	0.00184	MGD				
				Mass Loading to Stream				3106.23	mg/day						

METHOD FOR ESTIMATNG FLOW, AVERAGE CONCENTRATION AND MASS LOADING TO SURFACE WATER FROM GROUNDWATER

Project:	C-144D / AOI-11
Date:	9/8/2011
Contaminant:	Manganese
Prepared by:	TS

PA DEPARTMENT
OF ENVIRONMENTAL PROTECTION
SWLOAD5B.XLS
A METHOD FOR ESTIMATING
COMTAMINANT LOADING TO SURFACE WATER
based on
P.A. Domenico (1987)
Modified to Include Retardation

SOURCE CONC (units)	Ax (ft)	Ay (ft)	Az (ft)	LAMBDA	SOURCE WIDTH (ft)	SOURCE THICKNESS (ft)	Time (days)
mg/l	>.0001	>.0001	>=.0001	day-1			
2.89	200	20	1.00E-04	1.00E-10	100	20	1.00E+99

Hydraulic Cond (ft/day)	Hydraulic Gradient (ft/ft)	Porosity (dec. frac.)	Soil Bulk Density (g/cm^{3})	KOC	Frac. Org. Carb.	Retard-ation (R)	V (=K*i/n*R) (ft/day)
1.35E+02	0.0018	0.4	1.7	1.00E-10	5.00E-03	1	0.6075

	-237.5	-190	-142.5	-95	-47.5	0	47.5	95	142.5	190	237.5
Edge Criterion (mg/l) 0.3	0	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
Higest modeled conc. 0.88829	-2	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
	-4	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
SURFACE WATER LOADING GRID	-6	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
Distance to Stream (ft) 400	-8	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
Plume View Width (ft) 475	-10	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
Plume View Depth (ft) 20	-12	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
	-14	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
	-16	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
PENTOX NEEDED	-18	0.166497	0.30432	0.486333	0.679674	0.8307971	0.8882912	0.8307971	0.679674	0.4863328	0.30432	0.166497
	-20	0.083248	0.15216	0.243166	0.339837	0.4153986	0.4441456	0.4153986	0.339837	0.2431664	0.15216	0.083248

Average Groundwater Concentration	0.50535	mg/l
Plume Flow	0.02667 cfs	0.01724 MGD
Mass Loading to Stream	33037.99	mg/day

METHOD FOR ESTIMATNG FLOW, AVERAGE CONCENTRATION AND MASS LOADING TO SURFACE WATER FROM GROUNDWATER

PA DEPARTMENT
OF ENVIRONMENTAL PROTECTION
SWLOAD5B.XLS
A METHOD FOR ESTIMATING
COMTAMINANT LOADING TO SURFACE
WATER
based on
P.A. Domenico (1987)
Modified to Include Retardation

Project:	S-302D / AOI-11														
Date:	9/8/2011														
Contaminant:	Manganese			Prepared by:		TS									
SOURCE															
CONC	Ax	Ay	Az	LAMBDA	SOURCE	SOURCE									
(units)	(ft)	(ft)	(ft)		WIDTH	THICKNESS	Time								
mg/l	>.0001	>.0001	>=.0001	day-1	(ft)	(ft)	(days)								
4.14	200	20	1.00E-04	1.00E-10	100	25	1.00E+99								
Hydraulic	Hydraulic		Soil Bulk		Frac.	Retard-	V								
Cond	Gradient	Porosity	Density	KOC	Org. Carb.	ation	(=K*i/n*R)								
(ft/day)	(ft/ft)	(dec. frac.)	(g/cm^{3})			(R)	(ft/day)								
1.35E+02	0.0009	0.4	1.7	1.00E-10	5.00E-03	1	0.30375								
				-355	-284	-213	-142	-71	0	71	142	213	284	355	
Edge Criterion (mg/l)		0.3	0	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
Higest modeled conc.		0.81729	-2.5	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
			-5	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
SURFACE WATER LOADING GRID			-7.5	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
Distance to Stream (ft)		1000	-10	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
Plume View Width (ft)		710	-12.5	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
Plume View Depth (ft)		25	-15	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
			-17.5	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
			-20	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
PENTOX NEEDED			-22.5	0.174691	0.3044588	0.468984	0.6385141	0.7683771	0.8172881	0.7683771	0.6385141	0.468984	0.304459	0.174691	
			-25	0.087345	0.1522294	0.234492	0.319257	0.3841886	0.4086441	0.3841886	0.319257	0.234492	0.152229	0.087345	
				Average Groundwater Concentration				0.47965	mg/l						
				Plume Flow				0.02492	cfs	0.01611	MGD				
				Mass Loading to Stream			29294.62	mg/day							

Table J.14
Calculated Mass Balance Wasteload Allocation
Manganese at A-21D
Sunoco Refinery
AOI 11 Specific Calculation Using PADEP Specified River Flow
Philadelphia, Pennsylvania

Manganese Wasteload Allocation				
Parameter	**Unit**	**Value**	**Parameter Description**	**Data Source**
C_{gw}[(1)]	ug/l	**8,451.70**	WLA	Calculated
Cx	ug/l	1.00	WQC	PA Chapter 93
Cbsw	ug/l	0.00	Background Concentration	Assumed to be zero
Yc	unitless	1.00	Partial Mixing Factor	Not used, therefore set to a value of 1
Qsw	cfs	24.00	Surface Water Flow	10% of Q7-10 flow per PADEP (240 cfs)
Qgw	cfs	0.00284	Groundwater Flow	Calculated by SWLOAD

NOTES:

(1) Wasteload allocation calculated from equation in ACT 2 Guidance, Section IV, page 20.

