VOLUME III OF IV
APPENDICES C THROUGH K

TECHNICAL REPORT

NON-AQUEOUS PHASE LIQUID (NAPL) SOURCE STUDY AT DEFENSE SUPPLY CENTER PHILADELPHIA PHILADELPHIA, PENNSYLVANIA

Prepared For

SUNOCO

Prepared By

INTEGRATED
SCIENCE &
TECHNOLOGY, INC.

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MARCH 1998

INTEGRATED SCIENCE & TECHNOLOGY, INC.

HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-201 IN
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 19.87
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 29-Aug-97

User: P. Hildebrandt
Date: 10-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 20.13
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 14.13
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.0004
ln(Re/rw): 0.91

From semilog plot

Yo: 1.25 feet
Yt: 0.1 feet
t: 6800 sec

K(hydraulic conductivity)= 1.12E+00 ft/day
1.29E-05 ft/sec
= 3.95E-04 cm/sec

******************* ********* ********* ******

Equations

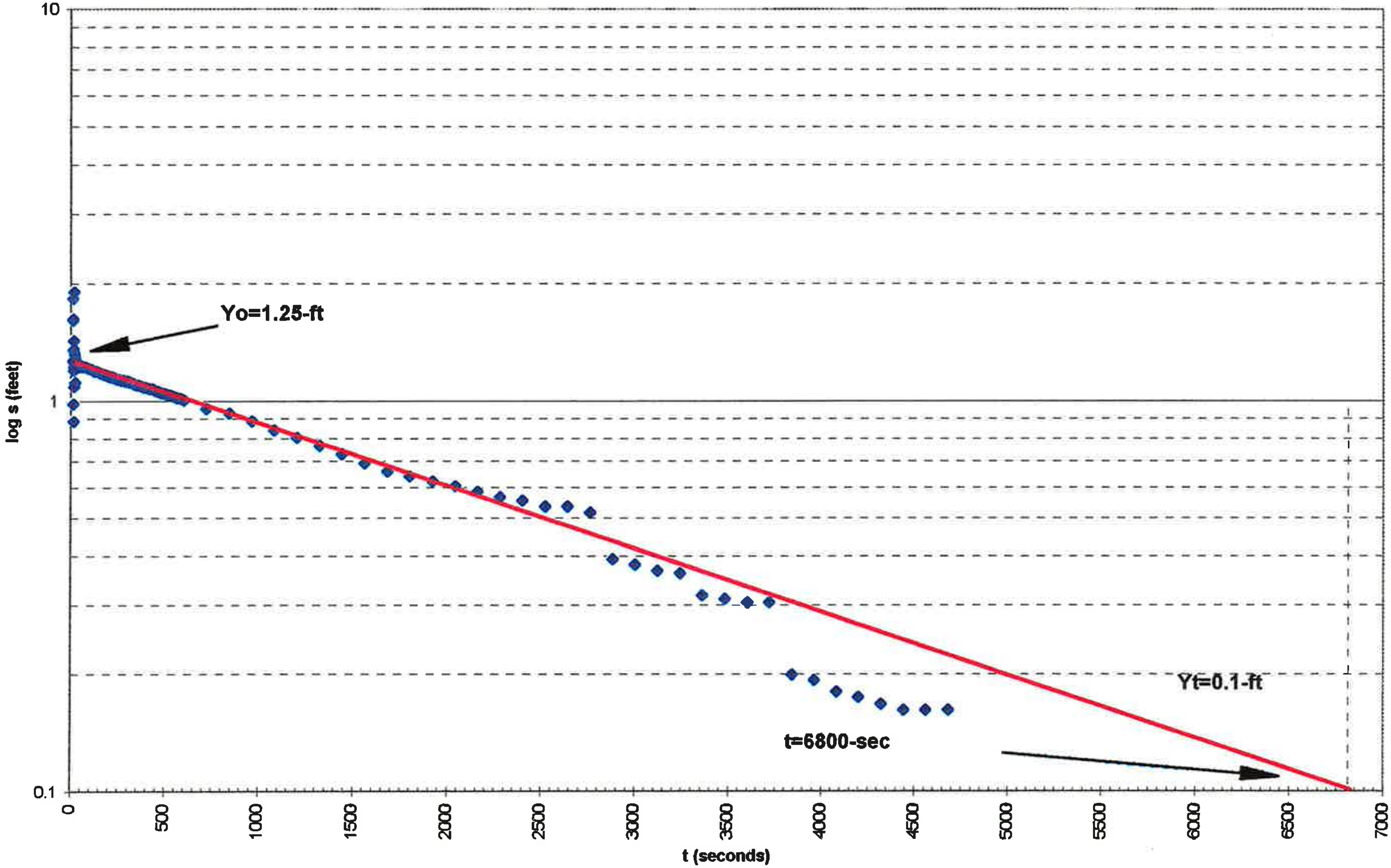
$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}\ \text{(Partially penetrating well)}$$

$$K = [r_c{}^{2[}\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_0/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

SUN COMPANY, INC
PHILADELPHIA POINT BREEZE REFINERY

TW-201
INSTANTANEOUS ADDITION



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-202a IN
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 15.31
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 2-Sep-97

User: P. Hildebrandt
Date: 10-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 24.69
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 7.45
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0
Corrected rc (in): 4.6904

Slope: 0.0001
ln(Re/rw): 0.78

From semilog plot

Yo: 1.27 feet
Yt: 0.1 feet
t: 37500 sec

K(hydraulic conductivity) = 1.75E-01 ft/day
2.03E-06 ft/sec
= 6.18E-05 cm/sec

****************** ********* ********* ******

Equations

$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

$$K = [r_c^{2}[\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_O/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

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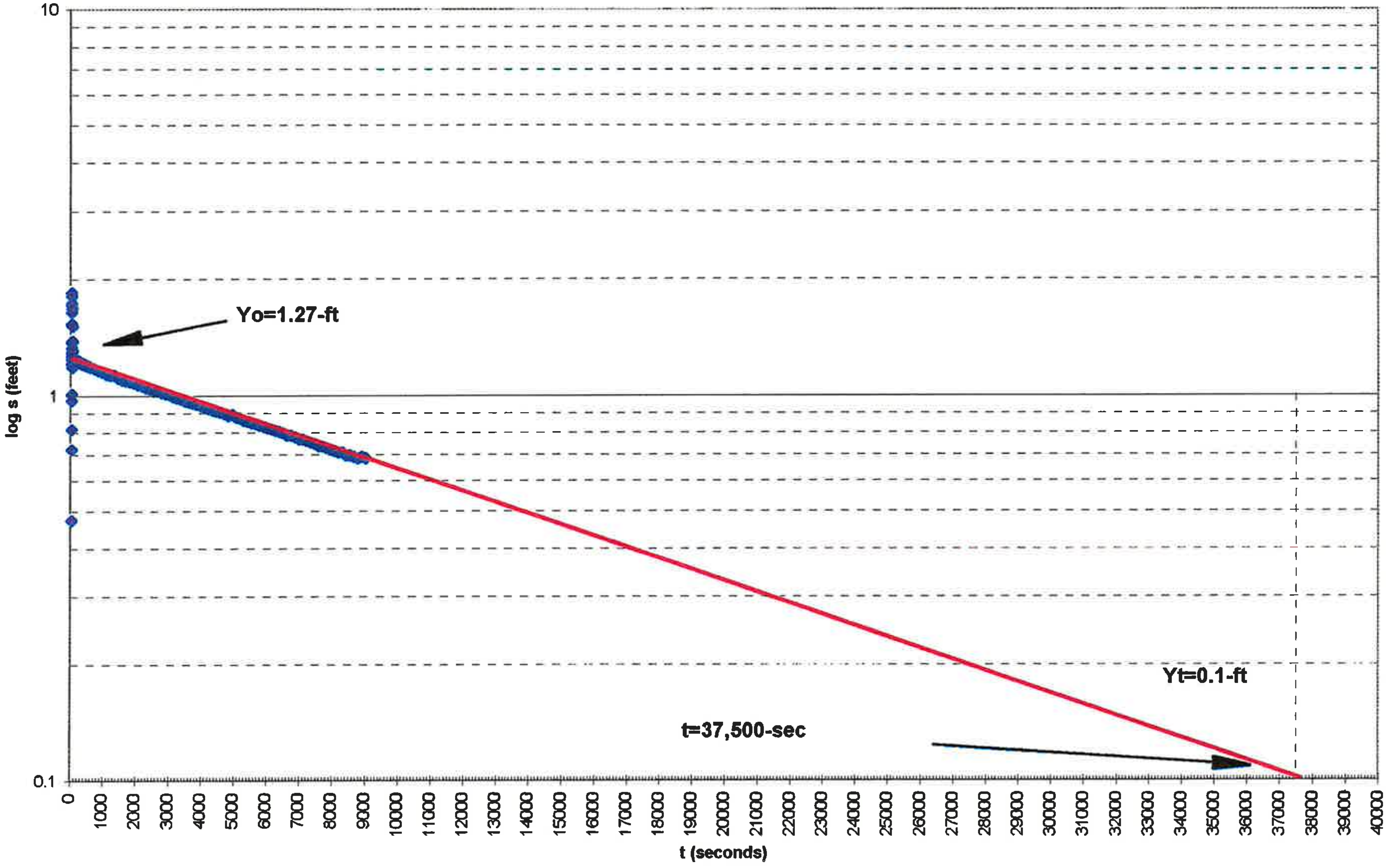
PHILADELPHIA POINT BREEZE REFINERY

TW-202
INSTANTANEOUS ADDITION



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-202c IN
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 13.70
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 29-Aug-97

User: P. Hildebrandt
Date: 10-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 26.30
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 23.30
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.0020
ln(Re/rw): 1.01

From semilog plot

Yo:	1.3	feet
Yt:	0.1	feet
t:	1272	sec

	6.72E+00	ft/day
K(hydraulic conductivity)=	7.78E-05	ft/sec
=	2.37E-03	cm/sec

****************** ********* ********* ******

Equations

$$\ln (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

$$K = [r_c{}^{2[}\ln(R_e/r_w)]/2L_e] [1/t] [\ln(y_o/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

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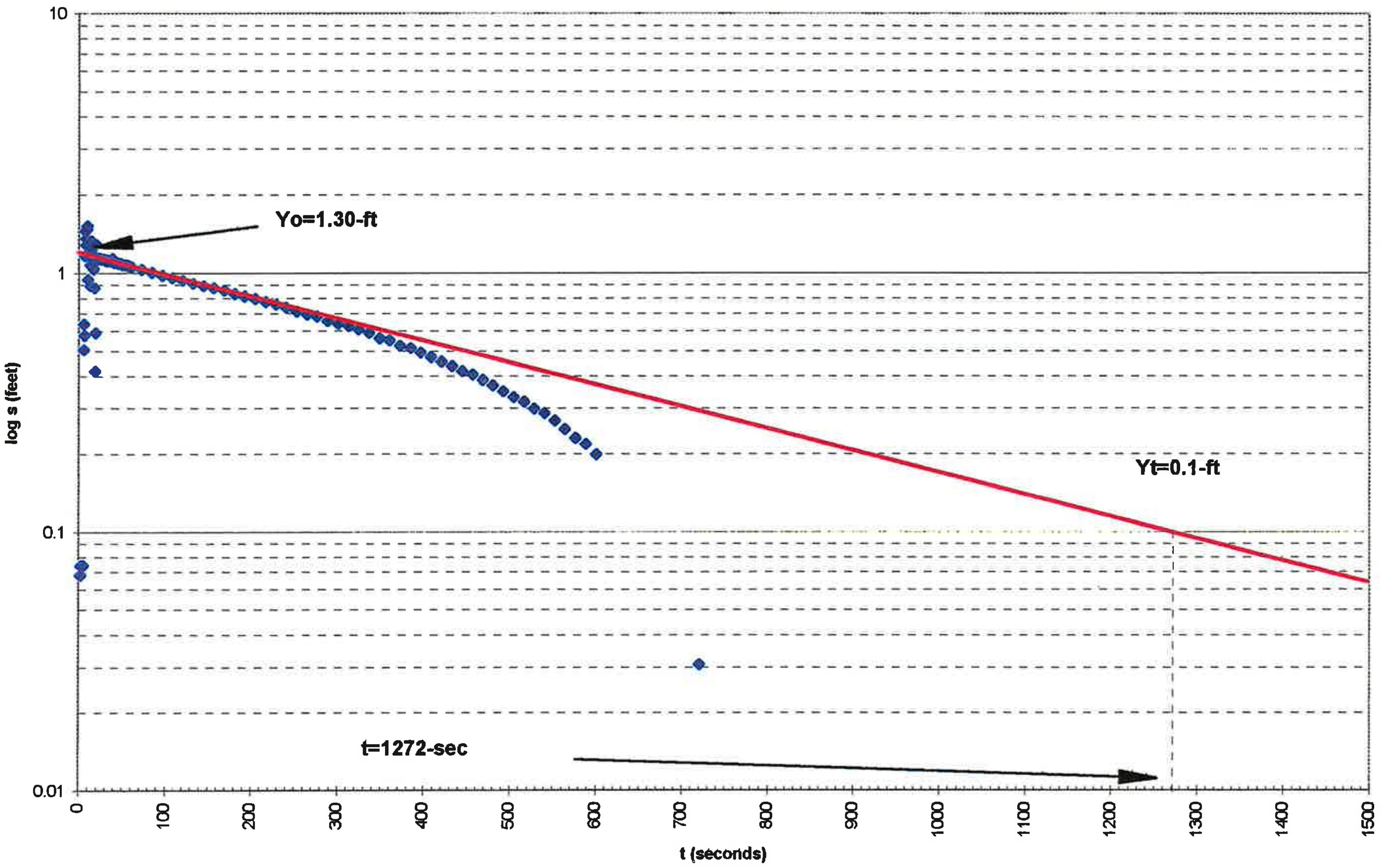
PHILADELPHIA POINT BREEZE REFINERY

TW-202
INSTANTANEOUS ADDITION



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-205
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 21.36
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 2-Sep-97

User: P. Hildebrandt
Date: 10-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 18.64
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 11.64
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.0001
ln(Re/rw): 0.88

From semilog plot

Yo: 1.01 feet
Yt: 0.1 feet
t: 25000 sec

K(hydraulic conductivity) = 2.69E-01 ft/day
3.12E-06 ft/sec
= 9.51E-05 cm/sec

****************** ********* ********* ******

Equations

$$\ln \; (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1} \quad \text{(Partially penetrating well)}$$

$$K = [r_c^{2[}\ln(R_e/r_w)]/2L_e] \; [1/t] \; [\ln(y_0/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

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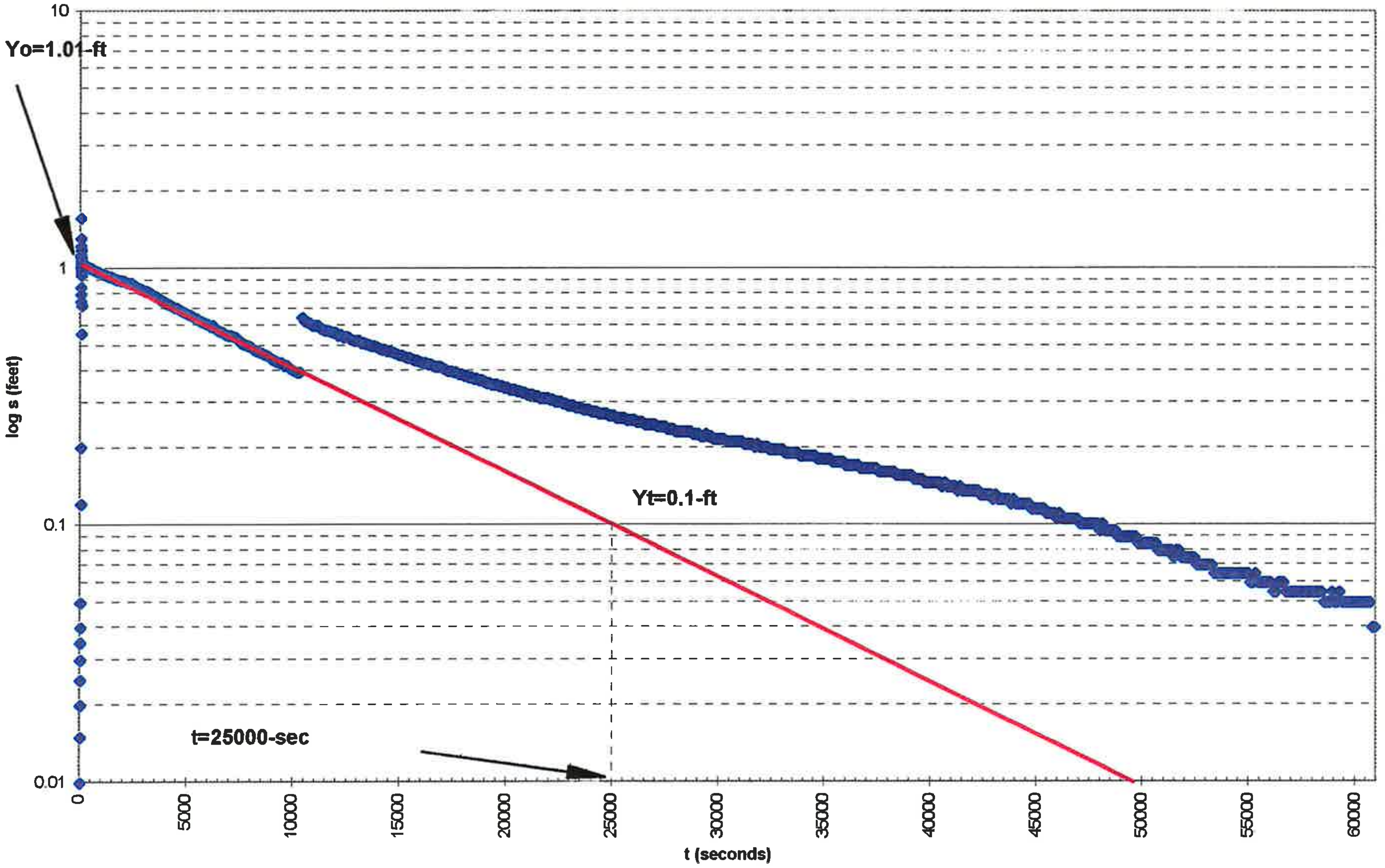
PHILADELPHIA POINT BREEZE REFINERY

TW-205
INSTANTANEOUS ADDITION



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-211 IN
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 22.87
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 4-Sep-97

User: P. Hildebrandt
Date: 10-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 17.13
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 6.13
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

From semilog plot

Yo: 0.93 feet
Yt: 0.1 feet
t: 4340 sec

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.0005
ln(Re/rw): 0.78

	1.32E+00	ft/day
K(hydraulic conductivity)=	1.53E-05	ft/sec
=	4.67E-04	cm/sec

****************** ********* ********* ******

Equations

$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

$$K\ =\ [r_c^{2}[\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_0/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

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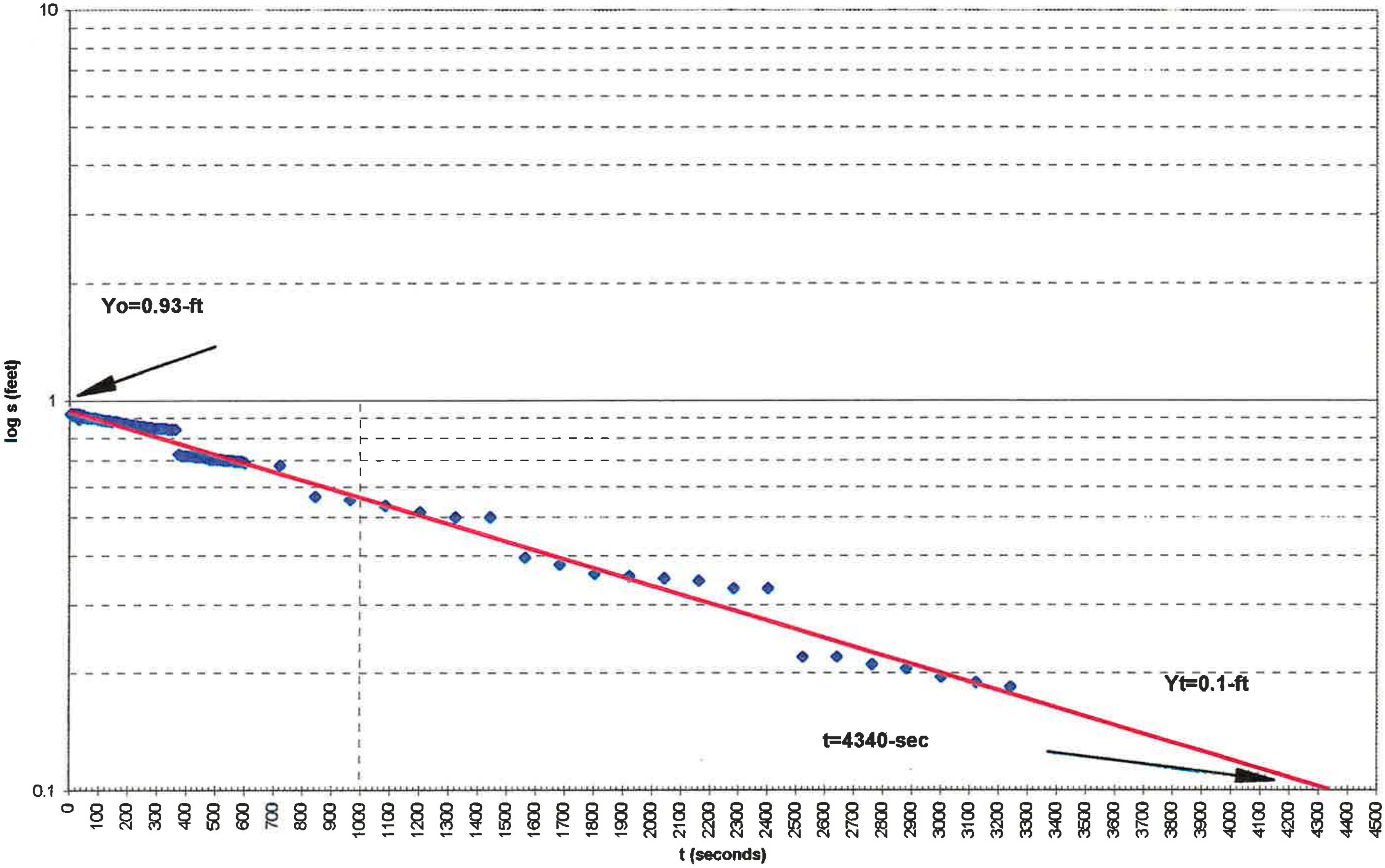
PHILADELPHIA POINT BREEZE REFINERY

TW-211
INSTANTANEOUS ADDITION



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-212 IN
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 21.72
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 3-Sep-97

User: P. Hildebrandt
Date: 10-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 18.28
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 7.45
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.0021
ln(Re/rw): 0.81

From semilog plot

Yo: 0.85 feet
Yt: 0.1 feet
t: 1020 sec

K(hydraulic conductivity)= 5.59E+00 ft/day
6.47E-05 ft/sec
= 1.97E-03 cm/sec

****************** ********* ********* ******

Equations

$\ln (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$ (Partially penetrating well)

$K = [r_c^{2[}\ln(R_e/r_w)]/2L_e] [1/t] [\ln(y_0/y_t)]$

(Bouwer and Rice 1976, Bouwer 1989)