Table J.15
Calculated Mass Balance Wasteload Allocation
Manganese at C-144D
Sunoco Refinery
AOI 11 Specific Calculation Using PADEP Specified River Flow
Philadelphia, Pennsylvania

Manganese Wasteload Allocation				
Parameter	**Unit**	**Value**	**Parameter Description**	**Data Source**
C_{gw}[(1)]	ug/l	**900.89**	WLA	Calculated
Cx	ug/l	1.00	WQC	PA Chapter 93
Cbsw	ug/l	0.00	Background Concentration	Assumed to be zero
Yc	unitless	1.00	Partial Mixing Factor	Not used, therefore set to a value of 1
Qsw	cfs	24.00	Surface Water Flow	10% of Q7-10 flow per PADEP (240 cfs)
Qgw	cfs	0.02667	Groundwater Flow	Calculated by SWLOAD

NOTES:

(1) Wasteload allocation calculated from equation in ACT 2 Guidance, Section IV, page 20.

Table J.16
Calculated Mass Balance Wasteload Allocation
Manganese at S-302D
Sunoco Refinery
AOI 11 Specific Calculation Using PADEP Specified River Flow
Philadelphia, Pennsylvania

Manganese Wasteload Allocation				
Parameter	**Unit**	**Value**	**Parameter Description**	**Data Source**
C_{gw}[(1)]	ug/l	**964.08**	WLA	Calculated
Cx	ug/l	1.00	WQC	PA Chapter 93
Cbsw	ug/l	0.00	Background Concentration	Assumed to be zero
Yc	unitless	1.00	Partial Mixing Factor	Not used, therefore set to a value of 1
Qsw	cfs	24.00	Surface Water Flow	10% of Q7-10 flow per PADEP (240 cfs)
Qgw	cfs	0.02492	Groundwater Flow	Calculated by SWLOAD

NOTES:

(1) Wasteload allocation calculated from equation in ACT 2 Guidance, Section IV, page 20.

Appendix J
Table J.17
AOI-11 Fate and Transport QD Results
Sunoco Philadehphia Refinery
Philadelphia, Pennsylvania

Well ID	Compound	Groundwater MSC	QD Starting Concentration	Predicted Distance to Achieve MSC	Distance to Receptor Along Approximate Groundwater Flow Path	Groundwater Plume Predicted to Reach Receptor?	Predicted Concentration at Receptor	Calculated Wasteload Allocation
		ug/l	ug/l	feet	feet		ug/l	ug/l
A-21D	Manganese	300.0	708.0	200.0	10	YES	699.20	8,451.70
C-144D	Manganese	300.0	2,890.0	2,672.0	400	YES	888.30	900.89
C-50D	Manganese	300.0	2,970.0	3,880.0	5000	NO	–	–
N-38D	Manganese	300.0	356.0	31.1	450	NO	–	–
N-44D	Manganese	300.0	605.0	140.0	2100	NO	–	–
N-44D	Arsenic	10.0	62.2	1,530.0	2100	NO	–	–
N-50D	Chrysene	1.9	5.0	7.1	2000	NO	–	–
N-50D	Manganese	300.0	1,000.0	421.0	2000	NO	–	–
S-106D	MTBE	20.0	300.0	504.0	2800	NO	–	–
S-106D	Manganese	300.0	1,030.0	447.0	2800	NO	–	–
S-120D	MTBE	20.0	37.0	69.5	2500	NO	–	–
S-120D	Manganese	300.0	1,720.0	1,285.0	2500	NO	–	–
S-302D	Manganese	300.0	4,140.0	7,550.0	1000	YES	817.30	964.08
S-38D2	Benzene	5.0	110.0	340.0	4500	NO	–	–

NOTES:
Groundwater MSC = ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.
QD = Quick Domenico

APPENDIX K

Deep Groundwater Analytical Trend Plans

N
W E
S

N-4
N-9
N-13
N-38D
N-19
N-21
N-27
N-30
N-44D
N-50D
AOI-8
S-294D
S-72D
S-80D
AOI-2
AOI-1
AOI -10
S-302D
S-305D
S-46D
SCHUYLKILL RIVER
S-59D
S-264
S-280D
S-119D
C-129D
S-284D
AOI-4
AOI-3
S-69D
BF-108
C-50D
AOI-7
S-38D2
S-38D
BF-90D
S-22
S-8
C-134D
AOI-6
B-48D
A-19D
S-76DSRTF
B-134D
B-133D
AOI-9
S-74D1SRTF
S-74D2SRTF
B-132D
AOI-5
A-21D
A-13D
S-120DSRTF
S-106DSRTF

Notes:
1. Bing Maps aerial imagery provided by © 2010 Microsoft Corporation and its data suppliers and obtained under the licensing agreement with ESRI.