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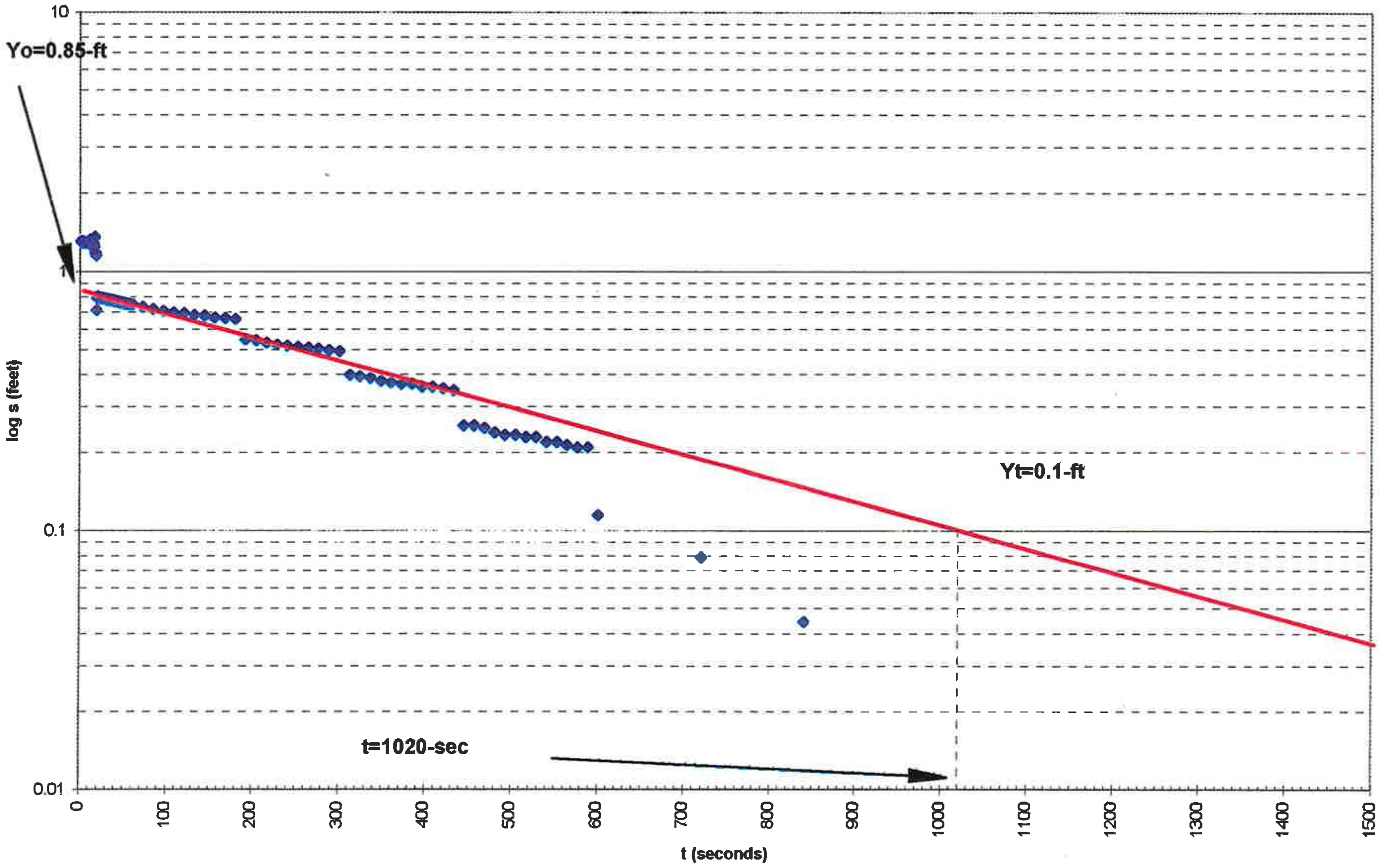
PHILADELPHIA POINT BREEZE REFINERY

TW-212
INSTANTANEOUS ADDITION



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-214 IN
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 21.92
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 28-Aug-97

User: P. Hildebrandt
Date: 8-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 18.08
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 3.08
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.0115
ln(Re/rw): 0.65

From semilog plot

Yo: 0.8 feet
Yt: 0.1 feet
t: 181 sec

K(hydraulic conductivity) = 2.48E+01 ft/day
2.87E-04 ft/sec
= 8.75E-03 cm/sec

****************** ********* ********* ******

Equations

$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

$$K = [r_c^{2[}\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_o/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

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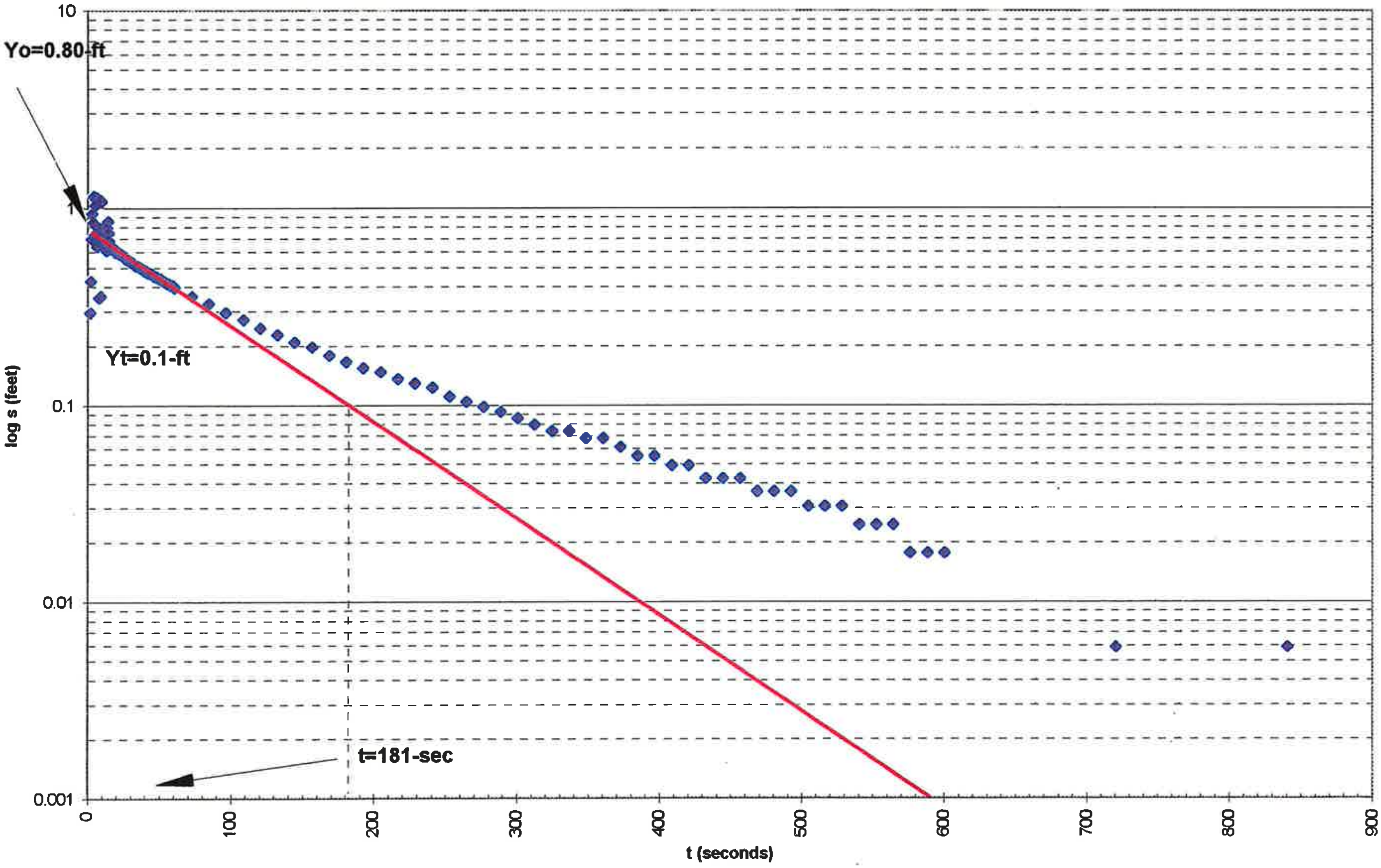
PHILADELPHIA POINT BREEZE REFINERY

TW-214
INSTANTANEOUS ADDITION



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-214 OUT

Project name: Sun Philadelphia Re

Project number: SU001E

Initial water table depth: 21.92

Water level at start of test: 0

(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt

Field work date: 28-Aug-97

User: P. Hildebrandt

Date: 8-Sep-97

User entered parameters		Calculated parameters	
H - Aquifer Thickness (ft):	18.08	Le/rw - for reading A & B from chart:	3.0
Le - Screen Length (ft):	2		
Lw - Screen Base to Water Table (ft):	3.08	Corrected rc (in):	4.6904
rw - Boring Radius (in):	8		
rc - Well Radius (in):	2		
A - dimensionless parameter from chart:	1.68		
B - dimensionless parameter from chart:	0.24	Slope:	0.0107
		ln(Re/rw):	0.65
n - porosity of sand pack:	0.3		

From semilog plot

Yo:	1.16	feet
Yt:	0.1	feet
t:	230	sec

K(hydraulic conductivity) = 2.30E+01 ft/day
= 2.66E-04 ft/sec
= 8.12E-03 cm/sec

****************** ********* ********* ******

Equations

$$\ln (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

$$K = [r_c^{2[}\ln(R_e/r_w)]/2L_e] [1/t] [\ln(y_o/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

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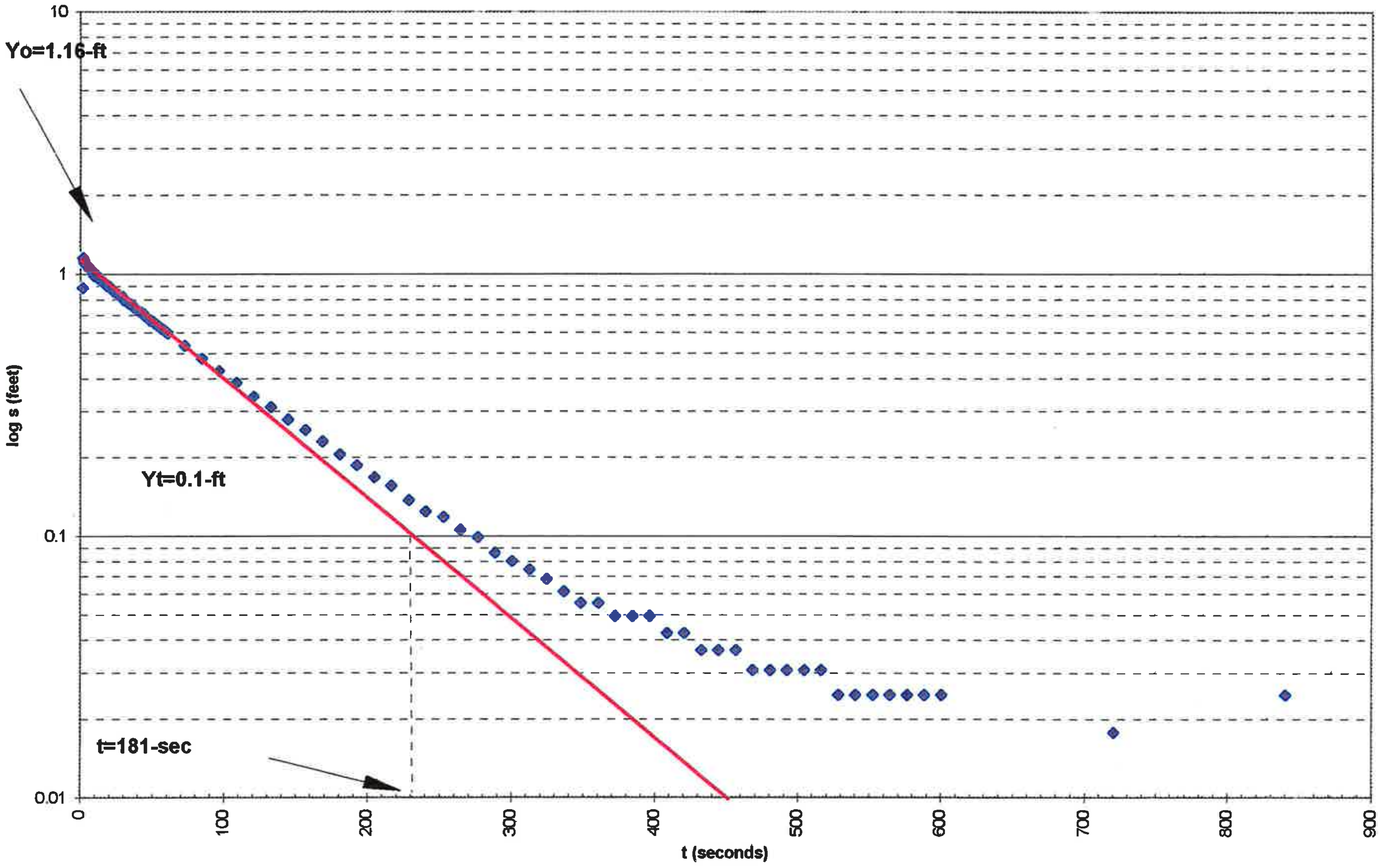
PHILADELPHIA POINT BREEZE REFINERY

TW-214
INSTANTANEOUS REMOVAL



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-215 In
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 23.33
Water level at start of test: 38.75
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 27-Aug-97

User: P. Hildebrandt
Date: 5-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 16.67
Le - Screen Length (ft): 3
Lw - Screen Base to Water Table (ft): 14.67
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.7
B - dimensionless parameter from chart: 0.25

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 4.5

Corrected rc (in): 4.6904

Slope: 0.0028
ln(Re/rw): 1.26

From semilog plot

Yo: 0.74 feet
Yt: 0.1 feet
t: 710 sec

	7.80E+00	ft/day
K(hydraulic conductivity) =	9.03E-05	ft/sec
=	2.75E-03	cm/sec

****************** ********* ********* ******

Equations

$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

$$K = [r_c^{2[}\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_O/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

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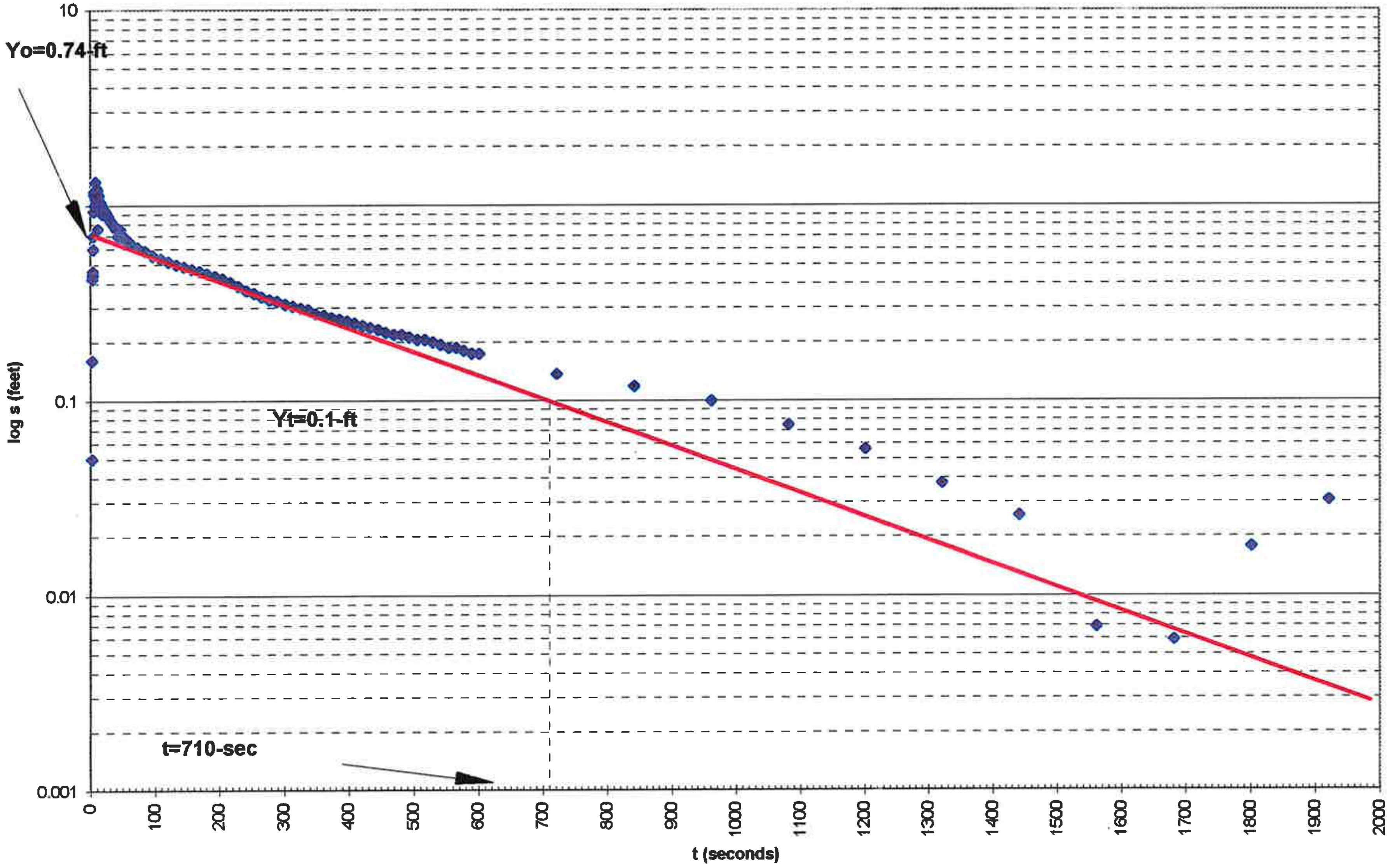
PHILADELPHIA POINT BREEZE REFINERY

TW-215
INSTANTANEOUS ADDITION



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-215 Out
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 23.38
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 28-Aug-97

User: P. Hildebrandt
Date: 5-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 16.62
Le - Screen Length (ft): 3
Lw - Screen Base to Water Table (ft): 14.62
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.7
B - dimensionless parameter from chart: 0.25

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 4.5

Corrected rc (in): 4.6904

Slope: 0.0011
ln(Re/rw): 1.26

From semilog plot

Yo: 0.913 feet
Yt: 0.1 feet
t: 2045 sec

K(hydraulic conductivity)= 2.99E+00 ft/day
3.46E-05 ft/sec
= 1.06E-03 cm/sec

****************** ********* ********* ******

Equations

$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

$$K = [r_c^{2[}\ln(R_e/r_w)]/2L_e] [1/t] [\ln(y_0/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

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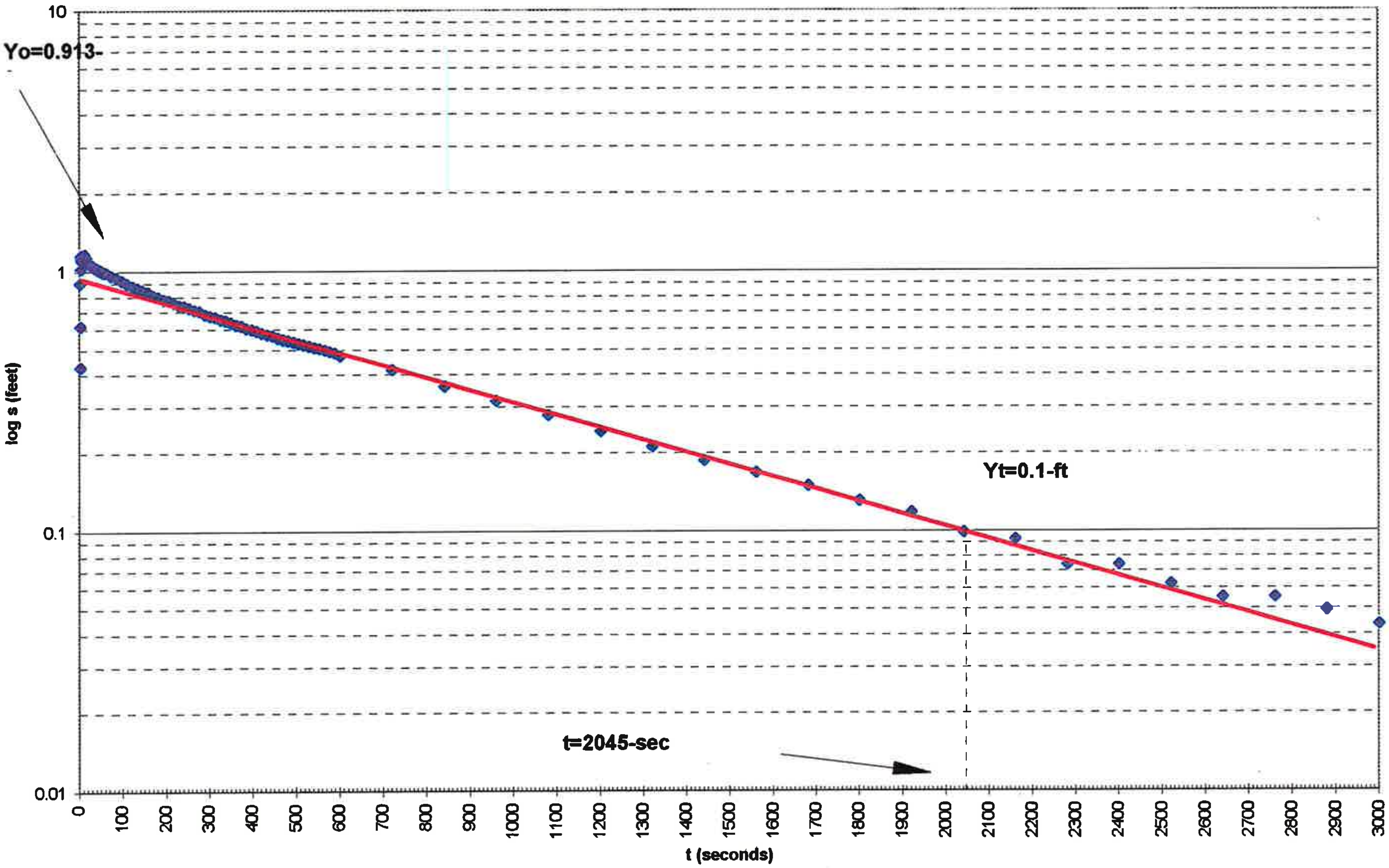
PHILADELPHIA POINT BREEZE REFINERY

TW-215
INSTANTANEOUS REMOVAL



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-216 IN
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 19.13
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 29-Aug-97

User: P. Hildebrandt
Date: 10-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 20.87
Le - Screen Length (ft): 3
Lw - Screen Base to Water Table (ft): 7.45
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.7
B - dimensionless parameter from chart: 0.25

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 4.5

Corrected rc (in): 4.6904

Slope: 0.0104
ln(Re/rw): 1.00

From semilog plot

Yo:	1.402	feet
Yt:	0.1	feet
t:	255	sec

K(hydraulic conductivity) = 2.28E+01 ft/day
2.64E-04 ft/sec
= 8.03E-03 cm/sec
****************** ********* ********* ******