PENNSYLVANIA

Approximate Site Location

Legend

Bicarbonate alkalinity (April 2011)

Result ug/L

- 0.0 - 149,000.0
- 149,000.1 - 242,000.0
- 242,000.1 - 364,000.0
- 364,000.1 - 627,000.0
- 627,000.1 - 1,090,000.0

Area of Interest (AOI)

Figure K-1: Groundwater Results For
Bicarbonate Alkalinity - April 2011
AOI-11 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
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SCALE: 1" = 1050'
DATE: September 9, 2011
DRN. BY: MH
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A-13D
S-120DSRTF
S-106DSRTF

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PENNSYLVANIA

Approximate Site Location

Legend

Bicarbonate alkalinity (June/July 2011)

Result ug/L

- 0.0 - 65,800.0
- 65,800.1 - 236,000.0
- 236,000.1 - 354,000.0
- 354,000.1 - 573,000.0
- 573,000.1 - 1,080,000.0

Area of Interest (AOI)

Figure K-2: Groundwater Results For
Bicarbonate Alkalinity - June/July 2011
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Philadelphia, Pennsylvania

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0 525 1,050 2,100
Feet

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PENNSYLVANIA

Approximate Site Location

Legend

Total Dissolved Solids (April 2011)

Result

- 150,000.0 - 275,000.0
- 275,000.1 - 400,000.0
- 400,000.1 - 531,000.0
- 531,000.1 - 818,000.0
- 818,000.1 - 1,140,000.0

Area of Interest (AOI)

Figure K-3: Groundwater Results For Total Dissolved Solids - April 2011

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Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
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Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

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PENNSYLVANIA

Approximate Site Location

Legend

Total Dissolved Solids (June/July 2011)

Result ug/L

- 154,000.0 - 352,000.0
- 352,000.1 - 550,000.0
- 550,000.1 - 801,000.0
- 801,000.1 - 1,160,000.0
- 1,160,000.1 - 7,000,000.0

Area of Interest (AOI)

Figure K-4: Groundwater Results For Total Dissolved Solids - June/July 2011
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Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
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19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
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S-106DSRTF

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PENNSYLVANIA

Approximate Site Location

Legend

Ammonia Nitrogen (April 2011)

Result ug/L

- 0.0 - 1,800.0
- 1,800.1 - 6,700.0
- 6,700.1 - 20,400.0
- 20,400.1 - 44,900.0
- 44,900.1 - 85,100.0

Area of Interest (AOI)

Figure K-5: Groundwater Results For Ammonia Nitrogen - April 2011
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Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
DATE: September 9, 2011
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PENNSYLVANIA

Approximate Site Location

Legend

Ammonia Nitrogen (June/July 2011)

Result ug/L

- 0.0 - 3,300.0
- 3,300.1 - 10,200.0
- 10,200.1 - 20,300.0
- 20,300.1 - 36,900.0
- 36,900.1 - 88,200.0

Area of Interest (AOI)

Figure K-6: Groundwater Results For Ammonia Nitrogen - June/July 2011
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Philadelphia, Pennsylvania

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3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

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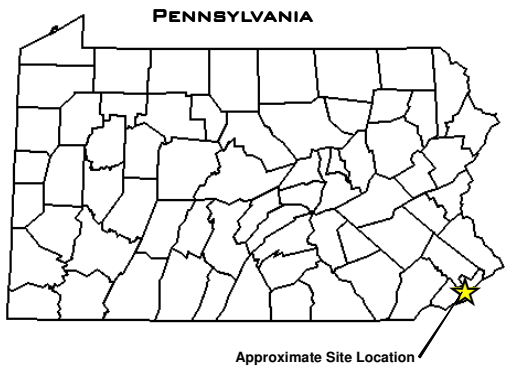

Legend

Sulfide (April 2011)

Result ug/L

- 0.0
- 0.1 - 97.0
- 97.1 - 220.0
- 220.1 - 560.0
- 560.1 - 2,000.0

Area of Interest (AOI)

Figure K-7: Groundwater Results For Sulfide
April 2011
AOI-11 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

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Philadelphia Refinery
3144 Passyunk Avenue
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19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
DATE: September 9, 2011
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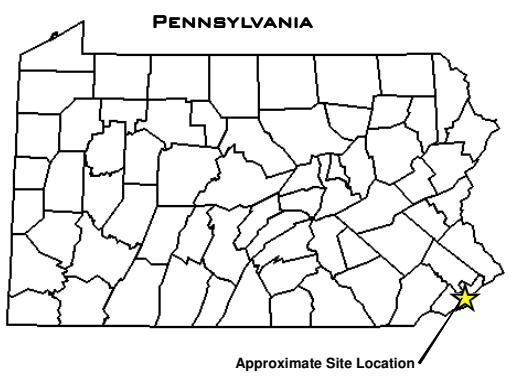

Legend

Area of Interest (AOI)

Sulfide (June/July 2011)

Result ug/L

- 0.0
- 0.1 - 120.0
- 120.1 - 1,100.0
- 1,100.1 - 1,600.0

Figure K-8: Groundwater Results For Sulfide June/July 2011
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Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

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Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
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PENNSYLVANIA

Approximate Site Location

Legend

Chloride (April 2011)

Result ug/L

- 4,100.0 - 28,400.0
- 28,400.1 - 52,600.0
- 52,600.1 - 72,300.0
- 72,300.1 - 108,000.0
- 108,000.1 - 199,000.0

Area of Interest (AOI)

Figure K-9: Groundwater Results For Chloride
April 2011
AOI-11 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
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PENNSYLVANIA

Approximate Site Location

Legend

Chloride (June/July 2011)

Result ug/L

- 3,200.00 - 27,300.00
- 27,300.01 - 51,200.00
- 51,200.01 - 77,700.00
- 77,700.01 - 108,000.00
- 108,000.01 - 212,000.00

Area of Interest (AOI)

Figure K-10: Groundwater Results For Chloride June/July 2011
AOI-11 Site Characterization/ Remedial Investigation Report
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19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
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PENNSYLVANIA

Approximate Site Location

Legend

Flouride (April 2011)

Result ug/L

0.0

0.1 - 500.0

Area of Interest (AOI)

Figure K-11: Groundwater Results For Flouride
April 2011
AOI-11 Site Characterization/
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PENNSYLVANIA

Approximate Site Location

Legend

Flouride (June/July 2011)

Result ug/L

- 0.0
- 0.1 - 580.0
- 580.1 - 630.0
- 630.1 - 910.0
- 910.1 - 1,200.0

Area of Interest (AOI)

Figure K-12: Groundwater Results For Flouride June/July 2011
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Philadelphia, Pennsylvania

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0 525 1,050 2,100
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Approximate Site Location

Legend

Nitrate Nitrogen (April 2011)

Result ug/L

0.0

0.1 - 630.0

Area of Interest (AOI)

Figure K-13: Groundwater Results For Nitrate Nitrogen - April 2011
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Approximate Site Location

Legend

Nitrate Nitrogen (June/July 2011)

Result ug/L

0.0

0.1 - 920.0

Area of Interest (AOI)

Figure K-14: Groundwater Results For Nitrate Nitrogen - June/July 2011
AOI-11 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
DATE: September 9, 2011
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\AOI 11\Misc\General_Chem\Bicarbonate Alkalinity_April 2011_rev1.mxd

N
W E
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N-4
N-9
N-13
N-38D
N-19
N-21
N-27
N-30
N-44D
N-50D
AOI-8
S-294D
S-72D
S-80D
AOI-2
AOI-1
AOI -10
S-302D
S-305D
S-46D
SCHUYLKILL RIVER
S-59D
S-264
S-280D
S-119D
C-129D
S-284D
AOI-4
S-69D
AOI-3
BF-108
C-50D
AOI-7
S-38D2
S-38D
BF-90D
S-22
S-8
C-134D
A-19D
B-48D
AOI-6
S-76DSRTF
B-134D
B-133D
AOI-9
S-74D1SRTF
S-74D2SRTF
B-132D
AOI-5
A-21D
A-13D
S-120DSRTF
S-106DSRTF

Notes:
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PENNSYLVANIA

Approximate Site Location

Legend

Nitrite Nitrogen (April 2011)

Result ug/L

0.0

Area of Interest (AOI)

Figure K-15: Groundwater Results For Nitrite Nitrogen - April 2011
AOI-11 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
DATE: September 9, 2011
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\AOI 11\Misc\General_Chem\Bicarbonate Alkalinity_April 2011_rev1.mxd

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N-4
N-9
N-13
N-38D
N-19
N-21
N-27
N-30
N-44D
N-50D
AOI-8
S-294D
S-72D
S-80D
AOI-2
AOI-1
AOI -10
S-302D
S-305D
S-46D
SCHUYLKILL RIVER
S-59D
S-264
S-280D
S-119D
C-129D
S-284D
AOI-4
C-144D
S-69D
AOI-3
BF-108
C-50D
AOI-7
S-38D2
S-38D
BF-90D
S-22
S-8
C-134D
A-19D
B-48D
AOI-6
S-76DSRTF
B-134D
B-133D
AOI-9
S-74D1SRTF
S-74D2SRTF
B-132D
AOI-5
A-21D
A-13D
S-120DSRTF
S-106DSRTF

Notes:
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PENNSYLVANIA

Approximate Site Location

Legend

Nitrite Nitrogen (June/July 2011)

Result ug/L

0.0

Area of Interest (AOI)

Figure K-16: Groundwater Results For Nitrite Nitrogen - June/July 2011
AOI-11 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
DATE: September 9, 2011
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\AOI 11\Misc\General_Chem\Bicarbonate Alkalinity_April 2011_rev1.mxd

N
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N-4
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N-13
N-38D
N-19
N-21
N-27
N-30
N-44D
N-50D
AOI-8
S-294D
S-72D
S-80D
AOI-2
AOI-1
AOI -10
S-302D
S-305D
S-46D
SCHUYLKILL RIVER
S-59D
S-264
S-280D
S-119D
C-129D
S-284D
AOI-4
AOI-3
S-69D
BF-108
C-50D
AOI-7
S-38D2
S-38D
BF-90D
S-22
S-8
C-134D
AOI-6
B-48D
A-19D
S-76DSRTF
B-134D
B-133D
AOI-9
S-74D1SRTF
S-74D2SRTF
B-132D
AOI-5
A-21D
A-13D
S-120DSRTF
S-106DSRTF

Notes:
1. Bing Maps aerial imagery provided by © 2010 Microsoft Corporation and its data suppliers and obtained under the licensing agreement with ESRI.