Equations

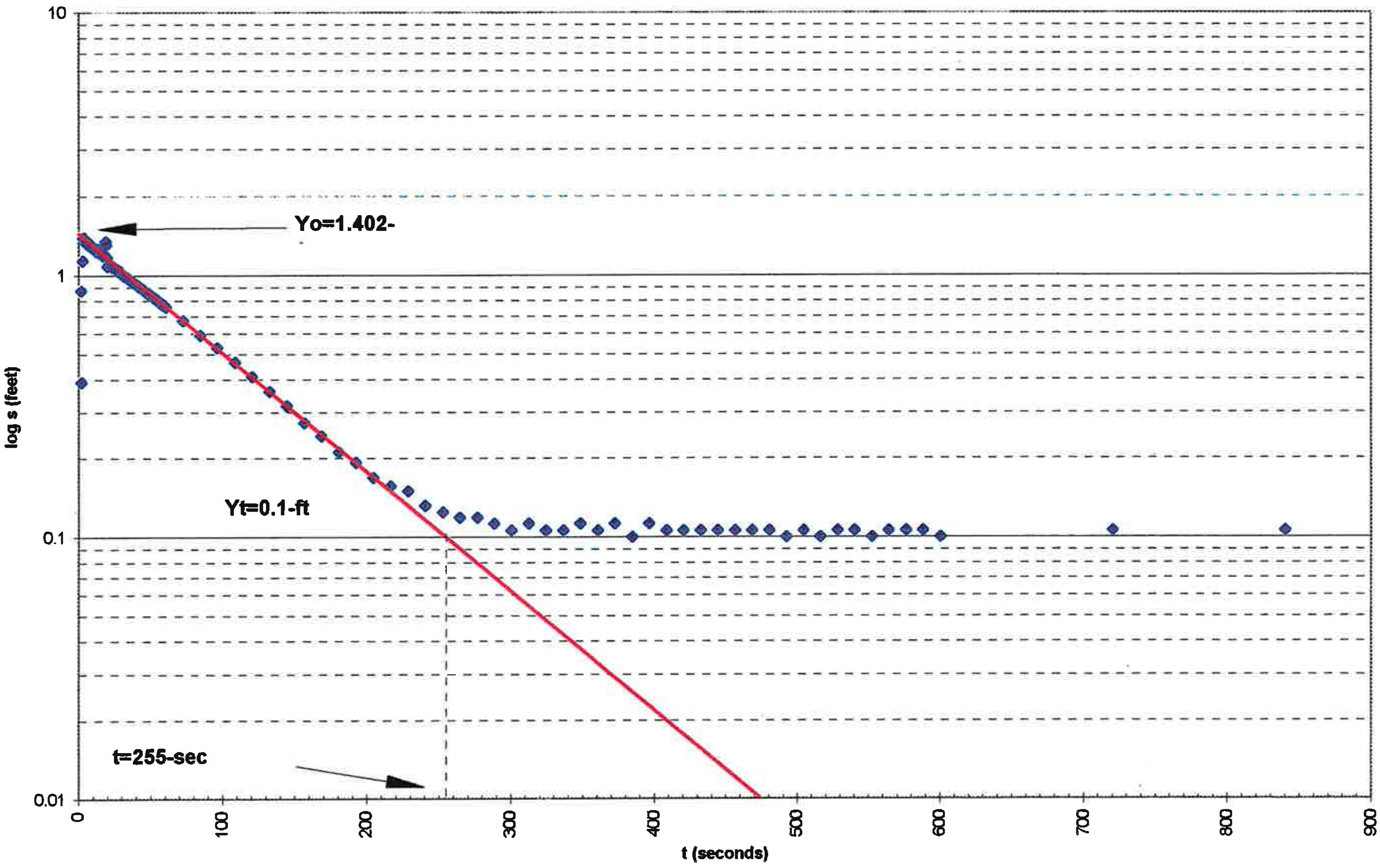
$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}\ \text{(Partially penetrating well)}$$

$$K = [r_c^{2}[\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_0/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

SUN COMPANY, INC
PHILADELPHIA POINT BREEZE REFINERY

TW-216
INSTANTANEOUS ADDITION



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HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-217 IN
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 21.71
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 29-Aug-97

User: P. Hildebrandt
Date: 8-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 18.29
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 12.29
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

From semilog plot

Yo: 1.05 feet
Yt: 0.1 feet
t: 2990 sec

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.0008
ln(Re/rw): 0.90

K(hydraulic conductivity)= 2.33E+00 ft/day
2.70E-05 ft/sec
= 8.22E-04 cm/sec

****************** ********* ********* ******

Equations

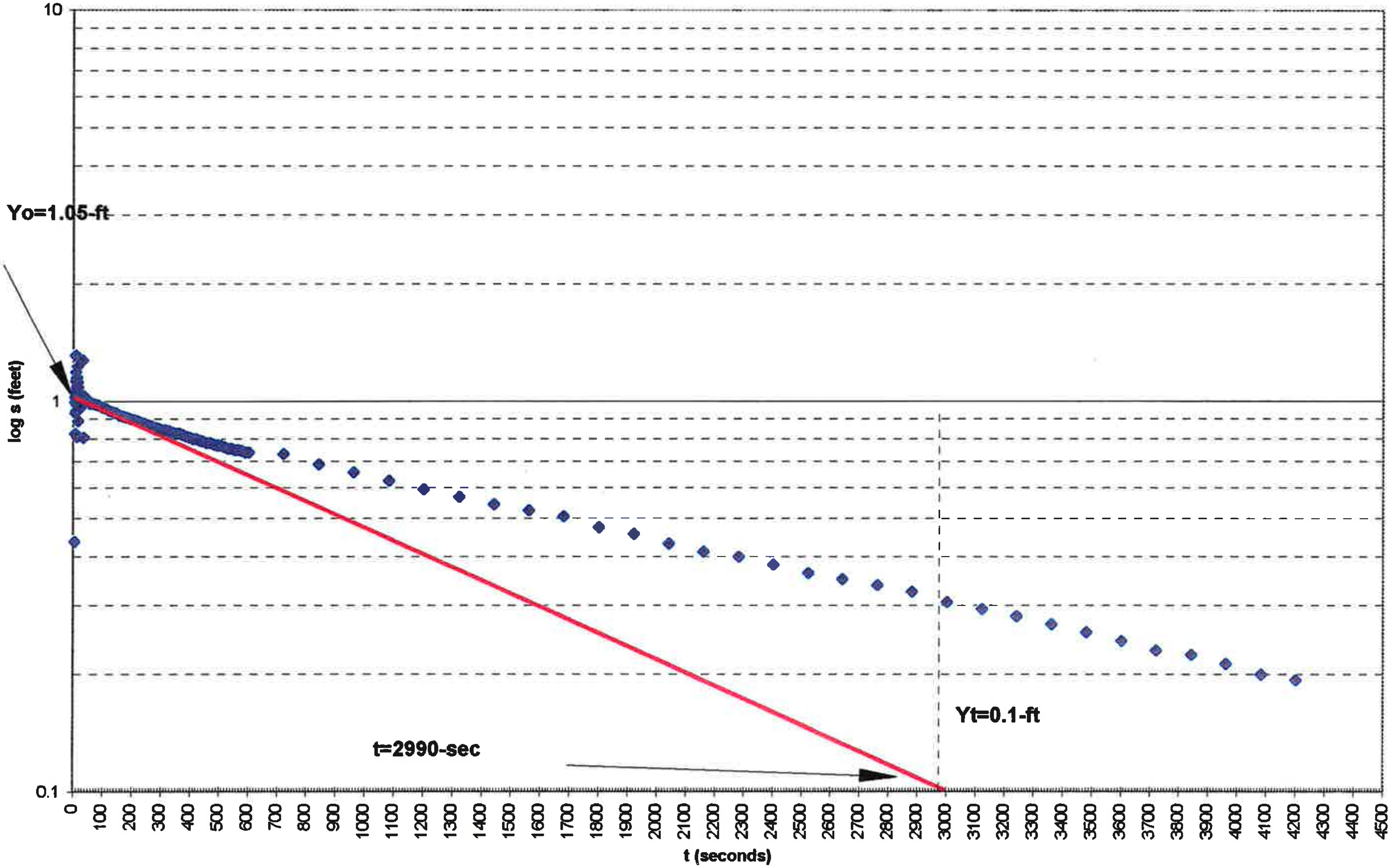
$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}\ \text{(Partially penetrating well)}$$

$$K = [r_c{}^{2[}\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_o/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

SUN COMPANY, INC
PHILADELPHIA POINT BREEZE REFINERY

TW-217
INSTANTANEOUS ADDITION



INTEGRATED SCIENCE & TECHNOLOGY, INC.

HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-217 OUT

Project name: Sun Philadelphia Re

Project number: SU001E

Initial water table depth: 21.53

Water level at start of test: 0

(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt

Field work date: 29-Aug-97

User: P. Hildebrandt

Date: 8-Sep-97

User entered parameters		Calculated parameters	
H - Aquifer Thickness (ft):	18.47	Le/rw - for reading A & B from chart:	3.0
Le - Screen Length (ft):	2		
Lw - Screen Base to Water Table (ft):	12.47	Corrected rc (in):	4.6904
rw - Boring Radius (in):	8		
rc - Well Radius (in):	2		
A - dimensionless parameter from chart:	1.68		
B - dimensionless parameter from chart:	0.24	Slope:	0.0007
		ln(Re/rw):	0.90
n - porosity of sand pack:	0.3		

From semilog plot

Yo:	1.25	feet
Yt:	0.1	feet
t:	3380	sec

K(hydraulic conductivity) = 2.22E+00 ft/day
= 2.57E-05 ft/sec
= 7.83E-04 cm/sec

****************** ********* ********* ******

Equations

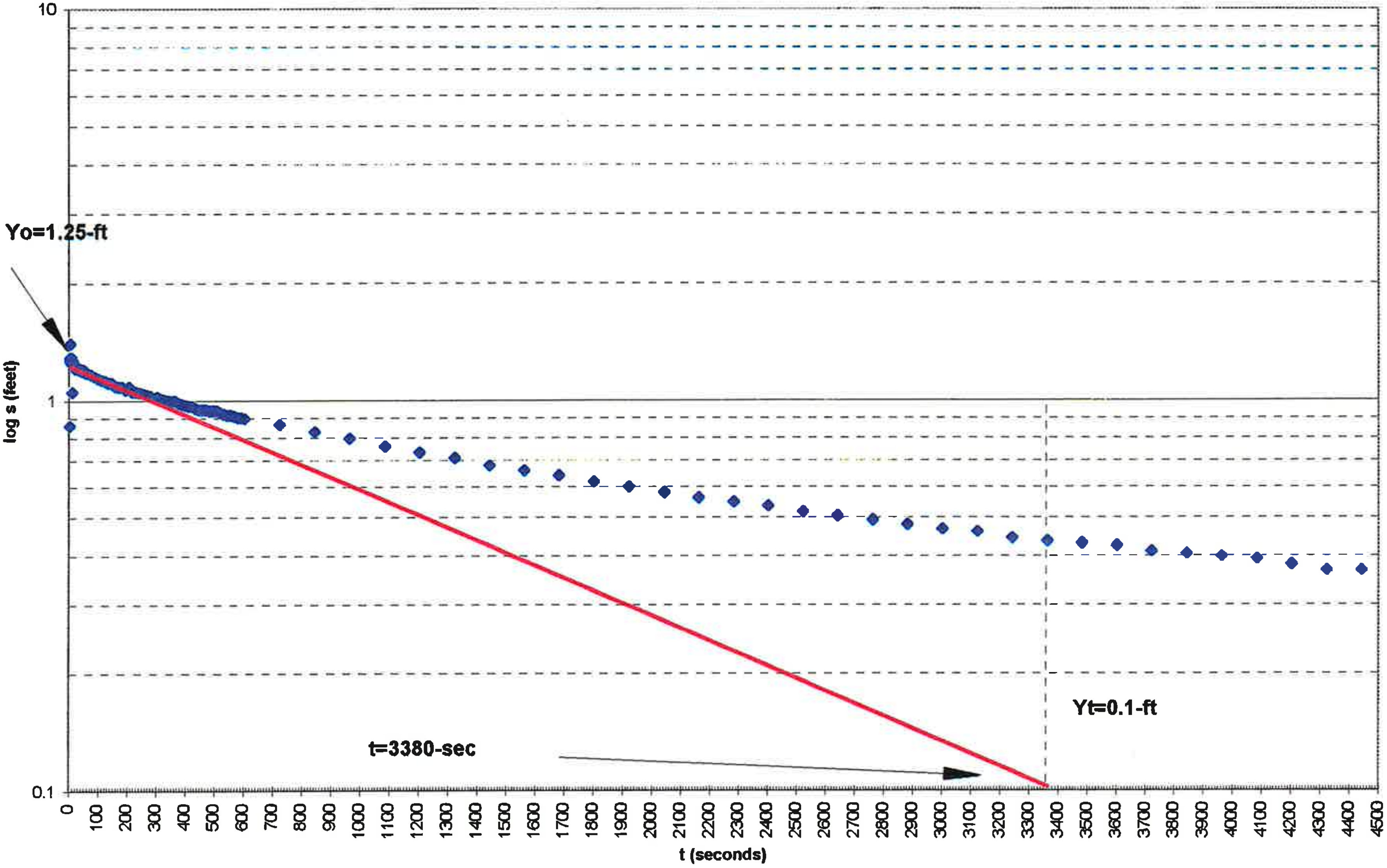
$\ln(R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$ (Partially penetrating well)

$K = [r_c^{2[}\ln(R_e/r_w)]/2L_e] [1/t] [\ln(y_0/y_t)]$

(Bouwer and Rice 1976, Bouwer 1989)

SUN COMPANY, INC.
PHILADELPHIA POINT BREEZE REFINERY

TW-217
INSTANTANEOUS REMOVAL



INTEGRATED SCIENCE & TECHNOLOGY, INC.

HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-218 In
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 22.59
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 28-Aug-97

User: P. Hildebrandt
Date: 8-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 17.41
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 5.41
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.2462
ln(Re/rw): 0.76

From semilog plot

Yo: 1.5 feet
Yt: 0.1 feet
t: 11 sec

K(hydraulic conductivity) = 6.17E+02 ft/day
7.14E-03 ft/sec
= 2.18E-01 cm/sec

****************** ********* ********* ******

Equations

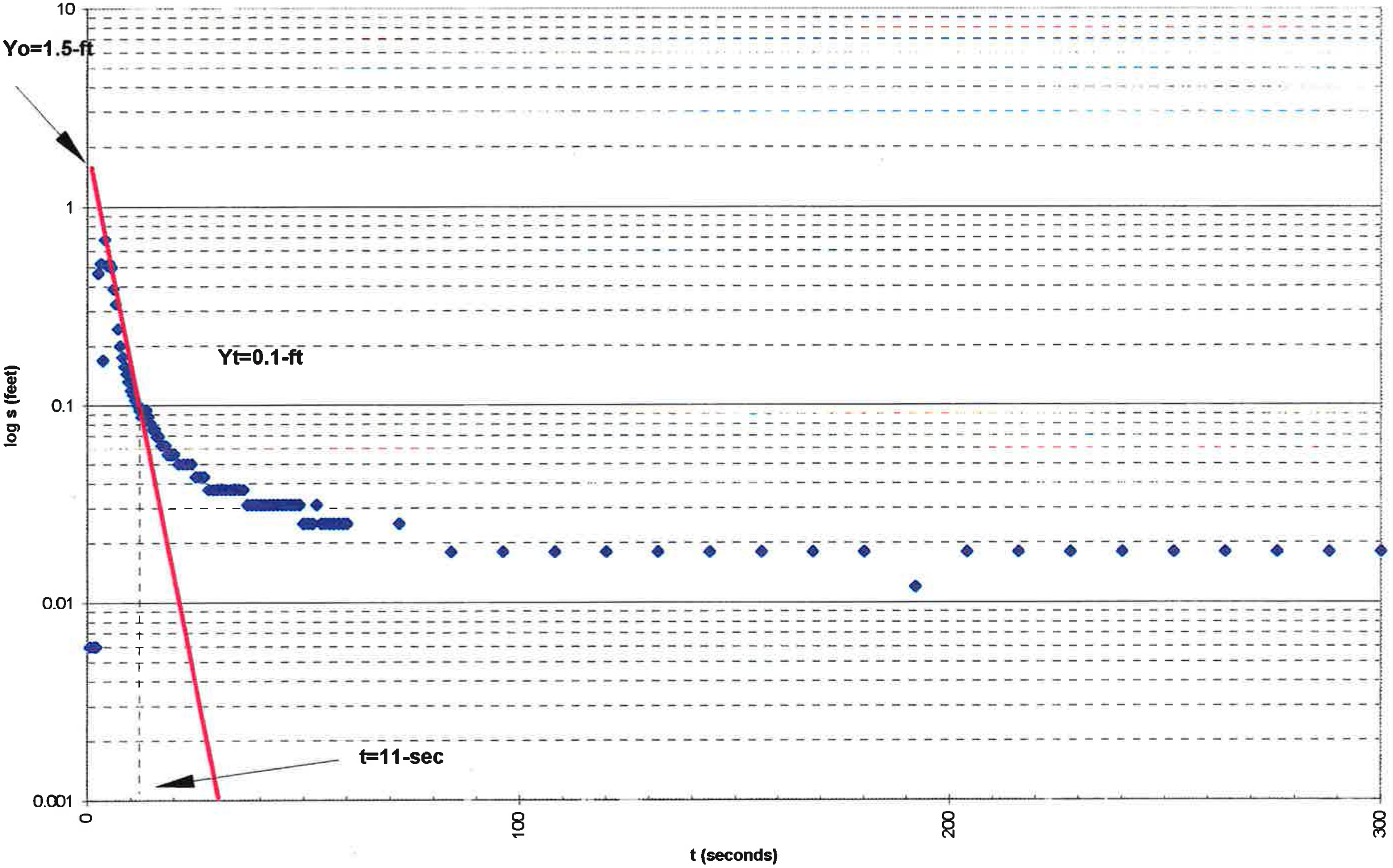
$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

$$K = [r_c^{2}[\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_o/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

SUN COMPANY, INC
PHILADELPHIA POINT BREEZE REFINERY

TW-218
INSTANTANEOUS ADDITION



INTEGRATED SCIENCE & TECHNOLOGY, INC.

HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-218 OUT

Project name: Sun Philadelphia Re

Project number: SU001E

Initial water table depth: 22.58

Water level at start of test: 0

(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt

Field work date: 28-Aug-97

User: P. Hildebrandt

Date: 8-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 17.42

Le - Screen Length (ft): 2

Lw - Screen Base to Water Table (ft): 5.42

rw - Boring Radius (in): 8

rc - Well Radius (in): 2

A - dimensionless parameter from chart: 1.68

B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.2429

ln(Re/rw): 0.76

From semilog plot

Yo:	0.89	feet
Yt:	0.1	feet
t:	9	sec

K(hydraulic conductivity) = 6.09E+02 ft/day
7.05E-03 ft/sec
= 2.15E-01 cm/sec

***************** ********* ********* ******

Equations

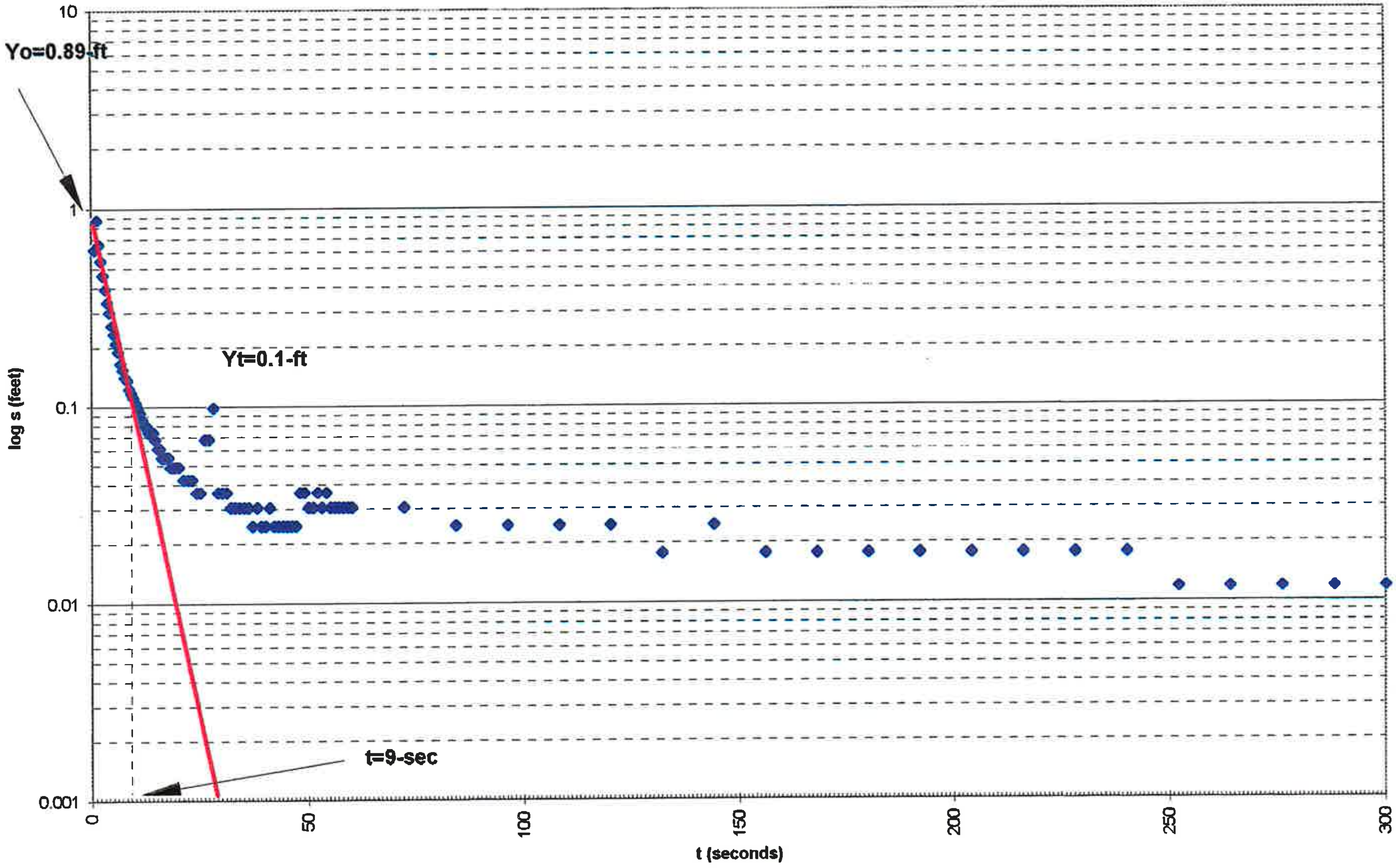
$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}\ \text{(Partially penetrating well)}$$

$$K\ =\ [r_c^{2}[\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_o/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

SUN COMPANY, INC
PHILADELPHIA POINT BREEZE REFINERY

TW-218
INSTANTANEOUS REMOVAL



INTEGRATED SCIENCE & TECHNOLOGY, INC.

HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-218 In
Project name: Sun Philadelphia Re
Project number: SU001E

Initial water table depth: 22.59
Water level at start of test: 0
(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt
Field work date: 28-Aug-97

User: P. Hildebrandt
Date: 8-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 17.41
Le - Screen Length (ft): 2
Lw - Screen Base to Water Table (ft): 5.41
rw - Boring Radius (in): 8
rc - Well Radius (in): 2
A - dimensionless parameter from chart: 1.68
B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.2462
ln(Re/rw): 0.76

From semilog plot

Yo:	1.5	feet
Yt:	0.1	feet
t:	11	sec

	6.17E+02	ft/day
K(hydraulic conductivity)=	7.14E-03	ft/sec
=	2.18E-01	cm/sec

****************** ********* ********* ******

Equations

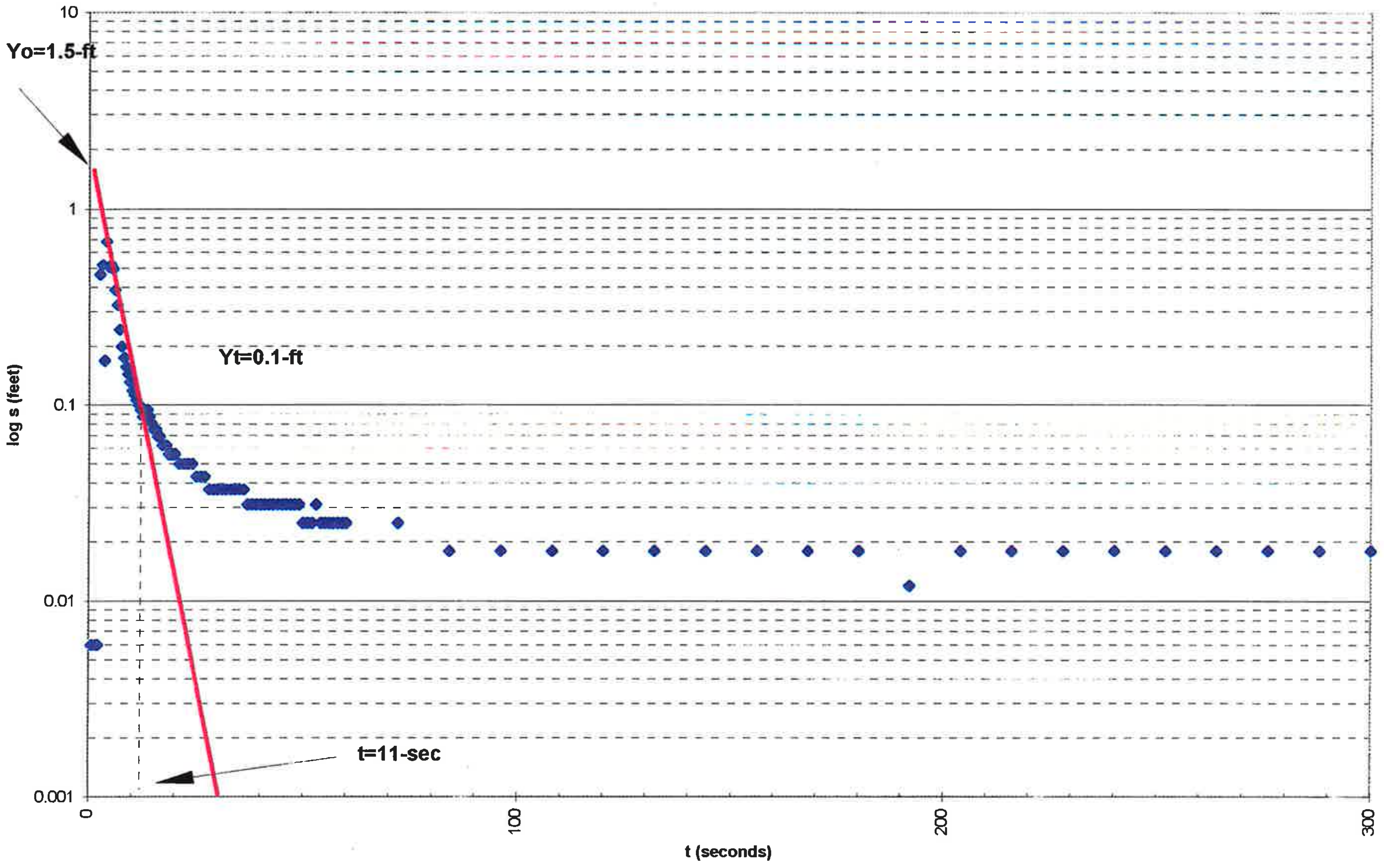
$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

$$K = [r_c^2[\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_0/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

SUN COMPANY, INC
PHILADELPHIA POINT BREEZE REFINERY

TW-218
INSTANTANEOUS ADDITION



INTEGRATED SCIENCE & TECHNOLOGY, INC.

HYDRAULIC CONDUCTIVITY
Bouwer and Rice Method
Partially or Fully Penetrating Well
Unconfined Aquifer
Instantaneous Removal

Determine parameters A and B from GROUND WATER, Vol.27, No.3, May-June 1989

Well ID number: TW-218 OUT

Project name: Sun Philadelphia Re

Project number: SU001E

Initial water table depth: 22.58

Water level at start of test: 0

(Water level measurements are from top of casing)

Data collector name: P. Hildebrandt

Field work date: 28-Aug-97

User: P. Hildebrandt

Date: 8-Sep-97

User entered parameters

H - Aquifer Thickness (ft): 17.42

Le - Screen Length (ft): 2

Lw - Screen Base to Water Table (ft): 5.42

rw - Boring Radius (in): 8

rc - Well Radius (in): 2

A - dimensionless parameter from chart: 1.68

B - dimensionless parameter from chart: 0.24

n - porosity of sand pack: 0.3

Calculated parameters

Le/rw - for reading A & B from chart: 3.0

Corrected rc (in): 4.6904

Slope: 0.2429

ln(Re/rw): 0.76

From semilog plot

Yo: 0.89 feet

Yt: 0.1 feet

t: 9 sec

K(hydraulic conductivity)= 6.09E+02 ft/day

7.05E-03 ft/sec

= 2.15E-01 cm/sec

****************** ********* ********* ******

Equations

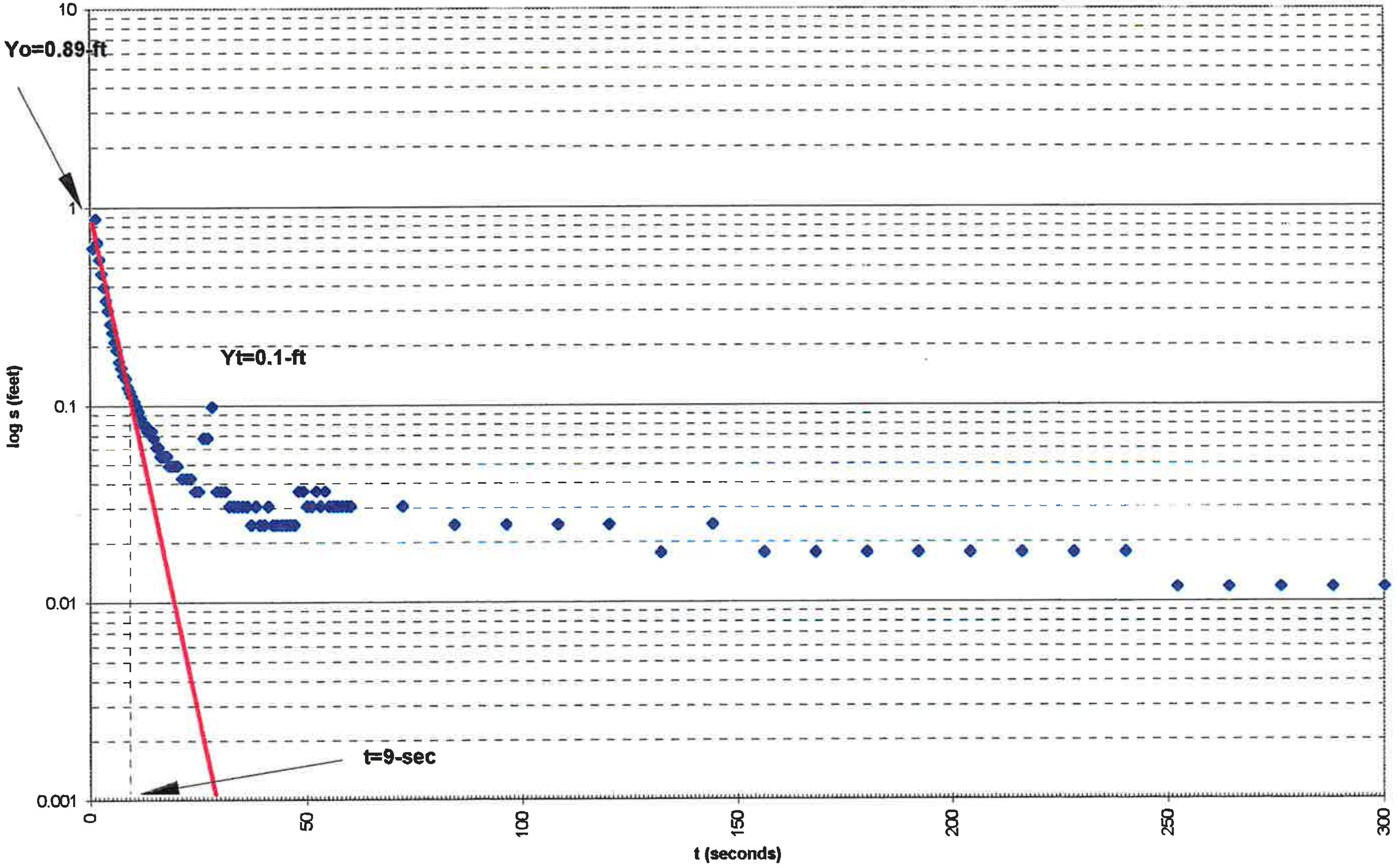
$$\ln\ (R_e/r_w) = [[1.1/\ln(L_w/r_w)] + [A+B[\ln[(H-L_w)/r_w]]/L_e/r_w]]^{-1}$$ (Partially penetrating well)

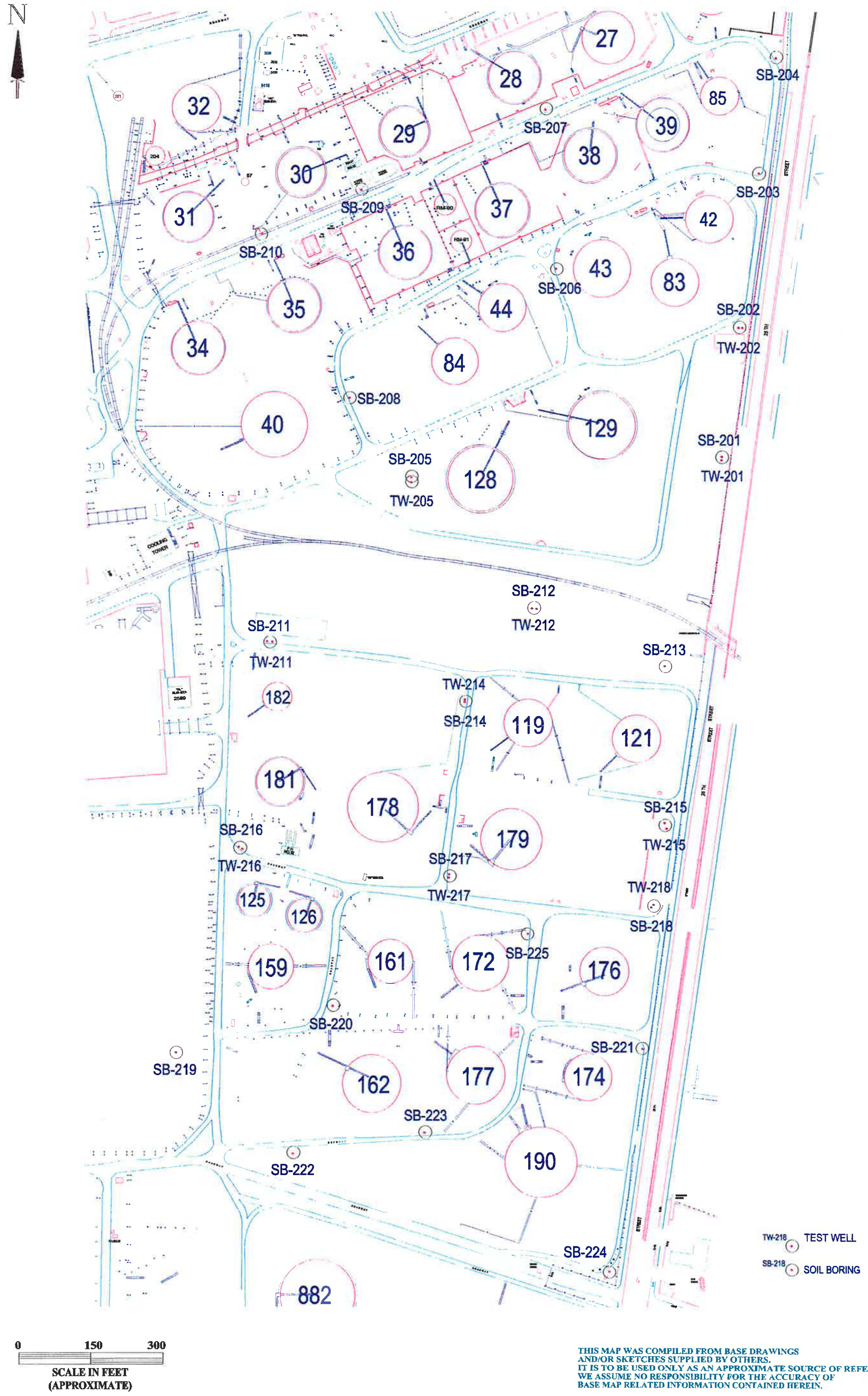
$$K\ =\ [r_c^{2[}\ln(R_e/r_w)]/2L_e]\ [1/t]\ [\ln(y_0/y_t)]$$

(Bouwer and Rice 1976, Bouwer 1989)

SUN COMPANY, INC
PHILADELPHIA POINT BREEZE REFINERY

TW-218
INSTANTANEOUS REMOVAL





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WE ASSUME NO RESPONSIBILITY FOR THE ACCURACY OF
BASE MAP RELATED INFORMATION CONTAINED HEREIN.

INTEGRATED SCIENCE & TECHNOLOGY, INC.	DRAWN BY:	DATE: September 1997	SOIL BORING LOCATIONS SUN REFINERY - SOUTH YARD SUN COMPANY, INC. (R&M) PHILADELPHIA, PENNSYLVANIA	FIGURE
	REVIEWED:	PROJECT NO. SU001E		
	APPROVED:	DWG. NO. SOILBLOC		

Summary of Pump Test Analyses

$$K = \frac{Q\,(1055 \log \frac{R}{r})}{(H^2 - h^2)}$$ (gpd/ft^2)

K_{ave} = 3,330 gpd/ft^2
K_{ave} = 446 ft/d
K_{ave} = 1.57E-01 cm/s

$$T = \frac{528\,Q}{\Delta s}$$ (gpd/ft)

T_{ave} = 64,100 gpd/ft
T_{ave} = 8,569 ft^2/day

K_{ave} = 428 ft/day
K_{ave} = 1.51E-01 cm/s

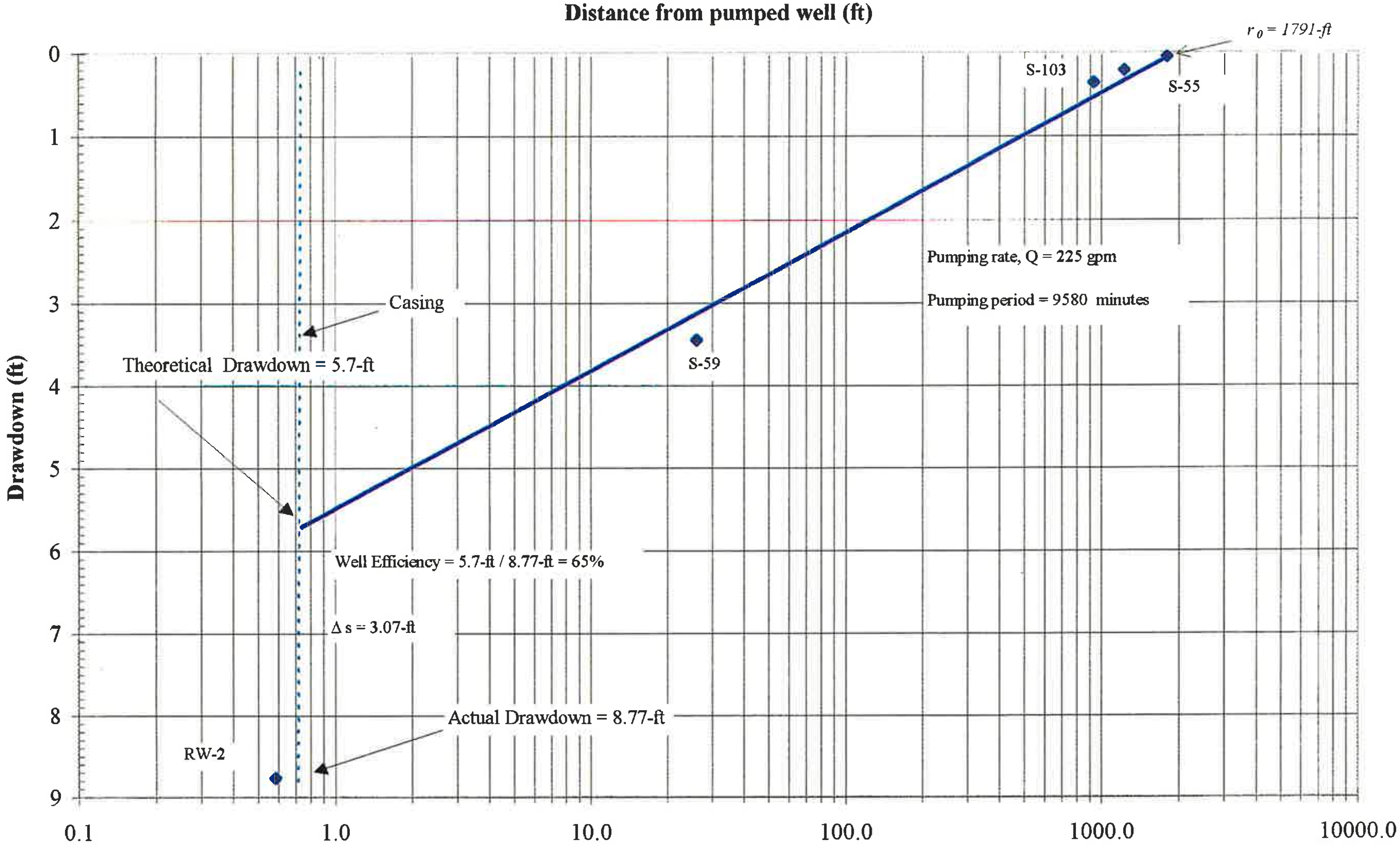
Radius of Influence (r_0) $r_0 = x = {}^{(y-b)}/_{m}$ = 1,680 ft

Well Efficiency = 65%

Well Efficiency Calculation

Distance Drawdown

RW-2 Pump Test (E Leg)



SE Pump Test Leg

Distance - Drawdown Calculations

Well	Distance (ft)	Drawdown (ft)	log (x)
RW-2	0.58	8.77	
S-59	26	3.448	0.53757
S-34	573	0.53	-0.27572
S-31	1263	0.06	-1.22185
$r_0 =$	1311	0.05	-1.30103

$$K = \frac{Q\,(1055 \log \frac{R}{r})}{(H^2 - h^2)} \quad (\text{gpd/ft}^2)$$

R = distance to farthest observation well (ft) = 1263

r = distance to nearest observation well (ft) = 26

h = saturated thickness at the nearest observation well (ft) = 16.55

H = saturated thickness at the farthest observation well (ft) = 19.94

Q = pumping rate (gpm) = 225

K = 3238 gpd/ft^2

K = 434 ft/d

K = 1.53E-01 cm/s

$$T = \frac{528\,Q}{\Delta s} \quad (\text{gpd/ft})$$

Δs = 1.88 ft

T = 63191 gpd/ft

T = 8448 $\text{ft}^2\text{/day}$

$K = {}^{T}/_{b}$

b = 20 ft = aquifer thickness

k = 422 ft/day

k = 1.49E-01 cm/s

y = mx + b

$r_0 = x = {}^{(y-b)}/_{m}$ = 1311 ft

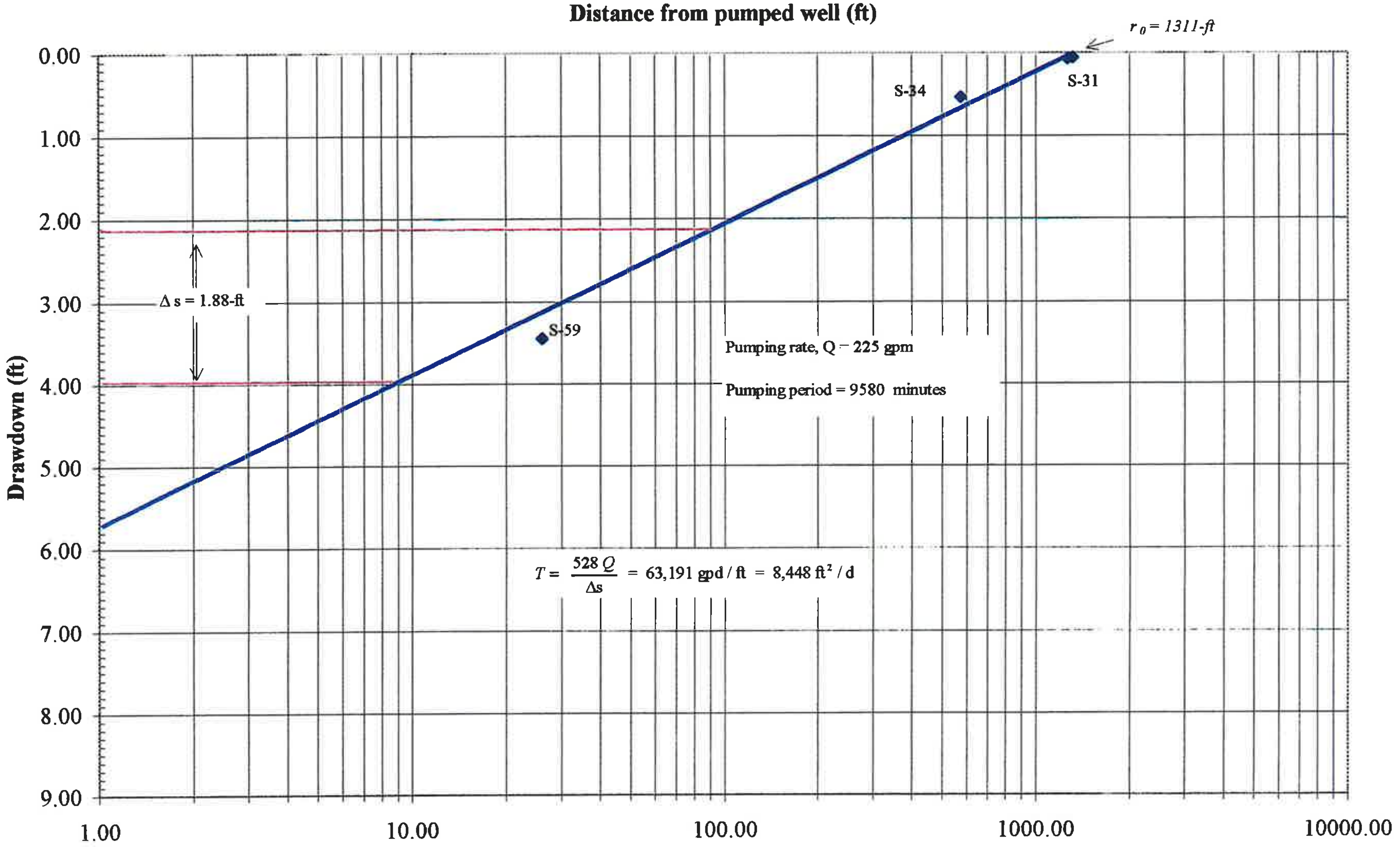
y = -1.30103

b = 0.56143 ft

m = -0.00142

Distance-Drawdown

RW-2 Pump Test (SE Leg)



E Pump Test Leg

Distance - Drawdown Calculations

Well	Distance (ft)	Drawdown (ft)	log (x)
RW-2	0.58	8.77	
S-59	26	3.448	0.53757
S-103	926	0.36	-0.44370
S-55	1218	0.21	-0.67778
r_0 =	1791	0.05	-1.30103

$$K = \frac{Q\,(1055 \log \frac{R}{r})}{(H^2 - h^2)} \quad (\text{gpd/ft}^2)$$

R = distance to farthest observation well (ft) =	1218
r = distance to nearest observation well (ft) =	26
h = saturated thickness at the nearest observation well (ft) =	16.55
H = saturated thickness at the farthest observation well (ft) =	19.79
Q = pumping rate (gpm) =	225