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Approximate Site Location

Legend

Sulfate (April 2011)

Result ug/L

- 0.0 - 21,400.0
- 21,400.1 - 89,000.0
- 89,000.1 - 176,000.0
- 176,000.1 - 331,000.0
- 331,000.1 - 703,000.0

Area of Interest (AOI)

Figure K-17: Groundwater Results For Sulfate
April 2011
AOI-11 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
DATE: September 9, 2011
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\AOI 11\Misc\General_Chem\Bicarbonate Alkalinity_April 2011_rev1.mxd

N
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N-4
N-9
N-13
N-38D
N-19
N-21
N-27
N-30
N-44D
N-50D
AOI-8
S-294D
S-72D
S-80D
AOI-2
AOI-1
AOI -10
S-302D
S-305D
S-46D
SCHUYLKILL RIVER
S-59D
S-264
S-280D
S-119D
C-129D
S-284D
AOI-4
C-144D
S-69D
AOI-3
BF-108
C-50D
AOI-7
S-38D2
S-38D
BF-90D
S-22
S-8
C-134D
B-48D
A-19D
AOI-6
S-76DSRTF
B-134D
B-133D
AOI-9
S-74D1SRTF
S-74D2SRTF
B-132D
AOI-5
A-21D
A-13D
S-120DSRTF
S-106DSRTF

Notes:
1. Bing Maps aerial imagery provided by © 2010 Microsoft Corporation and its data suppliers and obtained under the licensing agreement with ESRI.

PENNSYLVANIA

Approximate Site Location

Legend

Sulfate (June/July 2011)

Result ug/L

- 0.0 - 33,200.0
- 33,200.1 - 130,000.0
- 130,000.1 - 216,000.0
- 216,000.1 - 508,000.0
- 508,000.1 - 5,400,000.0

Area of Interest (AOI)

Figure K-18: Groundwater Results For Sulfate June/July 2011
AOI-11 Site Characterization/ Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
DATE: September 9, 2011
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\AOI 11\Misc\General_Chem\Bicarbonate Alkalinity_April 2011_rev1.mxd

N
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N-4
N-9
N-13
N-38D
N-19
N-21
N-27
N-30
N-44D
N-50D
AOI-8
S-294D
S-72D
S-80D
AOI-2
AOI-1
AOI -10
S-302D
S-305D
S-46D
SCHUYLKILL RIVER
S-59D
S-264
S-280D
S-119D
C-129D
S-284D
AOI-4
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S-69D
BF-108
C-50D
AOI-7
S-38D2
S-38D
BF-90D
S-22
S-8
C-134D
AOI-6
B-48D
A-19D
S-76DSRTF
B-134D
B-133D
AOI-9
S-74D1SRTF
S-74D2SRTF
B-132D
AOI-5
A-21D
A-13D
S-120DSRTF
S-106DSRTF

Notes:
1. Bing Maps aerial imagery provided by © 2010 Microsoft Corporation and its data suppliers and obtained under the licensing agreement with ESRI.

PENNSYLVANIA

Approximate Site Location

Legend

Total Organic Carbon (April 2011)

Result ug/L

- 0.0 - 2,600.0
- 2,600.1 - 5,500.0
- 5,500.1 - 12,000.0
- 12,000.1 - 23,400.0
- 23,400.1 - 49,400.0

Area of Interest (AOI)

Figure K-19: Groundwater Results For Total Organic Carbon - April 2011
AOI-11 Site Characterization/ Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
DATE: September 9, 2011
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\AOI 11\Misc\General_Chem\Bicarbonate Alkalinity_April 2011_rev1.mxd

N
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N-13
N-38D
N-19
N-21
N-27
N-30
N-44D
N-50D
AOI-8
AOI -10
SCHUYLKILL RIVER
S-294D
S-72D
S-80D
AOI-2
AOI-1
S-302D
S-305D
S-46D
S-59D
S-264
S-280D
S-119D
C-129D
S-284D
AOI-4
C-144D
S-69D
AOI-3
BF-108
C-50D
AOI-7
S-38D2
S-38D
BF-90D
S-22
S-8
C-134D
B-48D
A-19D
AOI-6
S-76DSRTF
B-134D
B-133D
AOI-9
S-74D1SRTF
S-74D2SRTF
B-132D
AOI-5
A-21D
A-13D
S-120DSRTF
S-106DSRTF

Notes:
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PENNSYLVANIA

Approximate Site Location

Legend

Total Organic Carbon (June/July 2011)

Result ug/L

- 0.0 - 2,600.0
- 2,600.1 - 5,500.0
- 5,500.1 - 12,000.0
- 12,000.1 - 23,400.0
- 23,400.1 - 49,400.0