K = 3370 gpd/ft^2

K = 452 ft/d

K = 1.59E-01 cm/s

$$T = \frac{528\,Q}{\Delta s} \quad (\text{gpd/ft})$$

Δs = 1.80 ft

T = 66000 gpd/ft

T = 8824 ft^2/day

$K = {}^{T}/_{b}$

b = 20 ft = aquifer thickness

k = 441 ft/day

k = 1.56E-01 cm/s

y = mx + b

$r_0 = x = {}^{(y-b)}/_{m}$ = 1791 ft

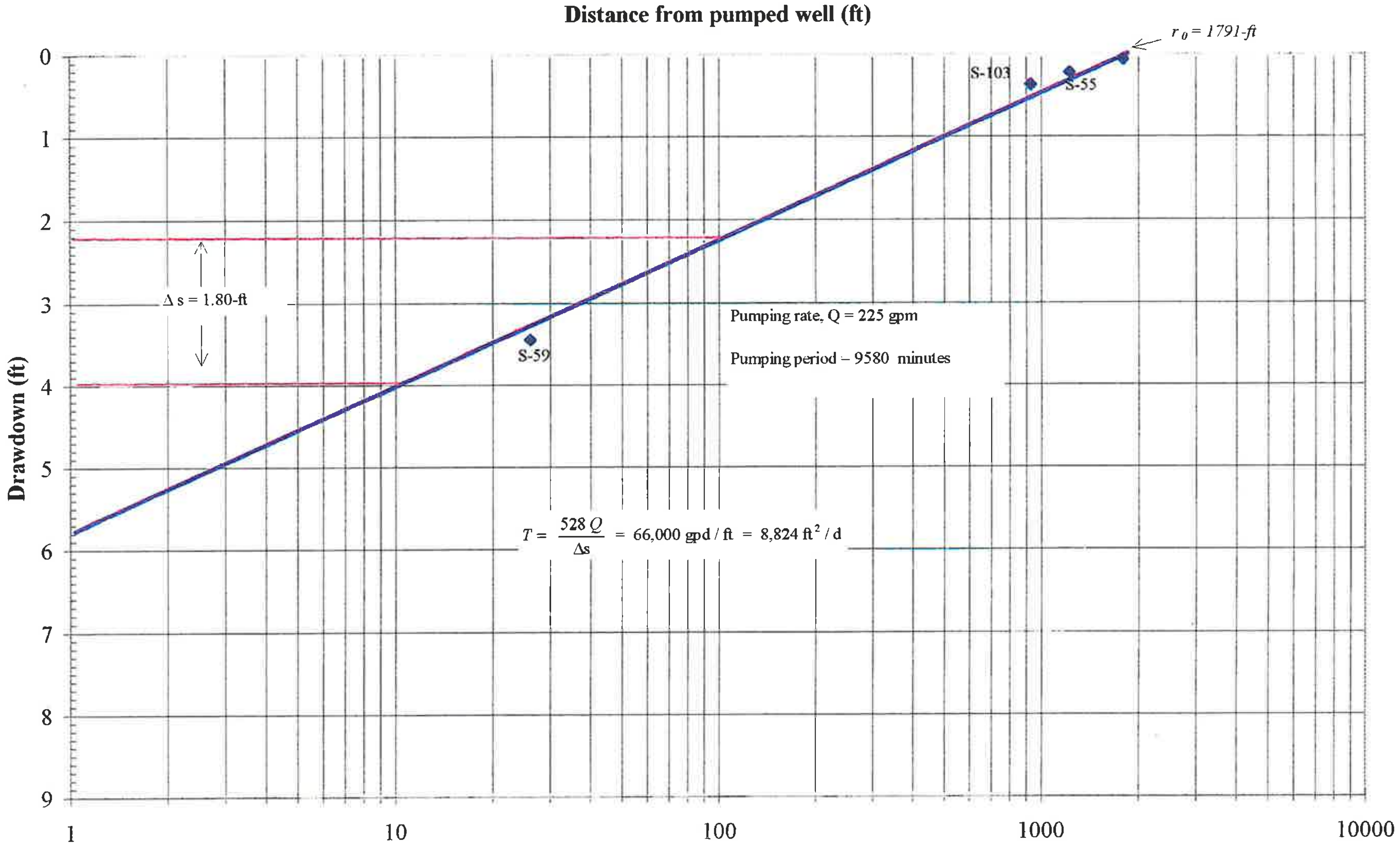
y = -1.30103

b = 0.55495 ft

m = -0.00104

Distance Drawdown

RW-2 Pump Test (E Leg)



SW Pump Test Leg

Distance - Drawdown Calculations

Well	Distance (ft)	Drawdown (ft)	log (x)
RW-2	0.58	8.77	
S-59	26	3.448	0.537567
S-113	302	1.5	0.176091
S-112	700	0.64	-0.19382
r_0 =	1715	0.05	-1.30103

$$K = \frac{Q\,(1055 \log \frac{R}{r})}{(H^2 - h^2)}$$ (gpd/ft^2)

R = distance to farthest observation well (ft) =	700
r = distance to nearest observation well (ft) =	26
h = saturated thickness at the nearest observation well (ft) =	16.55
H = saturated thickness at the farthest observation well (ft) =	19.36
Q = pumping rate (gpm) =	225

K = 3366 gpd/ft^2

K = 451 ft/d

K = 1.59E-01 cm/s

$$T = \frac{528\,Q}{\Delta s}$$ (gpd/ft)

Δs = 1.90 ft

T = 62526 gpd/ft

T = 8359 ft^2/day

$K = {}^{T}/_{b}$

b = 20 ft = aquifer thickness

k = 418 ft/day

k = 1.47E-01 cm/s

y = mx + b

$r_0 = x = {}^{(y-b)}/_{m}$ = 1715 ft

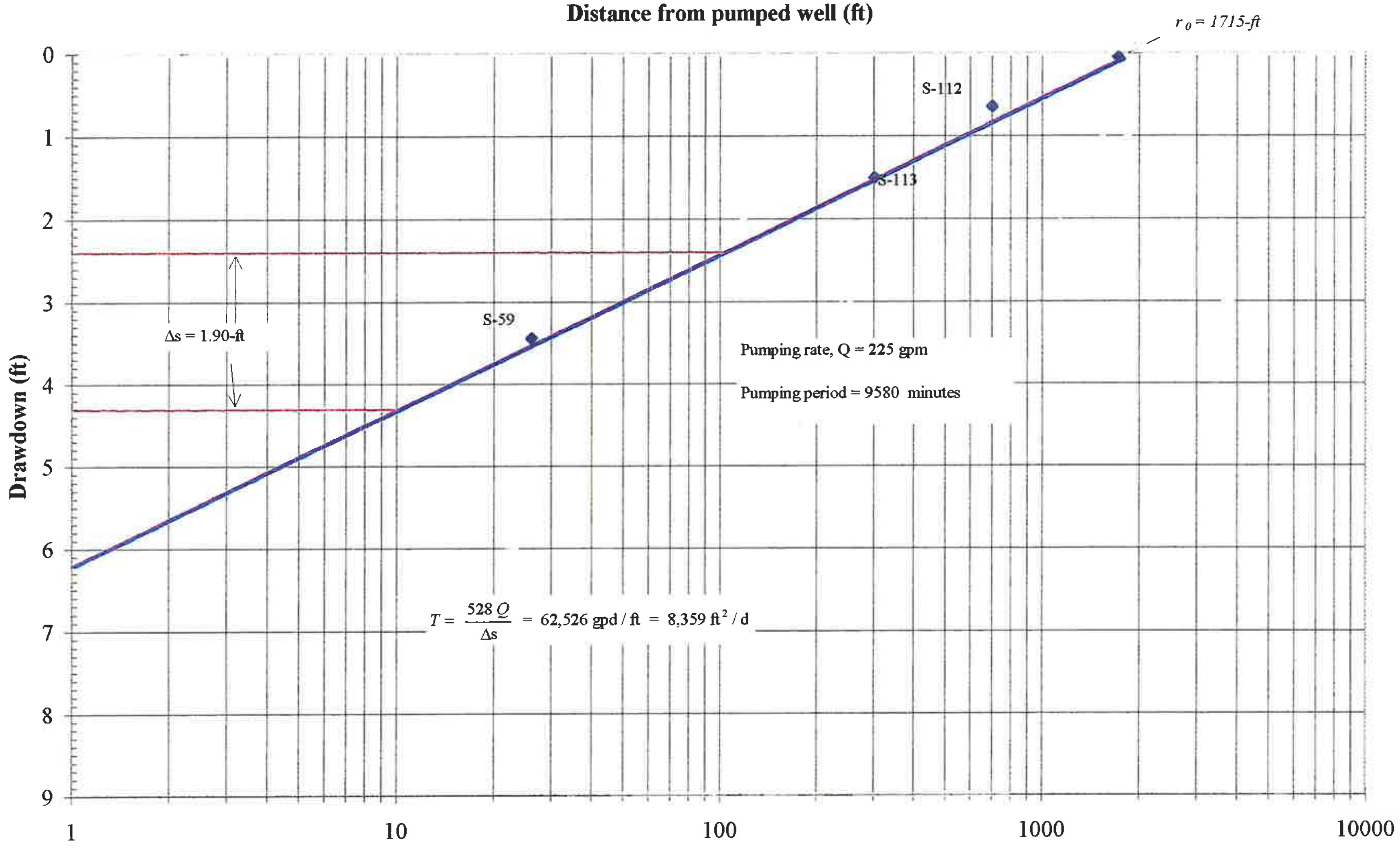
y = -1.30103

b = 0.54136 ft

m = -0.00107

Distance Drawdown

RW-2 Pump Test (SW Leg)



Distance - Drawdown Calculations

Well	Distance (ft)	Drawdown (ft)	log (x)
RW-2	0.58	8.77	
S-59	26	3.45	0.537567
S-102	644	0.69	-0.16115
S-54	1175	0.29	-0.5376
r_0 =	1940	0.05	-1.30103

$$K = \frac{Q\,(1055 \log \frac{R}{r})}{(H^2 - h^2)} \quad (\text{gpd/ft}^2)$$

R = distance to farthest observation well (ft) =	1175
r = distance to nearest observation well (ft) =	26
h = saturated thickness at the nearest observation well (ft) =	16.55
H = saturated thickness at the farthest observation well (ft) =	19.71
Q = pumping rate (gpm) =	225

K = 3431 gpd/ft^2

K = 460 ft/d

K = 1.62E-01 cm/s

$$T = \frac{528\ Q}{\Delta s} \quad (\text{gpd/ft})$$

Δs = 1.85 ft

T = 64216 gpd/ft

T = 8585 ft^2/day

$K = {}^{T}/_{b}$

b = 20 ft = aquifer thickness

K = 429 ft/day

y = mx + b

$r_0 = x = {}^{(y-b)}/_{m}$ = 1940 ft

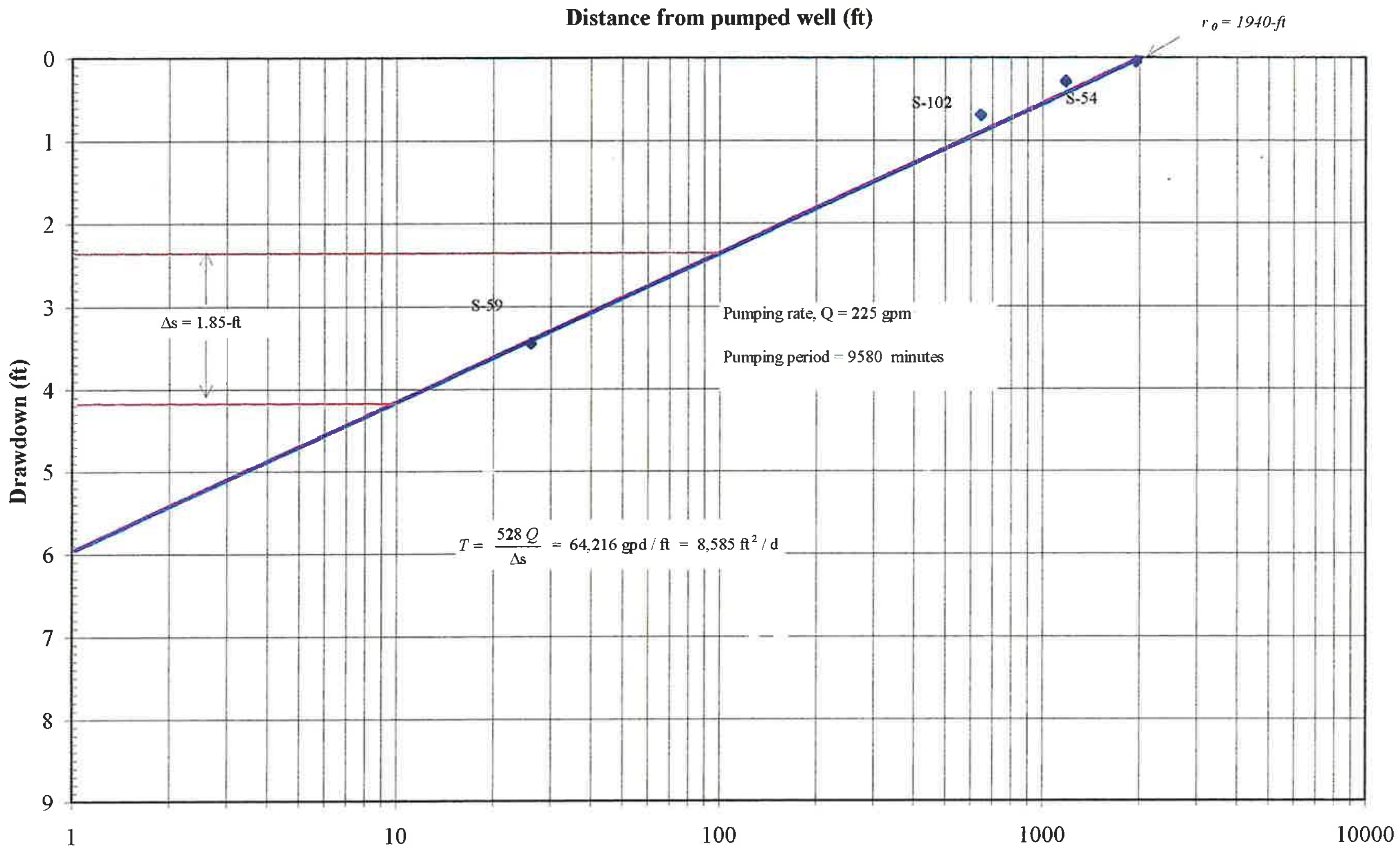
y = -1.30103

b = 0.52500 ft

m = -0.00094

Distance-Drawdown

RW-2 Pump Test (NE Leg)



N Pump Test Leg

Distance - Drawdown Calculations

Well	Distance (ft)	Drawdown (ft)	log (x)
RW-2	0.58	8.77	
S-59	26	3.45	0.537567
S-60	260	1.61	0.206826
S-102	644	0.69	-0.16115
S-61	899	0.34	-0.46852
r_0 =	1644	0.05	-1.30103

$$K = \frac{Q\,(1055 \log \frac{R}{r})}{(H^2 - h^2)} \quad (\text{gpd/ft}^2)$$

R = distance to farthest observation well (ft) =	899
r = distance to nearest observation well (ft) =	26
h = saturated thickness at the nearest observation well (ft) =	16.55
H = saturated thickness at the farthest observation well (ft) =	19.66
Q = pumping rate (gpm) =	225

K = 3245 gpd/ft^2

K = 435 ft/d

K = 1.53E-01 cm/s

$$T = \frac{528\,Q}{\Delta s} \quad (\text{gpd/ft})$$

Δs = 1.84 ft

T = 64565 gpd/ft

T = 8632 ft^2/day

$K = {}^{T}/_{b}$

b = 20 ft = aquifer thickness

k = 432 ft/day

k = 1.52E-01 cm/s

y = mx + b

$r_0 = x = {}^{(y-b)}/_{m}$ = 1644 ft

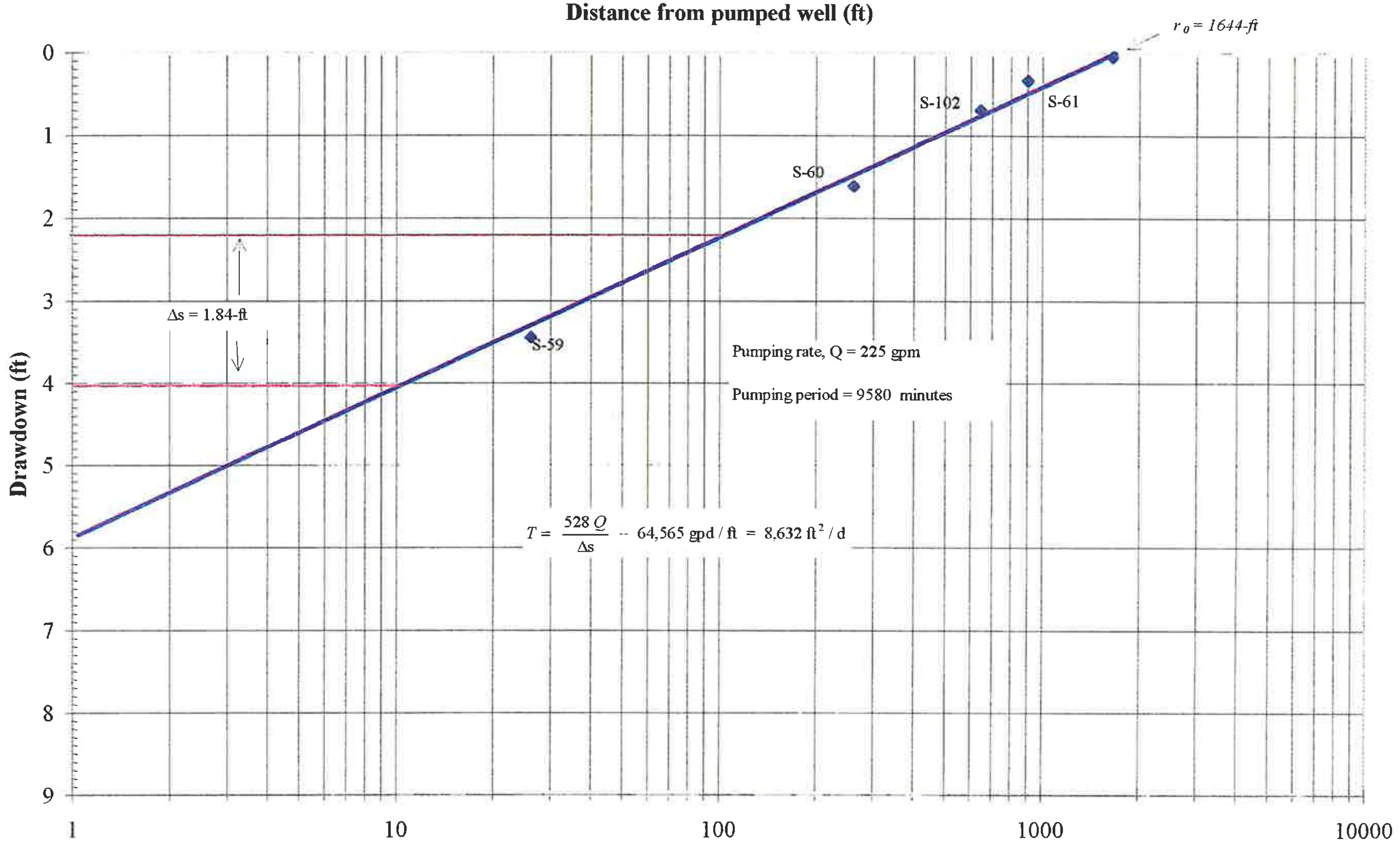
y = -1.30103

b = 0.54100 ft

m = -0.00112

Distance Drawdown

RW-2 Pump Test (N Leg)



S-59 Aquifer Parameters

Slope 1

$T = 264\ Q / \Delta s$

$T =$ 108592 gpd/ft

$T =$ 14518 ft^2/day

$K_1 =$ 726 ft/day

$b =$ 20 ft

$\Delta s =$ 0.547 ft

$S = 0.3\ Tt_o/r^2$

$S =$ 5.783023

$r =$ 26 ft

$t_0 =$ 0.12 min.

$t =$ 7 days

$$u = \frac{1.87\ r^2 S}{Tt}$$

$u =$ 0.00962

Slope 2

$T = 264\ Q / \Delta s$

$T =$ 53036 gpd/ft

$T =$ 7090 ft^2/day

$K_2 =$ 355 ft/day

$b =$ 20 ft

$\Delta s =$ 1.12 ft

$S = 0.3\ Tt_o/r^2$

$S =$ 188.2925

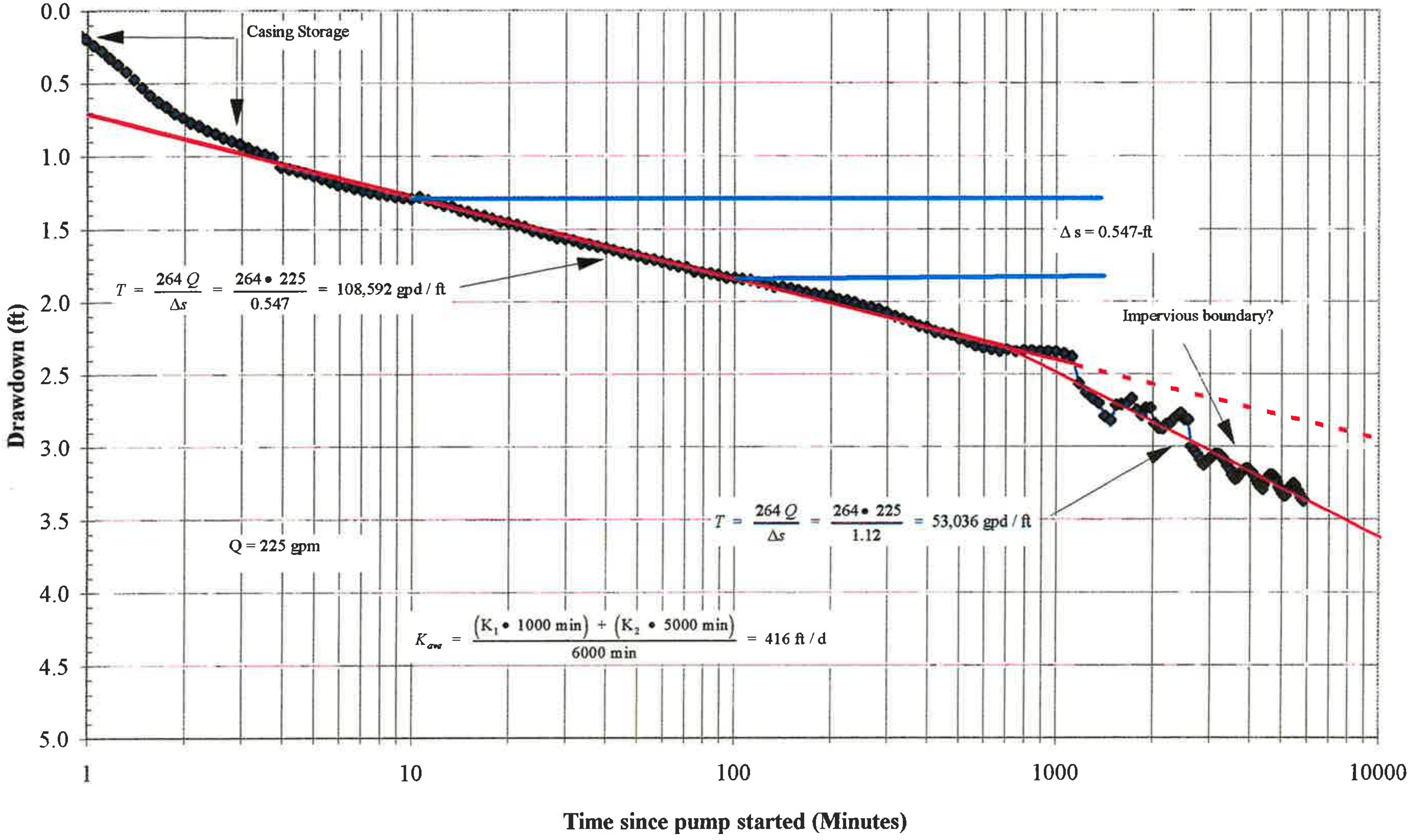
$r =$ 26 ft

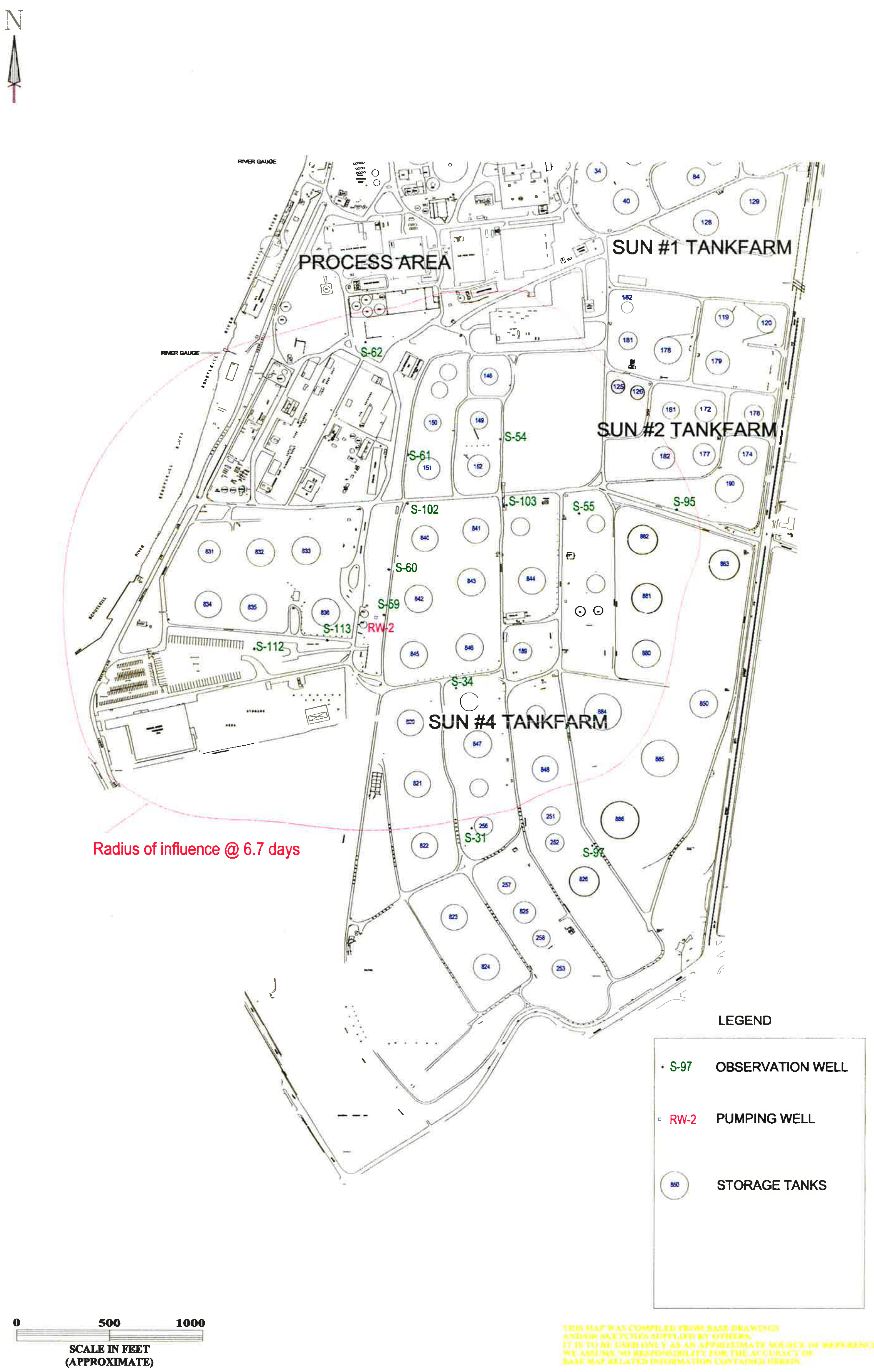
$t_0 =$ 8 min.