Area of Interest (AOI)

Figure K-20: Groundwater Results For Total Organic Carbon - June/July 2011
AOI-11 Site Characterization/
Remedial Investigation Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

0 525 1,050 2,100
Feet

SCALE: 1" = 1050'
DATE: September 9, 2011
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601

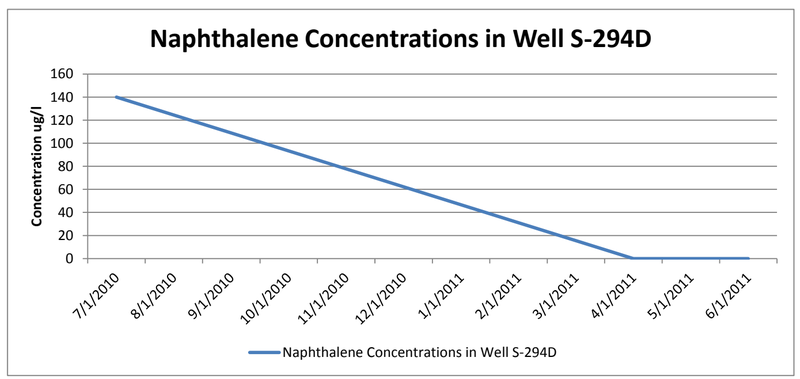
Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\AOI 11\Misc\General_Chem\Bicarbonate Alkalinity_April 2011_rev1.mxd

Appendix K
AOI 11 Deep Groundwater Trend Graphs
Sunoco Philadelphia Refinery
Philadelphia, PA

Chemical Name	Cas No	PADEP Non-Residential Used Aquifer MSC for Groundwater TDS<2,500		S-294D												BF-108											
			AOI	2			2				2					3			3				3				
			Sample ID	S-294D_072310			S-294D_04062011				S-294D_06282011					BF-108_072210			BF-108_04072011				BF-108_07052011				
			Sample Date	7/23/2010			4/6/2011				6/28/2011					7/22/2010			4/7/2011				7/5/2011				
			Sample Matrix	Groundwater			Groundwater				Groundwater					Groundwater			Groundwater				Groundwater				
			Unit	ug/l			ug/l				ug/l					ug/l			ug/l				ug/l				
Volatile Organic Compounds				**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**DF**	**Result**	**Q**	**RL**	**DF**		**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**DF**	**Result**	**Q**	**RL**	**DF**	
Benzene	71-43-2	5	ug/l	ND	U	1	ND	U	0.5	1	ND	U	0.5	1		ND	U	1	ND	U	0.5	1	ND	U	0.5	1	
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/l	ND	U	1	0.8	J	0.5	1	0.8	J	0.5	1		**120**	-	1	**55**	-	0.5	1	ND	U	0.5	1	

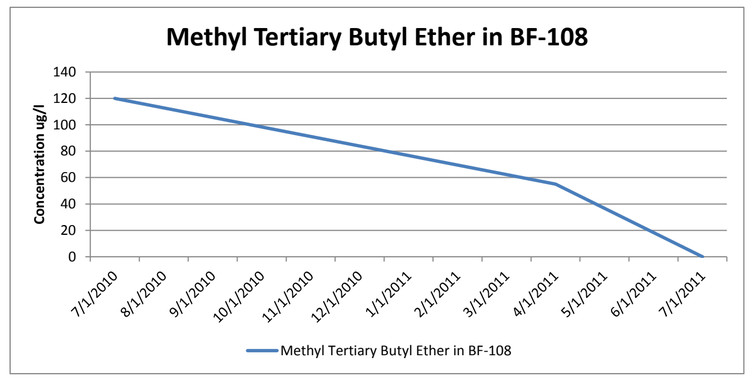
Naphthalene Concentrations in Well S-294D

Date	Result
7/23/2010	140
4/6/2011	0
6/28/2011	0



Methyl Tertiary Butyl Ether in BF-108

Date	Result
7/22/2010	120
4/7/2011	55
7/5/2011	0

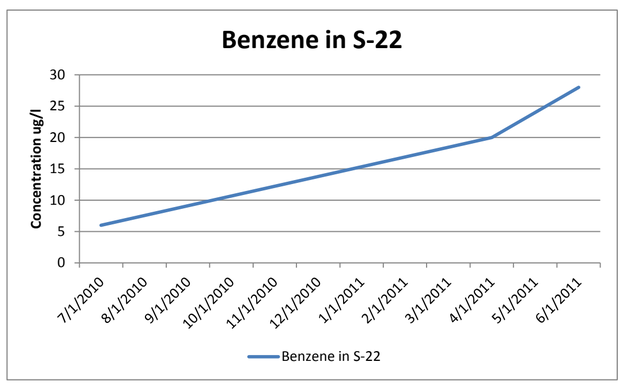


Appendix K
AOI 11 Deep Groundwater Trend Graphs
Sunoco Philadelphia Refinery
Philadelphia, PA