Average K

$$K_{ave} = \frac{\left(K_1 \bullet 1000\ \text{min}\right) + \left(K_2 \bullet 5000\ \text{min}\right)}{6000\ \text{min}} = 416\ \text{ft/d}$$

S-59 Drawdown





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BASE MAP RELATED INFORMATION CONTAINED HEREIN.

INTEGRATED SCIENCE & TECHNOLOGY, INC.	DRAWN BY:	DATE: 3 MAR 1998	PUMP TEST RADIUS OF INFLUENCE & WELL LOCATIONS STUDY AREA PHILADELPHIA, PENNSYLVANIA	FIGURE
	REVIEWED:	PROJECT NO. SU001H		
	APPROVED:	DWG. NO.		

Summary of NAPL Fate Mechanisms
Sun/DPSC Philadelphia, Pennsylvania

	English Units			Metric Units			Estimated
	lb	ft^3	gallons	kg	m^3	L	% Loss
IRREDUCIBLE LNAPL IN SOIL	**3,993,600**	**80,000**	**598,400**	**1,812,278**	**2,265**	**2,265,348**	**NA**
	SUMMARY OF MASS LOST in 1 YEAR						
BIODEGRADATION	1610	32.24	241	730	0.91	913	0.04%
SOLUBILIZATION	97	1.94	15	44	0.06	55	0.00%
VOLATILIZATION	11,587	232	1,712	5,267	6.58	6,583	0.29%
TOTAL ESTIMATED MASS LOST	13,293	267	1,967	6,041	7.55	7,551	0.33%
	SUMMARY OF MASS LOST in 10 YEARS						
BIODEGRADATION	3074	61.58	461	1,394	1.74	1,743	0.08%
SOLUBILIZATION	969	19	145	440	1	551	0.02%
VOLATILIZATION	115,867	2,325	17,117	52,667	66	65,833	2.91%
TOTAL ESTIMATED MASS LOST	119,910	2,406	17,723	54,501	68	68,127	3.01%
	SUMMARY OF MASS LOST in 50 YEARS						
BIODEGRADATION	9,746	195	1,680	5,085	6	6,356	0.28%
SOLUBILIZATION	4,846	97	726	2,202	3	2,753	0.12%
VOLATILIZATION	579,333	11,624	85,583	263,333	329	329,167	14.53%
TOTAL ESTIMATED MASS LOST	593,925	11,916	87,989	270,620	338	338,275	14.93%

NAPL Fate Calculations
Sun/DPSC Philadelphia, Pennsylvania

General Assumptions:	**Symbol**		**English Units**			**Metric Units**		**Source**
Dimensions of Alleged NAPL Pathway:	L	Length =	1000	ft	=	304.8	m	Malcom Pirnie, 1996
	W	Width =	800	ft	=	243.8	m	Malcom Pirnie, 1996
	H	Thickness =	10	ft	=	3.0	m	Malcom Pirnie, 1996
Specific Gravity of NAPL	S.G.	Specific Gravity =	0.80	unitless	=	0.80	unitless	A.D. Little, 1997
Mean Temperature	T	Temperature =	50	°F	=	10	°C	Leeden et al., 1993
Dissolved Oxygen Concentration in Water	D.O.	D.O. Concentration =	0.0007042	lb/ft^3	=	11.28	mg/L	Metcalf and Eddy 1992
Surficial Aquifer Characteristics	n_{eff}	Effective Porosity =	0.25	unitless	=	0.25	unitless	Assumed
	dh/dl	Hydraulic gradient =	0.001	ft/ft	=	0.001	m/m	Assumed
	K	Hydraulic conductivity =	30	ft/day	=	0.0106	cm/sec	Assumed
Rate of Infiltration	I	Infiltration =	27.5	in/yr	=	69.9	cm/yr	Leeden et al., 1990
Mass Ratio of Oxygen to Carbon		Oxygen : Hydrocarbon =	3.5	unitless	=	3.5	unitless	Assumed

General Calculations:	**Symbol**		**English Units**			**Metric Units**		**Source**
Volume of void space in plume	V	Volume =	2,000,000	ft^3	=	226,535	m^3	Calculated
		=	14,960,000	gallons	=	226,534,773	liters	Calculated
Linear Ground Water Velocity	v	Ground-Water Velocity =	0.12	ft/day	=	0.04	m/day	USGS, 1993

Estimated Mass of Soil Residual NAPL
Sun/DPSC Philadelphia, Pennsylvania

General Assumptions:	**Symbol**		**English Units**			**Metric Units**		**Source**
Dimensions of Alleged NAPL Pathway:	L	Length =	1000	ft	=	304.8	m	Malcom Pirnie, 1996
	W	Width =	800	ft	=	243.8	m	Malcom Pirnie, 1996
	H	Thickness =	10	ft	=	3.0	m	Malcom Pirnie, 1996
Specific Gravity of NAPL	S.G.	Specific Gravity =	0.80	unitless	=	0.80	unitless	A.D. Little, 1997
Surficial Aquifer Characteristics	n_{eff}	Effective Porosity =	0.25	unitless	=	0.25	unitless	Assumed
Irreducible Oil Content of Soil Matrix	S_{ro}	Irreducible Oil Content =	0.01	unitless	=	0.01	unitless	Assumed

General Calculations:	**Symbol**		**English Units**			**Metric Units**		**Source**
Volume of void space in plume	V_{Total}	=	2,000,000	ft^3	=	56,634	m^3	Calculated
		=	14,960,000	gallons	=	56,633,693	liters	Calculated
Volume of void space occupied by NAPL	V_{NAPL}	=	80,000	ft^3	=	2,265	m^3	Calculated
		=	598,400	gallons	=	2,265,348	liters	Calculated
Mass of NAPL	M_{NAPL}	=	3,993,600	lb	=	1,812,278	kg	

Estimation of Maximum Mass of NAPL Biodegraded
Sun/DPSC Philadelphia, Pennsylvania

ASSUMPTIONS:	Symbol		English Units			Metric Units		Source
Plume Dimensions:	L	Length =	1000	ft	=	304.8	m	Malcom Pirnie, 1996
	W	Width =	800	ft	=	243.8	m	Malcom Pirnie, 1996
	H	Thickness =	10	ft	=	3.0	m	Malcom Pirnie, 1996
Surficial Aquifer Characteristics	n_{eff}	Effective Porosity =	0.25	unitless	=	0.25	unitless	Assumed
	dh/dl	Hydraulic gradient =	0.001	ft/ft	=	0.001	m/m	Assumed
	K	Hydraulic conductivity =	30	ft/day	=	0.0106	cm/sec	Assumed
Linear Ground Water Velocity	v	Ground-Water Velocity =	0.12	ft/day	=	0.04	m/day	USGS, 1993
Volume of void space in plume	V	Volume =	2,000,000	ft^3	=	226,535	m^3	Calculated
		=	14,960,000	gallons	=	#########	liters	Calculated
Mean Temperature	T	Temperature =	50	° F	=	10	° C	Leeden et al., 1990
Dissolved Oxygen Concentration in Water at T	D.O.	D.O. Concentration =	7.04E-04	lb/ft^3	=	11.28	mg/L	Metcalf and Eddy 1992
Rate of Infiltration	I	Infiltration =	27.5	in/yr	=	69.9	cm/yr	Leeden et al., 1990
Mass Ratio of Oxygen to Carbon		Oxygen : Hydrocarbon =	3.5	unitless	=	3.5	unitless	Assumed
Specific Gravity of NAPL	S.G.	Specific Gravity =	0.80	unitless	=	0.80	unitless	A.D. Little, 1997

CALCULATIONS:		English Units			Metric Units	
Volume of Water in Impacted Area	=	8,000,000	ft^3	=	#########	L/yr
Volume of Water Infiltrating from ground surface	=	458,333	ft^3/yr	=	12,978,555	L/yr
Volume of Ground Water Entering NAPL smear zone	=	350,400	ft^3/yr	=	9,922,223	L/yr
Initial mass of oxygen available from water in impacted area	=	5634	lb	=	2,555	kg
Mass of oxygen available from infiltrating water per year	=	323	lb/yr	=	146	kg/yr
Mass of oxygen available from ground water per year	=	247	lb/yr	=	112	kg/yr
Additional Mass of Oxygen Available for Biodegradation per yr	=	570	lb/yr		258	kg/yr
Initial Mass of NAPL Biodegraded	=	1610	lb	=	730	kg
Initial Volume of NAPL Bioderaded	=	32.2	ft^3	=	0.9	m^3
Initial Volume of NAPL Bioderaded	=	241	gal	=	913	L
Additional Mass of NAPL Biodegraded per year	=	163	lb/yr	=	74	kg/yr
Additional Volume of NAPL Biodegraded per year	=	3.3	ft^3/yr	=	0.1	m^3/yr
Additional Volume of NAPL Biodegraded per year	=	24	gal/yr	=	92	L/yr

Estimation of Maximum Mass of NAPL Solubilized
Sun/DPSC Philadelphia, Pennsylvania

ASSUMPTIONS:	**Symbol**		**English Units**			**Metric Units**		**Source**
Plume Dimensions:	L	Length =	1000	ft	=	304.8	m	Malcom Pirnie, 1996
	W	Width =	800	ft	=	243.8	m	Malcom Pirnie, 1996
	H	Thickness =	10	ft	=	3.0	m	Malcom Pirnie, 1996
Surficial Aquifer Characteristics	n_{eff}	Effective Porosity =	0.25	unitless	=	0.25	unitless	Assumed
	dh/dl	Hydraulic gradient =	0.001	ft/ft	=	0.001	m/m	Assumed
	K	Hydraulic conductivity =	30	ft/day	=	0.0106	cm/sec	Assumed
Linear Ground Water Velocity	v	Ground-Water Velocity =	0.12	ft/day	=	0.04	m/day	USGS, 1993
Volume of void space in plume	V	Volume =	2,000,000	ft^3	=	226,535	m^3	Calculated
		=	14,960,000	gallons	=	226,534,773	liters	Calculated
Mean Temperature	T	Temperature =	50	° F	=	10	° C	Leeden et al., 1990
Dissolved Oxygen Concentration in Water at T	D.O.	D.O. Concentration =	7.04E-04	lb/ft^3	=	11.28	mg/L	Metcalf and Eddy 1992
Rate of Infiltration	I	Infiltration =	27.5	in/yr	=	69.9	cm/yr	Leeden et al., 1990
Mean Solubility of NAPL	S_i	Mean Solubility =	3.60E-05	lb/ft^3	=	0.577	g/m^3	
Specific Gravity of NAPL	S.G.	Specific Gravity =	0.80	unitless	=	0.80	unitless	A.D. Little, 1997

CALCULATIONS:		**English Units**			**Metric Units**	
Volume of Water Infiltrating from ground surface	=	458,333	ft^3/yr	=	12,978,555	L/yr
Volume of Ground Water Entering NAPL smear zone	=	350,400	ft^3/yr	=	9,922,223	L/yr
Total Volume of Water Available for Dissolution	=	808,733	ft^3/yr	=	22,900,778	L/yr
Total Mass of Hydrocarbon Solubilized per year	=	29	lb/yr		13	kg/yr
Total Volume of NAPL Biodegraded per year	=	0.6	ft^3/yr	=	0.0	m^3/yr
Total Volume of NAPL Biodegraded per year	=	4	gal/yr	=	17	L/yr

Arthur D
Environm onitoring and Analysis Unit

Project Title : Sun Company
Data Package #: GRO PIANO Distributions
Data : GRO - GC/FID - SAMPLES

		CHEMICAL PROPERTIES			NAPL SAMPLE IDENTIFICATION					
COMPOUND	TYPE	M.W. (g/mol)	VAPOR PRESSURE (kPa)	SOLUBILITY (g/m³)	PH-3 97C0282 0213009.D (µg/mg)	MW-5 97C0283 0213010.D (µg/mg)	MW-7 97C0284 0213011.D (µg/mg)	MW-6 97C0285 0213012.D (µg/mg)	Mean Compound Mass per Sample (µg/sample)	Mean No. of Moles per Sample (#moles/sample)
n-Propane (R9)	P3	44.09				0.0047		0.0044	0.00	8.30228E-11
Isobutane (R5)	I4				0.28	0.18	0.0083	0.3	0.15	
n-Butane (R9)	P4				2	1.5	0.15	2.2	1.18	
3-Methyl-1-Butene	O5				0.26	0.19		0.28	0.20	
Isopentane	I5	72.15	92.6	48	13	8.5	2	14	7.54	1.04535E-07
1-Pentene	O5	72.15	85	148	0.72	0.54		0.78	0.55	7.58226E-09
2-Methyl-1-Butene	O5				1.8	1.2	0.056	2	1.02	
2-Methyl-1,3-Butadiene	O5									
n-Pentane	P5	72.15	68.4	40.8	9.2	8	2.5	9.3	5.83	8.08403E-08
trans-2-Pentene	O5	70.13	66	203	2.1	1.5		2.3	1.58	2.25607E-08
cis-2-Pentene	O5	70.13	66	203	1.1	0.77		1.2	0.82	1.17392E-08
4-Methylpentene-1	O6	84.16	36.1	48	0.58	0.59	0.14	0.54	0.37	4.42112E-09
Cyclopentane (C14)	N5	70.13	42.4	160	1.6	1.5	0.85	1.6	1.12	1.59168E-08
2,3-Dimethylbutane	I6	86.18	31.3	19.1	3.2	2.3	1.2	3.5	2.05	2.38045E-08
2-Methylpentane	I6	86.18	28.2	13.8	12	10	7.2	13	8.49	9.84854E-08
3-Methylpentane	I6	86.18	26	78	7.8	6.6	5.8	8.1	5.69	6.60459E-08
1-Hexene	O6	84.16	24.8	50	0.77	0.64		0.88	0.61	7.29684E-09
n-Hexane	P6	84.16	20.2	12.3	14	15	2.9	14	9.23	1.09692E-07
trans-2-Hexene	O6				1.8	1.6		1.9	1.42	
2-Methylpentene-2	O6				2.5	2	0.56	2.6	1.54	
cis-2-Hexene	O6				0.92	0.75	0.01	0.96	0.53	
2,2-Dimethylpentane	I7	162.27	14	4.4	0.4	0.4	0.67	0.39	0.37	2.30537E-09
Methylcyclopentane	N6	82.15	18.3	41.8	11	11	9.8	11	8.61	1.04786E-07
2,4-Dimethylpentane	I7	96.17	13.1	4.41	2.2	1.7	1.3	2.4	1.53	1.58942E-08
2,2,3-Trimethylbutane	I7	100.13			0.18	0.15	0.22	0.19	0.15	1.48639E-09
Benzene	A6	78.11	12.7	1790	8.6	6	0.49	8	4.64	5.94543E-08
3,3-Dimethylpentane	I7	100.2	11	5.94	0.28	0.29	0.55	0.27	0.28	2.79006E-09
Cyclohexane	N6	84.16	12.7	57.5	8.2	8.7	9.9	7.8	6.96	8.26868E-08
2-Methylhexane	I7	100.2	8.78	2.54	8	7.5	8.3	8	6.40	6.38301E-08
2,3-Dimethylpentane	I7	96.17	9.18	5.25	3	2.8	3.2	3.1	2.43	2.53053E-08
1,1-Dimethylcyclopentane	N7				1.5	1.6	2.1	1.4	1.33	
3-Methylhexane	I7	100.2	8.21	2.64	8.7	8.5	11	8.6	7.40	7.38663E-08
cis-1,3-Dimethylcyclopentane	N7	96.17	5.3	3.73	3.4	3.3	3.9	3.3	2.80	2.90697E-08
trans-1,3-Dimethylcyclopentane	N7	96.17	5.3	3.73	4.7	4.7	5.2	4.6	3.86	4.01539E-08
3-Ethylpentane	I7				1.3	1.3	1.1	1.4	1.03	
trans-1,2-Dimethylcyclopentane	N7				6.5	6.8	8.2	6.4	5.61	
1-Heptene	O7									
2,2,4-Trimethylpentane (R49)	I8	114.23	6.56							0
trans-3-Heptene	O7	114.19		2.29	0.77	0.67		0.78	0.60	5.2135E-09
n-Heptane	P7	100.2	6.11	3.06	19	21	4.9	17	12.45	1.24248E-07
cis-3-Heptene	O7									
trans-2-Heptene	O7	98.19	6.45	15	1.1	1.1		1	0.86	8.73952E-09
cis-2-Heptene	O7				0.61	0.62		0.59	0.49	
Methylcyclohexane	N7	98.19	6.18	16	22	25	33	21	20.31	2.06881E-07
2,2-Dimethylhexane	I8				0.34	0.38	0.64	0.33	0.34	
Ethylcyclopentane (C48)	N7				4.4	4.4	4.9	4.3	3.62	
2,5-Dimethylhexane (C47)	I8				4.4	4.4	4.9	4.3	3.62	
2,2,3-Trimethylpentane (C50)	I8				3	2.9	3	2.9	2.37	
2,4-Dimethylhexane (C49)	I8				3	2.9	3	2.9	2.37	
ctc-1,2,4-Trimethylcyclopentane	N8				2.8	2.9	3.9	2.6	2.45	
ctc-1,2,3-Trimethylcyclopentane	N8				3.1	3.4	4.5	3	2.82	
2,3,4-Trimethylpentane (R49)	I8	114.23	3.6	2.3						0
Toluene	A7				12	6.4	0.3	12	6.17	
2,3,3-Trimethylpentane (R49)	I8				0.24	0.24	0.064	0.31	0.17	
2,3-Dimethylhexane	I8				2	2	2.2	2	1.65	

COMPOUND	TYPE	M.W. (g/mol)	VAPOR PRESSURE (kPa)	SOLUBILITY (g/m³)	PH-3 97C0282 0213009.D (µg/mg)	MW-5 97C0283 0213010.D (µg/mg)	MW-7 97C0284 0213011.D (µg/mg)	MW-6 97C0285 0213012.D (µg/mg)	Mean Compound Mass per Sample (µg/sample)	Mean No. of Moles per Sample (#moles/sample)
2-Methylheptane	I8				10	11	13	9.3	8.71	
4-Methylheptane	I8				2.8	3	4.3	2.7	2.57	
3-Methylheptane	I8	114.23	260	0.792	6.8	7.1	9.2	6.6	5.97	5.22929E-08
3-Ethylhexane	I8				1.2	1.1	1.8	1.1	1.05	
2,2,5-Trimethylpentane (R49)	I8	114.23	2.21	0.54						0
1-Octene	O8	112.22	2.32	2.7				0.33	0.27	2.36575E-09
n-Octane	P8	114.23	1.88	0.682	18	22	4.8	16	12.23	1.07051E-07
trans-2-Octene	O8				3.5	3.6	4.9	3.4	3.10	
Isopropylcyclopentane	N8	112.22	164	2.04						0
cis-2-Octene	O8				1.4	1.4	1.4	1.1	1.07	
cis-1,2-Dimethylcyclohexane	N8	112.22	1.93	6	0.38	0.45		0.37	0.32	2.86758E-09
ccc-1,3,5-Trimethylcyclohexane	N9				1.1	1.4	1.6	1.2	1.07	
n-Propylcyclopentane	N8				0.85	1.3	1.4	1.2	0.96	
1,1,4-Trimethylcyclohexane	N9									
Ethylbenzene	A8	106.17	1.27	135	9.6	10	4.2	9	6.60	6.21353E-08
ctt-1,2,4-Trimethylcyclohexane	N9				2.9	3.4	4.2	2.7	2.65	
m-Xylene	A8	106.17	1.1	160	8.4	7.1	1.4	7.7	4.95	4.66014E-08
p-Xylene	A8	106.17	1.17	221	22	22	2.4	21	13.56	1.2768E-07
2-Methyloctane	I9				5.2	5.8	7.4	4.8	4.67	
3-Methyloctane	I9									
o-Xylene	A8	106.17	0.882	215	7.6	7.7	1.2	7.2	4.77	4.48965E-08
1-Nonene	O9						4.7	3.1	3.14	
Isobutylcyclopentane (C80)	N9						1.8		1.45	
trans-3-Nonene (C79)	O9						1.8		1.45	
cis-3-Nonene	O9				0.6	0.93		0.56	0.56	
n-Nonane	P9	128.26	0.571	0.122	16	20	1.4	14	10.34	8.06005E-08
trans-2-Nonene	O9				1.1	1.2	0.46	0.84	0.72	
Isopropylbenzene	A9	120.19	0.611	48.3				0.62	0.50	4.15001E-09
n-Butylcyclopentane	N9				1.3	1.4	1.7	1.1	1.11	
3,3-Dimethyloctane	I10				1.3	1.3	1.7	1.1	1.09	
n-Propylbenzene	A9	120.19	0.449	52.2	3.5	3.2	1.9	2.6	2.25	1.8742E-08
1-Methyl-3-Ethylbenzene	A9				10	10		9.3	7.86	
1-Methyl-4-Ethylbenzene	A9	120.19	0.393	94.9	4.3	4.4	1.9	4	2.94	2.44315E-08
2,3-Dimethyloctane	I10				2.5	2.8	4.3	2.3	2.39	
1,3,5-Trimethylbenzene	A9	120.19	0.328	48.2	5.7	5.5	1.8	5.1	3.64	3.02884E-08
3,3,4-Trimethylheptane	I10				3.7	4.2	4.8	3.6	3.28	
tert-Butylbenzene (C94)	A10				16	17	3.8	15	10.42	
1,2,4-Trimethybenzene (C93)	A9				16	17	3.8	15	10.42	
n-Decane	P10	142.28	0.175	0.052	15	18	1.1	12	9.27	6.51663E-08
1-Methyl-3-Isopropylbenzene	A10				1.7	1.8		1.2	1.26	
1-Methyl-4-Isopropylbenzene	A10	134.22	0.204	34.2	0.83	0.9	2.5	0.71	0.99	7.40245E-09
Indan (R98)	A9				2	2	1.1	1.9	1.41	
1-Methyl-2-Isopropylbenzene	A10				2.6	2.8	3.6	2.2	2.25	
1-Methyl-3-n-Propylbenzene (C101)	A10				4	4.2	1.9	3.6	2.76	
1,3-Diethylbenzene (C100)	A10				4	4.2	1.9	3.6	2.76	
1-Methyl-4-n-Propylbenzene (C103)	A10				2.9	3	2	2.3	2.05	
1,4-Diethylbenzene (C102)	A10				2.9	3	2	2.3	2.05	
n-Butylbenzene (C105)	A10	134.22	0.137	13.8	4.9	5	3.2	4.5	3.54	2.63731E-08
1,3-Dimethyl-5-Ethylbenzene (C104)	A10				4.9	5	3.2	4.5	3.54	
1,2-Diethylbenzene	A10				1.3	1.4		1.2	1.05	
1-Methyl-2-n-Propylbenzene	A10				3.2	3.6	4	2.8	2.74	
1,4-Dimethyl-2-Ethylbenzene	A10				2.5	2.5	1.1	2.2	1.67	
1,2-Dimethyl-4-Ethylbenzene	A10				3.6	3.8	2.9	3.4	2.76	
1,3-Dimethyl-2-Ethylbenzene	A10				1	1.3	1.8	1	1.03	
n-Undecane (C112)	P11	156.31	0.0522	0.044	14	16	0.64	12	8.58	5.48651E-08
1,2-Dimethyl-3-Ethylbenzene (C111)	A10	148.25	0.202	65.5	14	16	0.6	12	8.57	5.77938E-08

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Environme[illegible]onitoring and Analysis Unit

Project Title : Sun Company
Data Package #: GRO PIANO Distributions
Data : GRO - GC/FID - SAMPLES

COMPOUND	TYPE	M.W. (g/mol)	VAPOR PRESSURE (kPa)	SOLUBILITY (g/m^3)	PH-3 97C0282 0213009.D (µg/mg)	MW-5 97C0283 0213010.D (µg/mg)	MW-7 97C0284 0213011.D (µg/mg)	MW-6 97C0285 0213012.D (µg/mg)	Mean Compound Mass per Sample (µg/sample)	Mean No. of Moles per Sample (#moles/sample)
1,2,4,5-Tetramethylbenzene	A10	134.22	0.066	3.48			1.4		1.13	8.39145E-09
2-Methylbutylbenzene	A11									
tert-1-Butyl-2-Methylbenzene	A11				0.76	0.98	0.68	0.75	0.64	
n-Pentylbenzene	A11	148.25	4.37E-02	10.5		0.57			0.46	3.09319E-09
t-1-Methyl-2-(4MP)cyclopentane	N12									
t-1-Butyl-3,5-Dimethylbenzene	A12				0.84	0.94	0.95	0.85	0.72	
t-1-Butyl-4-Ethylbenzene	A12						0.12		0.10	
n-Dodecane	P12	170.34	0.0175	0.0034	7.8	9.2	1.9	7.2	5.26	3.0817E-08
1,3,5-Triethylbenzene	A12				0.5	0.53	0.45	0.55	0.41	
1,2,4-Triethylbenzene	A12				0.83	0.76	0.55	0.67	0.57	
n-Hexylbenzene	A12						0.15	0.084	0.09	
n-Tridecane	P13				5.3	5.4		4.7	4.13	
n-Tetradecane	P14				3.6	3.8		3.2	2.84	
n-Pentadecane	P15				2.6	2.6		2	1.93	
SAMPLE MASS (mg)	(mg)				0.818	0.796	0.813	0.791	0.8045	
TOTAL	T				513.64	522.9747	293.4083	488.6384	378.17	2.25772E-06
TOTAL NUMBER OF MOLES									7.62905E-06	
ARITHMETIC MEAN VALUE		105.45	23.03	80.39						
PARAFFINS (WT % OF TOTAL)	P				24.63%	27.25%	6.92%	23.25%		
ISOPAR (WT% OF TOTAL)	I				20.80%	19.00%	35.05%	22.00%		
AROM (WT% OF TOTAL)	A				35.62%	34.53%	20.21%	34.55%		
NAPHTHENES (WT% OF TOTAL)	N				14.74%	15.54%	33.04%	15.06%		
OLEFINS (WT% OF TOTAL)	O				4.21%	3.69%	4.78%	5.14%		

Project Title : Sun Company
Data Package #: GRO PIANO Distributions
Data : GRO - GC/FID - SAMPLES

COMPOUND	TYPE	Compound Mole Fraction X_i (unitless)	Effective Solubility S_i (g/m^3)	Vapor-phase Concnetration C_i (g/m^3)	Mass Rate of Flus N_i (g/m^2-sec)	Mass Rate of Flus N_i (kg/yr)
n-Propane (R9)	P3	1.08825E-05				
Isobutane (R5)	I4					
n-Butane (R9)	P4					
3-Methyl-1-Butene	O5					
Isopentane	I5	0.013702212	0.657706168	39.40110544	7.79851E-07	327.9117722
1-Pentene	O5	0.000993867	0.14709233	2.62333638	3.4365E-09	1.444979782
2-Methyl-1-Butene	O5					
2-Methyl-1,3-Butadiene	O5					
n-Pentane	P5	0.010596377	0.432332188	22.50713686	2.53772E-07	106.706148
trans-2-Pentene	O5	0.002957213	0.600314305	5.891160243	1.78395E-08	7.501163505
cis-2-Pentene	O5	0.001538753	0.312366935	3.06540033	4.82784E-09	2.030008322
4-Methylpentene-1	O6	0.000579511	0.027816532	0.757783391	2.45749E-10	0.103332397
Cyclopentane (C14)	N5	0.002086339	0.33381425	2.670084415	3.66269E-09	1.540085884
2,3-Dimethylbutane	I6	0.00312025	0.05959678	3.622518912	5.48641E-09	2.306925812
2-Methylpentane	I6	0.012909271	0.178147935	13.50292052	7.63312E-08	32.09573128
3-Methylpentane	I6	0.008657165	0.675258863	8.348836108	2.91606E-08	12.2614334
1-Hexene	O6	0.000956454	0.047822716	0.859195615	3.1593E-10	0.132842342
n-Hexane	P6	0.01437814	0.17685112	10.52035045	4.74294E-08	19.94310453
trans-2-Hexene	O6					
2-Methylpentene-2	O6					
cis-2-Hexene	O6					
2,2-Dimethylpentane	I7	0.000302183	0.001329606	0.295465741	1.93752E-11	0.00814689
Methylcyclopentane	N6	0.013735104	0.574127339	8.887119316	3.46675E-08	14.57697691
2,4-Dimethylpentane	I7	0.002083386	0.009187732	1.129668555	4.77951E-10	0.200968675
2,2,3-Trimethylbutane	I7	0.000194833				
Benzene	A6	0.00779315	13.94973864	3.327314143	5.1069E-09	2.147348902
3,3-Dimethylpentane	I7	0.000365715	0.002172347	0.173489677	1.08181E-11	0.00454878
Cyclohexane	N6	0.010838424	0.623209352	4.965927647	1.0645E-08	4.476019004
2-Methylhexane	I7	0.008366718	0.021251464	3.168019077	3.60852E-09	1.517309069
2,3-Dimethylpentane	I7	0.00331697	0.017414091	1.260358816	5.94944E-10	0.250162124
1,1-Dimethylcyclopentane	N7					
3-Methylhexane	I7	0.00968224	0.025561114	3.428128779	4.22552E-09	1.776748015
cis-1,3-Dimethylcyclopentane	N7	0.003810403	0.014212804	0.835904806	2.61685E-10	0.110033397
trans-1,3-Dimethylcyclopentane	N7	0.005263291	0.019632074	1.154631099	4.99308E-10	0.20994914
3-Ethylpentane	I7					
trans-1,2-Dimethylcyclopentane	N7					
1-Heptene	O7					
2,2,4-Trimethylpentane (R49)	I8	0				
trans-3-Heptene	O7	0.000683375	0.00156493	0	0	0
n-Heptane	P7	0.016286159	0.049835647	4.291390263	6.62225E-09	2.784524896
cis-3-Heptene	O7					
trans-2-Heptene	O7	0.001145558	0.017183375	0.312258725	3.57634E-11	0.01503781
cis-2-Heptene	O7					
Methylcyclohexane	N7	0.027117513	0.43388021	7.082327428	1.84124E-08	7.742042298
2,2-Dimethylhexane	I8					
Ethylcyclopentane (C48)	N7					
2,5-Dimethylhexane (C47)	I8					
2,2,3-Trimethylpentane (C50)	I8					
2,4-Dimethylhexane (C49)	I8					
ctc-1,2,4-Trimethylcyclopentane	N8					
ctc-1,2,3-Trimethylcyclopentane	N8					
2,3,4-Trimethylpentane (R49)	I8	0		0	0	0
Toluene	A7					
2,3,3-Trimethylpentane (R49)	I8					
2,3-Dimethylhexane	I8					

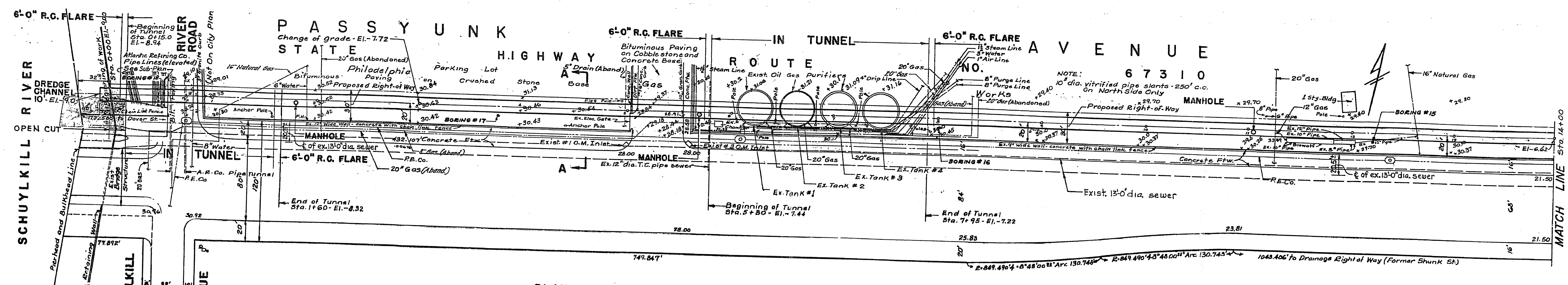
Project Title : Sun Company
Data Package #: GRO PIANO Distributions
Data : GRO - GC/FID - SAMPLES

COMPOUND	TYPE	Compound Mole Fraction X_i (unitless)	Effective Solubility S_i (g/m^3)	Vapor-phase Concnetration C_i (g/m^3)	Mass Rate of Flus N_i (g/m^2-sec)	Mass Rate of Flus N_i (kg/yr)
2-Methylheptane	I8					
4-Methylheptane	I8					
3-Methylheptane	I8	0.006854441	0.005428717	87.61852735	2.44215E-06	1026.874345
3-Ethylhexane	I8					
2,2,5-Trimethylpentane (R49)	I8	0		0	0	0
1-Octene	O8	0.000310098	0.000837265	0.03474786	3.87479E-13	0.000162927
n-Octane	P8	0.014031986	0.009569815	1.296962982	5.30388E-10	0.223017483
trans-2-Octene	O8					
Isopropylcyclopentane	N8	0		0	0	0
cis-2-Octene	O8					
cis-1,2-Dimethylcyclohexane	N8	0.000375877	0.002255261	0.035038334	3.93985E-13	0.000165663
ccc-1,3,5-Trimethylcyclohexane	N9					
n-Propylcyclopentane	N8					
1,1,4-Trimethylcyclohexane	N9					
Ethylbenzene	A8	0.008144563	1.099515965	0.472654413	7.57826E-11	0.031865058
ctt-1,2,4-Trimethylcyclohexane	N9					
m-Xylene	A8	0.006108422	0.977347524	0.307039284	3.19788E-11	0.013446439
p-Xylene	A8	0.016736083	3.698674369	0.894771022	2.71598E-10	0.11420133
2-Methyloctane	I9					
3-Methyloctane	I9					
o-Xylene	A8	0.005884943	1.265262782	0.237182741	1.90826E-11	0.00802384
1-Nonene	O9					
Isobutylcyclopentane (C80)	N9					
trans-3-Nonene (C79)	O9					
cis-3-Nonene	O9					
n-Nonane	P9	0.010564954	0.001288924	0.333016214	3.11397E-11	0.013093606
trans-2-Nonene	O9					
Isopropylbenzene	A9	0.000543975	0.026274002	0.017193292	8.85751E-14	3.72441E-05
n-Butylcyclopentane	N9					
3,3-Dimethyloctane	I10					
n-Propylbenzene	A9	0.002456662	0.128237764	0.057059836	9.75565E-13	0.000410206
1-Methyl-3-Ethylbenzene	A9					
1-Methyl-4-Ethylbenzene	A9	0.003202435	0.303911041	0.065104583	1.27004E-12	0.000534028
2,3-Dimethyloctane	I10					
1,3,5-Trimethylbenzene	A9	0.003970141	0.19136082	0.067362558	1.35967E-12	0.000571713
3,3,4-Trimethylheptane	I10					
tert-Butylbenzene (C94)	A10					
1,2,4-Trimethybenzene (C93)	A9					
n-Decane	P10	0.008541867	0.000444177	0.091538781	2.12095E-12	0.000891818
1-Methyl-3-Isopropylbenzene	A10					
1-Methyl-4-Isopropylbenzene	A10	0.000970299	0.033184216	0.01143466	3.50825E-14	1.47515E-05
Indan (R98)	A9					
1-Methyl-2-Isopropylbenzene	A10					
1-Methyl-3-n-Propylbenzene (C101)	A10					
1,3-Diethylbenzene (C100)	A10					
1-Methyl-4-n-Propylbenzene (C103)	A10					
1,4-Diethylbenzene (C102)	A10					
n-Butylbenzene (C105)	A10	0.003456935	0.047705699	0.027358948	2.00837E-13	8.4448E-05
1,3-Dimethyl-5-Ethylbenzene (C104)	A10					
1,2-Diethylbenzene	A10					
1-Methyl-2-n-Propylbenzene	A10					
1,4-Dimethyl-2-Ethylbenzene	A10					
1,2-Dimethyl-4-Ethylbenzene	A10					
1,3-Dimethyl-2-Ethylbenzene	A10					
n-Undecane (C112)	P11	0.007191611	0.000316431	0.025255377	1.46955E-13	6.17915E-05
1,2-Dimethyl-3-Ethylbenzene (C111)	A10	0.007575488	0.496194495	0.097639854	2.31592E-12	0.000973799

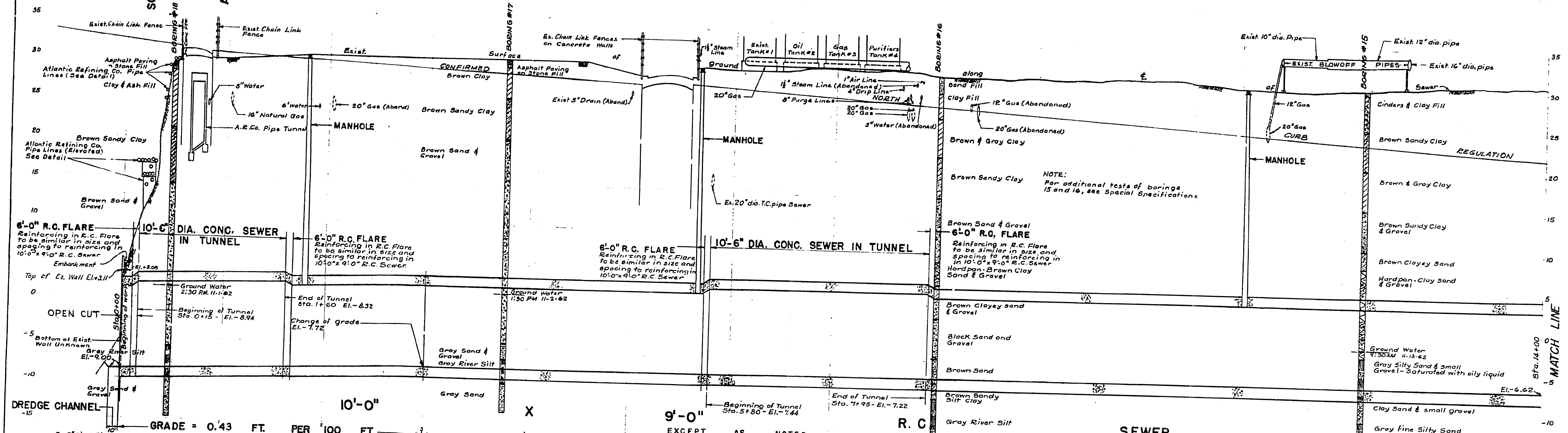
Project Title : Sun Company
Data Package #: GRO PIANO Distributions
Data : GRO - GC/FID - SAMPLES

COMPOUND	TYPE	Compound Mole Fraction X_i (unitless)	Effective Solubility S_i (g/m^3)	Vapor-phase Concnetration C_i (g/m^3)	Mass Rate of Flus N_i (g/m^2-sec)	Mass Rate of Flus N_i (kg/yr)
1,2,4,5-Tetramethylbenzene	A10	0.001099934	0.00382777	0.004193707	4.7189E-15	1.9842E-06
2-Methylbutylbenzene	A11					
tert-1-Butyl-2-Methylbenzene	A11					
n-Pentylbenzene	A11	0.000405449	0.004257211	0.001130531	3.10478E-16	1.3055E-07
t-1-Methyl-2-(4MP)cyclopentane	N12					
t-1-Butyl-3,5-Dimethylbenzene	A12					
t-1-Butyl-4-Ethylbenzene	A12					
n-Dodecane	P12	0.004039426	1.3734E-05	0.005182564	5.67851E-15	2.3877E-06
1,3,5-Triethylbenzene	A12					
1,2,4-Triethylbenzene	A12					
n-Hexylbenzene	A12					
n-Tridecane	P13					
n-Tetradecane	P14					
n-Pentadecane	P15					
SAMPLE MASS (mg)	(mg)					
TOTAL	T	0.295937047	2.77E+01	2.46E+02	3.75E-06	1.58E+03
TOTAL NUMBER OF MOLES						
ARITHMETIC MEAN VALUE			5.77E-01	4.82E+00	7.35E-08	3.09E+01

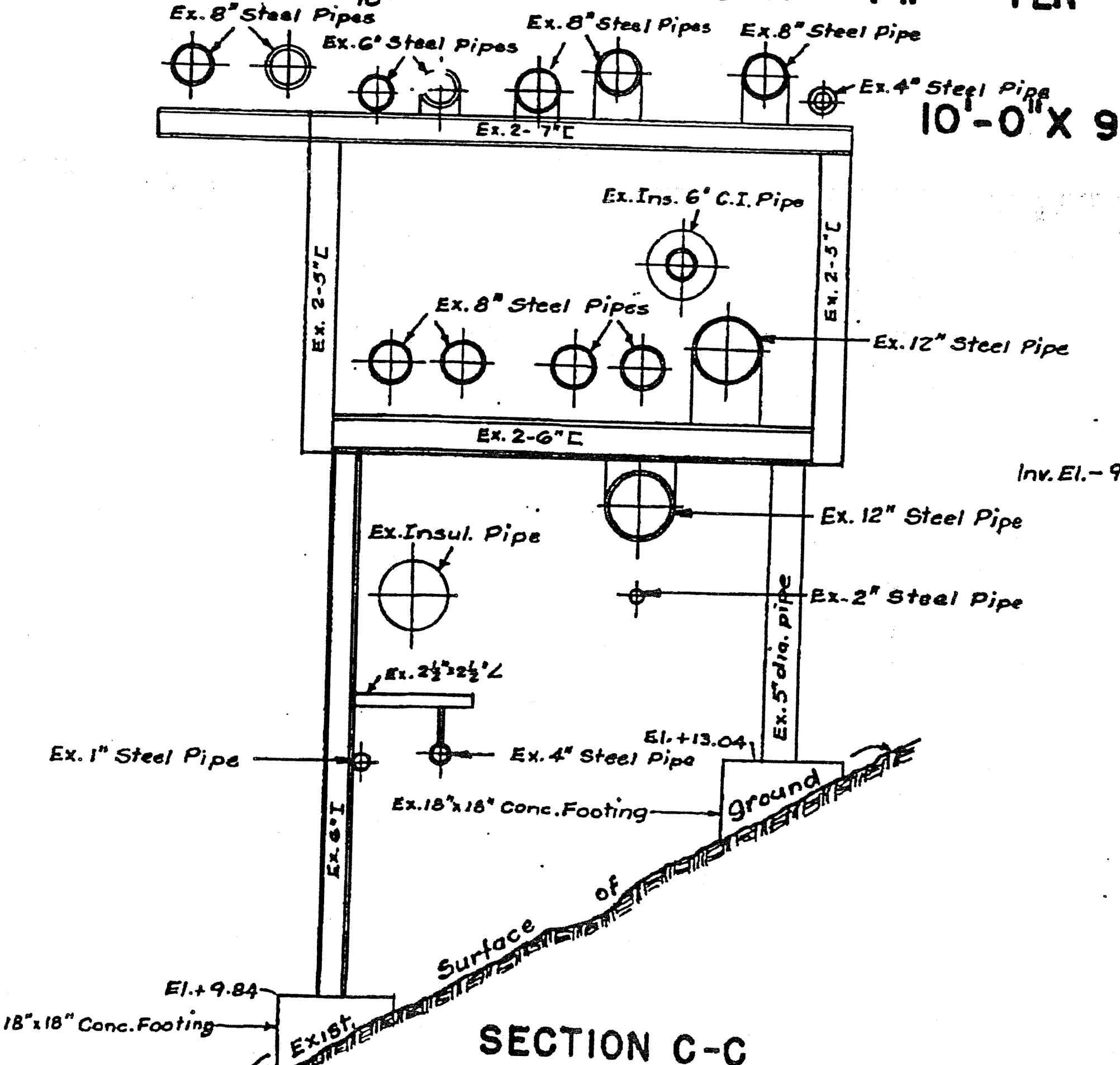
PARAFFINS (WT % OF TOTAL)	P
ISOPAR (WT% OF TOTAL)	I
AROM (WT% OF TOTAL)	A
NAPHTHENES (WT% OF TOTAL)	N
OLEFINS (WT% OF TOTAL)	O