S-22											N-4									
3			3				3				8			8				8		
S-22_071610			S-22_04072011				S-22_06292011				N-4			N-4_04062011				N-4_06272011		
7/16/2010			4/7/2011				6/29/2011				7/15/2008			4/6/2011				6/27/2011		
Groundwater			Groundwater				Groundwater				Groundwater			Groundwater				Groundwater		
ug/l			ug/l				ug/l				ug/l			ug/l				ug/l		
Result	Q	RL	Result	Q	RL	DF	Result	Q	RL	DF	Result	Q	RL	Result	Q	RL	DF	Result	Q	RL	DF
6	-	1	20	-	0.5	1	28	-	3	5	5	-	1	2	-	0.5	1	ND	U	0.5	1
48	-	1	75	-	0.5	1	49	-	3	5	2	-	1	2	-	0.5	1	2	-	0.5	1

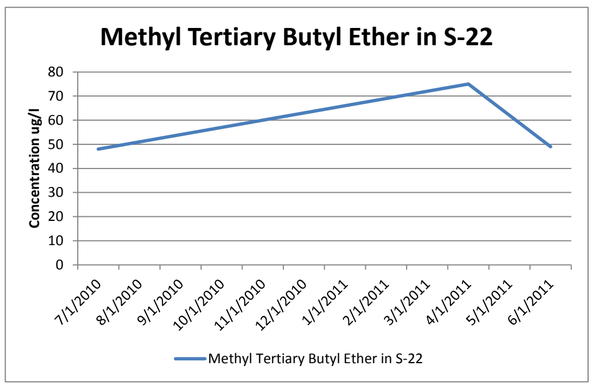
Benzene in S-22

Date	Result
7/16/2010	6
4/7/2011	20
6/29/2011	28



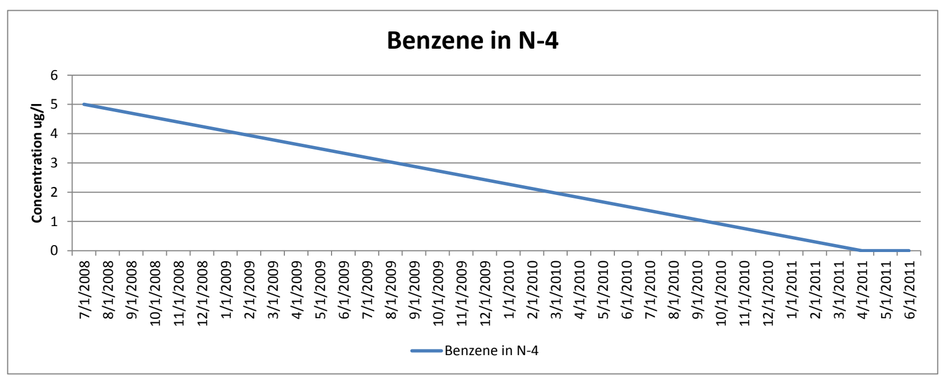
Methyl Tertiary Butyl Ether in S-22

Date	Result
7/16/2010	48
4/7/2011	75
6/29/2011	49



Benzene in N-4

Date	Result
7/15/2008	5
4/6/2011	0
6/27/2011	0



Appendix K
AOI 11 Deep Groundwater Trend Graphs
Sunoco Philadelphia Refinery
Philadelphia, PA

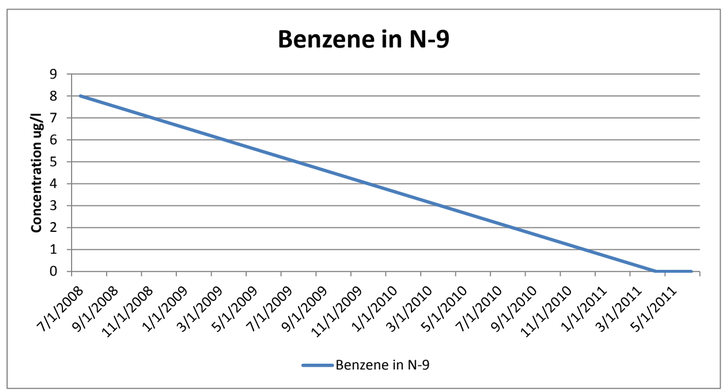
N-9										
8			8				8			
N-9			N-9_4-5-11				N-9_06272011			
7/16/2008			4/5/2011				6/27/2011			
Groundwater			Groundwater				Groundwater			
ug/l			ug/l				ug/l			
Result	Q	RL	Result	Q	RL	DF	Result	Q	RL	DF
8	-	1	ND	U	0.5	1	ND	U	0.5	1
ND	U	1	ND	U	0.5	1	ND	U	0.5	1

N-21										
8			8				8			
N-21			N-21_04062011				N-21_06292011			
7/23/2008			4/6/2011				6/29/2011			
Groundwater			Groundwater				Groundwater			
ug/l			ug/l				ug/l			
Result	Q	RL	Result	Q	RL	DF	Result	Q	RL	DF
16	-	1	20	-	0.5	1	110	-	1	1
ND	U	1	0.6	J	0.5	1	ND	U	1	1

N-44D										
8			8				8			
N-44D			N-44D_4-5-11				N-44D_06282011			
7/25/2008			4/5/2011				6/28/2011			
Groundwater			Groundwater				Groundwater			
ug/l			ug/l				ug/l			
Result	Q	RL	Result	Q	RL	DF	Result	Q	RL	DF
6	-	1	10	-	0.5	1	7	-	0.5	1
ND	U	1	ND	U	0.5	1	ND	U	0.5	1

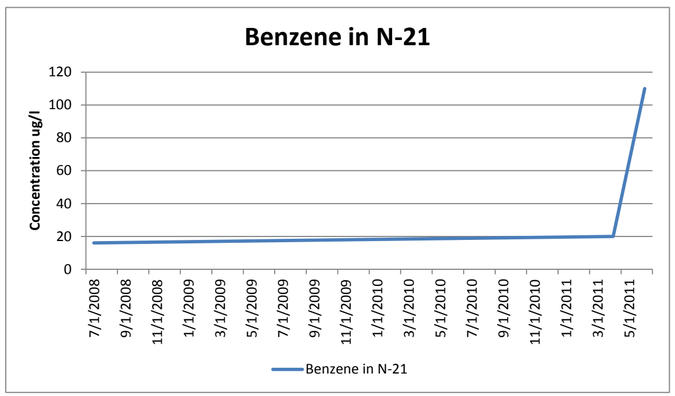
Benzene in N-9

Date	Result
7/16/2008	8
4/5/2011	0
6/27/2011	0



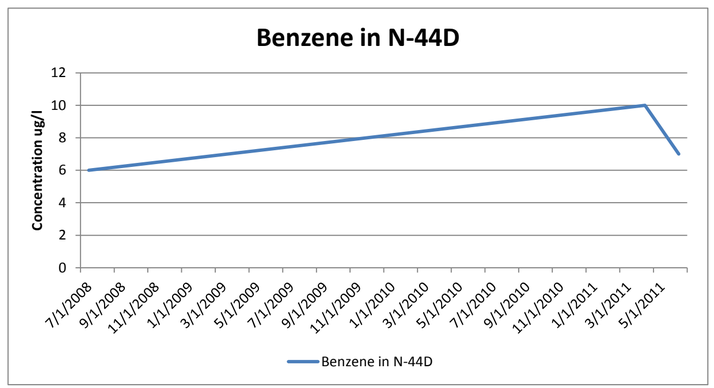
Benzene in N-21

Date	Result
7/23/2008	16
4/6/2011	20
6/29/2011	110



Benzene in N-44D

Date	Result
7/25/2008	6
4/5/2011	10
6/28/2011	7

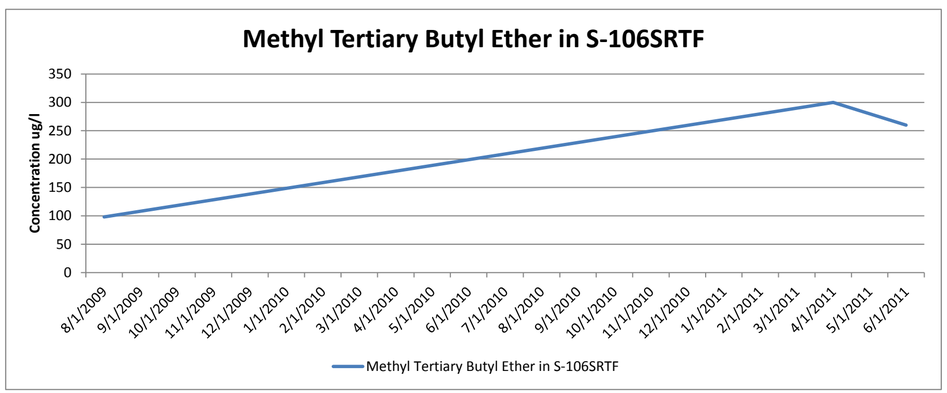


Appendix K
AOI 11 Deep Groundwater Trend Graphs
Sunoco Philadelphia Refinery
Philadelphia, PA

S-106D SRTF										
9			9				9			
S-106D SRTF			S-106DSRTF_04082011				S-106DSRTF_06302011			
8/12/2009			4/8/2011				6/30/2011			
Groundwater			Groundwater				Groundwater			
ug/l			ug/l				ug/l			
Result	Q	RL	Result	Q	RL	DF	Result	Q	RL	DF
ND	U	1	ND	U	0.5	1	ND	U	0.5	1
98	-	1	**300**	-	0.5	1	**260**	-	0.5	1

Methyl Tertiary Butyl Ether in S-106SRTF

Date	Result
8/12/2009	98
4/8/2011	300
6/30/2011	260



S-120D SRTF										
9			9				9			
S-120D SRTF			S-120DSRTF_04082011				S-120DSRTF_06302011			
8/12/2009			4/8/2011				6/30/2011			
Groundwater			Groundwater				Groundwater			
ug/l			ug/l				ug/l			
Result	Q	RL	Result	Q	RL	DF	Result	Q	RL	DF
ND	U	1	0.7	J	0.5	1	0.6	J	0.5	1
21	-	1	**37**	-	0.5	1	**30**	-	0.5	1

Methyl Tertiary Butyl Ether in S-120DSRTF

Date	Result
8/12/2009	21
4/8/2011	37
6/30/2011	30