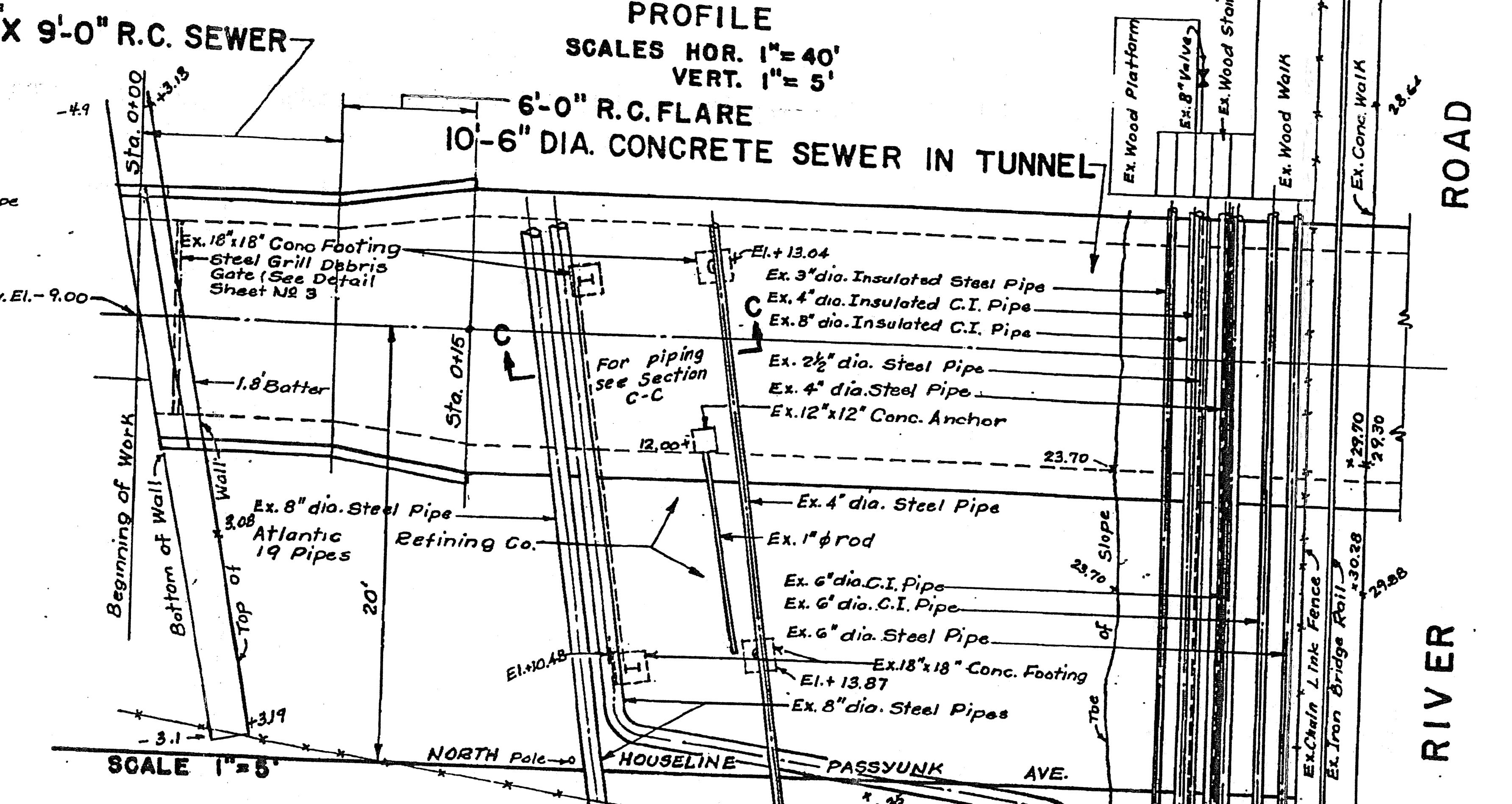
PLAN
SCALE 1"= 40'



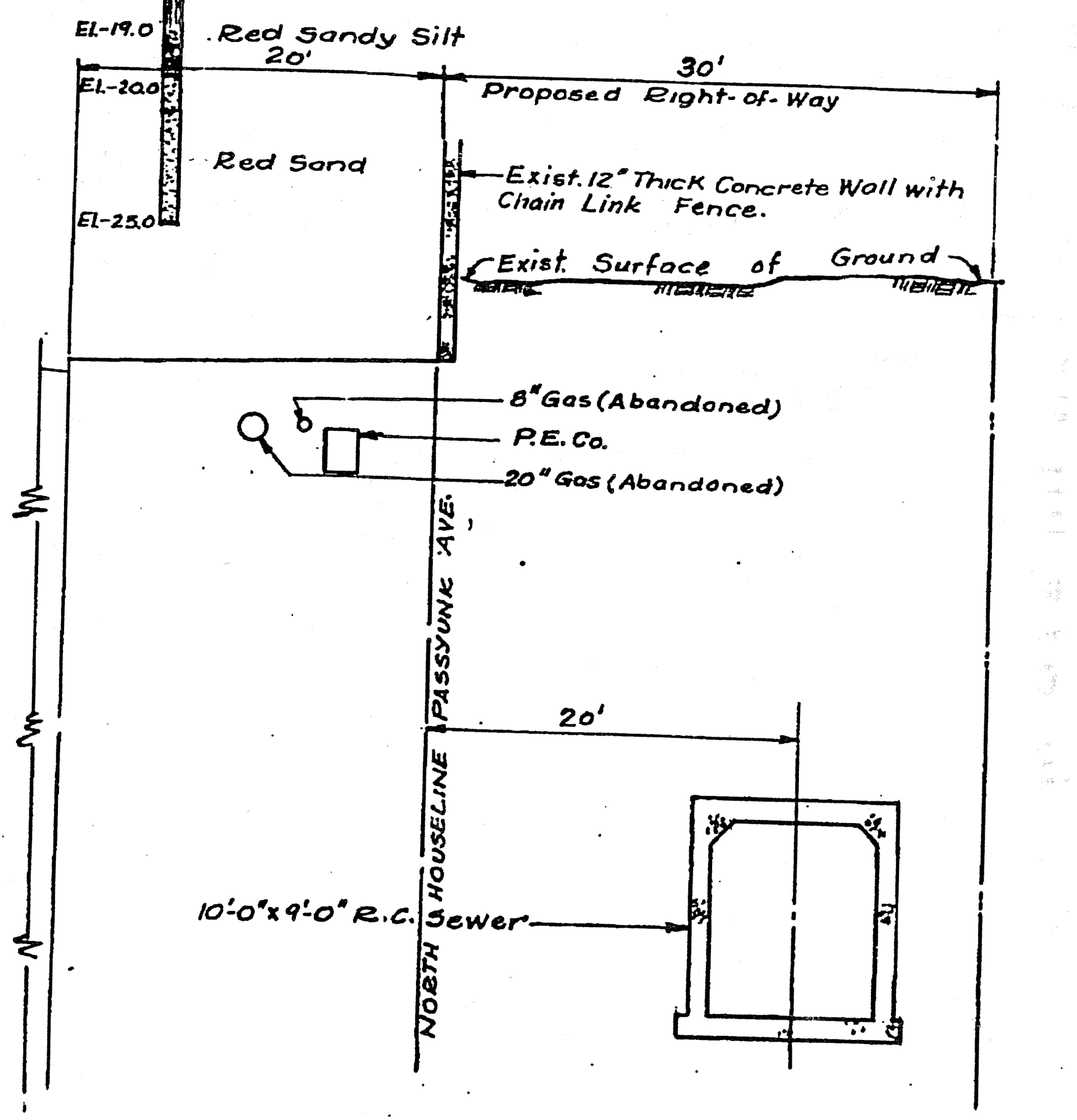
PROFILE
SCALES HOR. 1"= 40'
VERT. 1"= 5'



SECTION C-C
EXISTING ATLANTIC REFINING CO. PIPE STAND
SCALE ½" = 1'-0"



SUB-PLAN
NEW 10'-6" DIA. CONC. SEWER IN TUNNEL
WITH EXIST. ATLANTIC REFINING COMPANY PIPES



SECTION "A-A"
SCALE ⅛" = 1'-0"

NOTE:
All distances are in District Standard Measurement and payment will be based upon this Measurement.

The Contractor shall field check elevations of existing sewers before making connections or adjustments.

For additional notes see Special Specifications

PROJECT APW-PA-156 G
PASSYUNK RELIEF SEWER

CITY PROPERTY (PHILA. GAS WORKS STATION A) AND IN PRIVATE PROPERTY
NORTH OF PASSYUNK AVENUE
FROM
THE SCHUYLKILL RIVER TO 28TH STREET
AND IN
28TH STREET
FROM
PASSYUNK AVENUE TO 86 FEET± NORTH OF PASSYUNK AVENUE

APPROVED A. Finkelstein
CHIEF, DESIGN BRANCH, ENGINEERING BUREAU

APPROVED Samuel S. Baxter
CHIEF ENGINEER

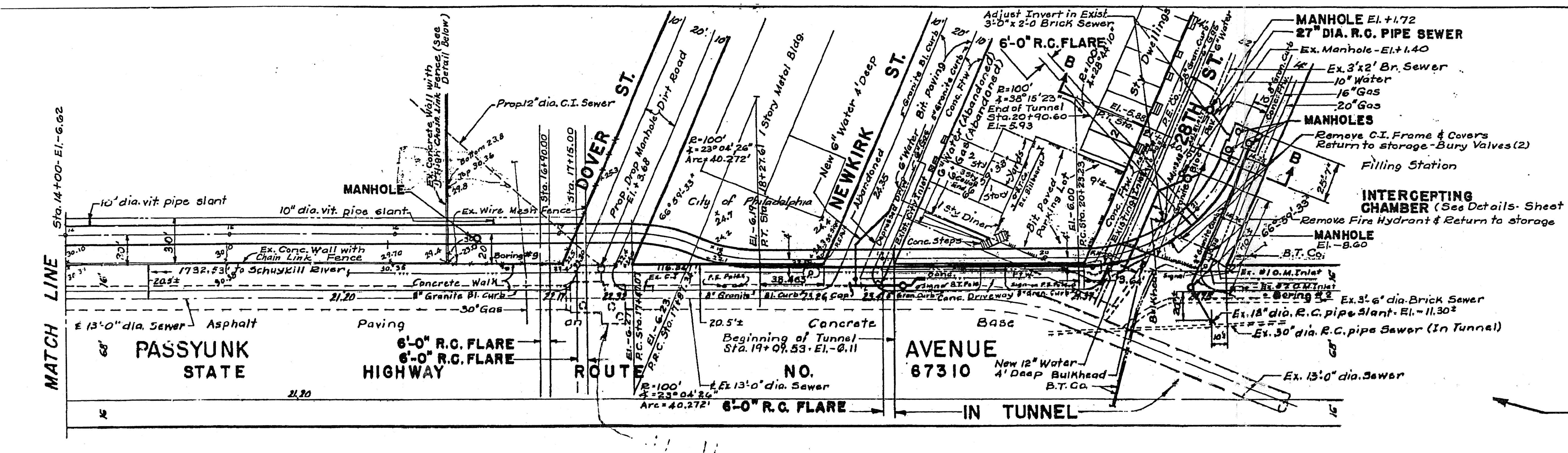
CITY OF PHILADELPHIA
WATER DEPARTMENT

SCALE - AS NOTED

WORK NO. S-3117 F

SHEET NO. 1 OF 4 SHEETS

DRAWN BY	J.H. MIRKIL	12-3-62
CHECKED BY	A. Strouse	10 Dec. 1962
SUPERVISER		12-19-62
HIGHWAY SUPV		12-12-62



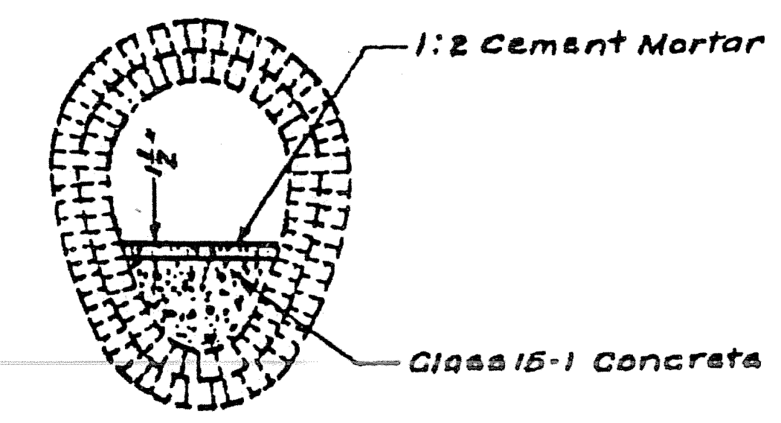
PLAN
SCALE 1" = 40'

28TH STREET
WATER BILL OF MATERIAL

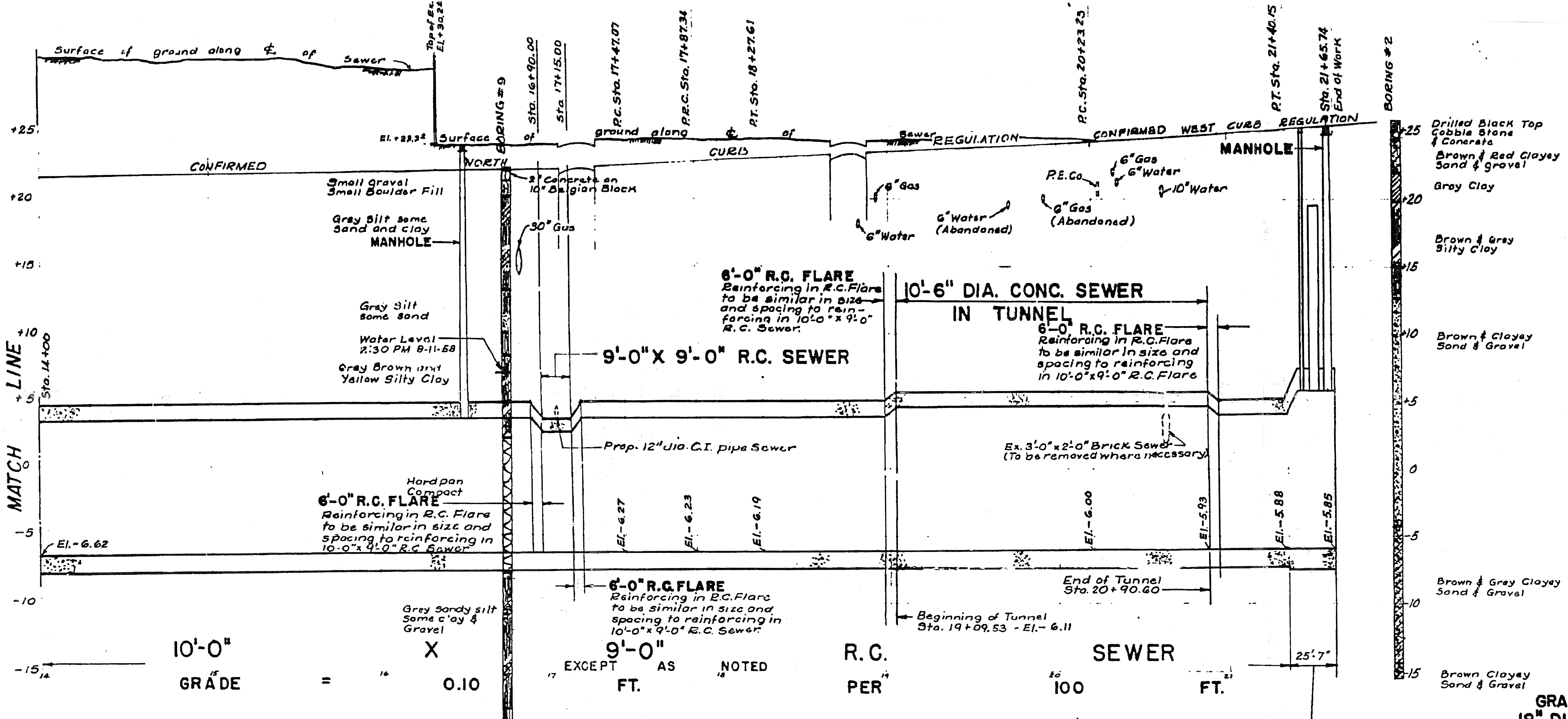
1	12" M.J. VALVE
1	STD. CONC. VALVE BOX (COMPLETE)
2	12" M.J. 1/8 BENDS (HOR.)
1	10" M.J. 1/16 BEND (HOR.)
2	10" C.I. SLEEVES (B&S TYPE)
1	12" X 10" C.I. REDUCER (M.J. TYPE)
1	12" X 10" C.I. REDUCER (BELL & BELL)
96'±	12" C.I. TYTON JOINT PIPE

NEWKIRK STREET
WATER BILL OF MATERIAL

1	6" M.J. VALVE
1	STD. CONC. VALVE BOX (COMPLETE)
1	6" X 6" M.J. TEE
3	6" M.J. 1/8 BENDS (HOR.)
1	6" M.J. 1/16 BEND (HOR.)
2	6" C.I. SLEEVES (B&S TYPE)
1	6" C.I. CAP (M.J. TYPE)
108'±	6" C.I. TYTON JOINT PIPE

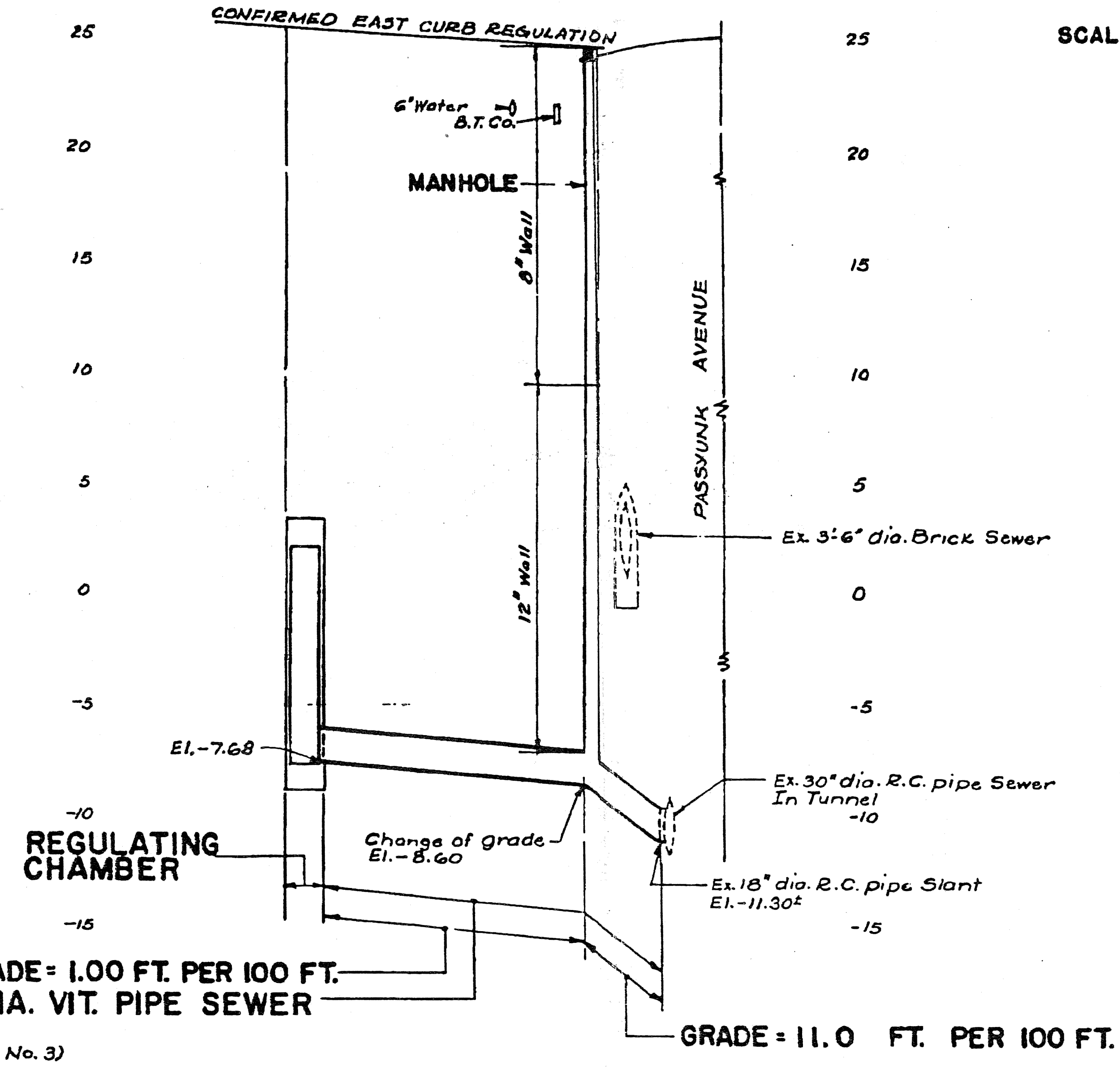


DETAIL
ADJUSTMENT OF INVERT OF EXISTING 3'-0" X 2'-0" BRICK SEWER
SCALE ½" = 1'-0"



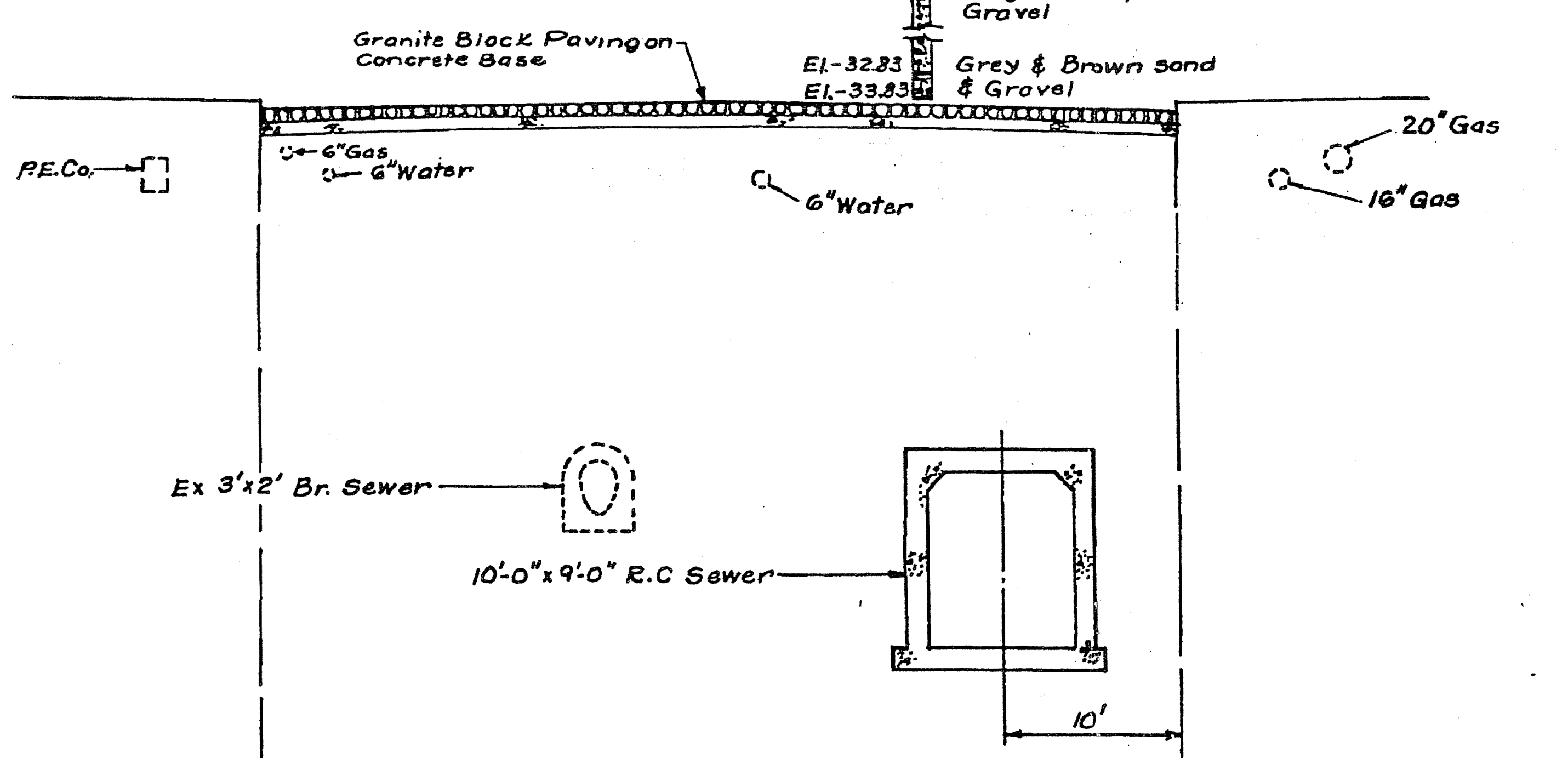
PROFILE
SCALE HOR. 1" = 40'
VERT. 1" = 5'

INTERCEPTING CHAMBER (See Details - Sheet No. 3)

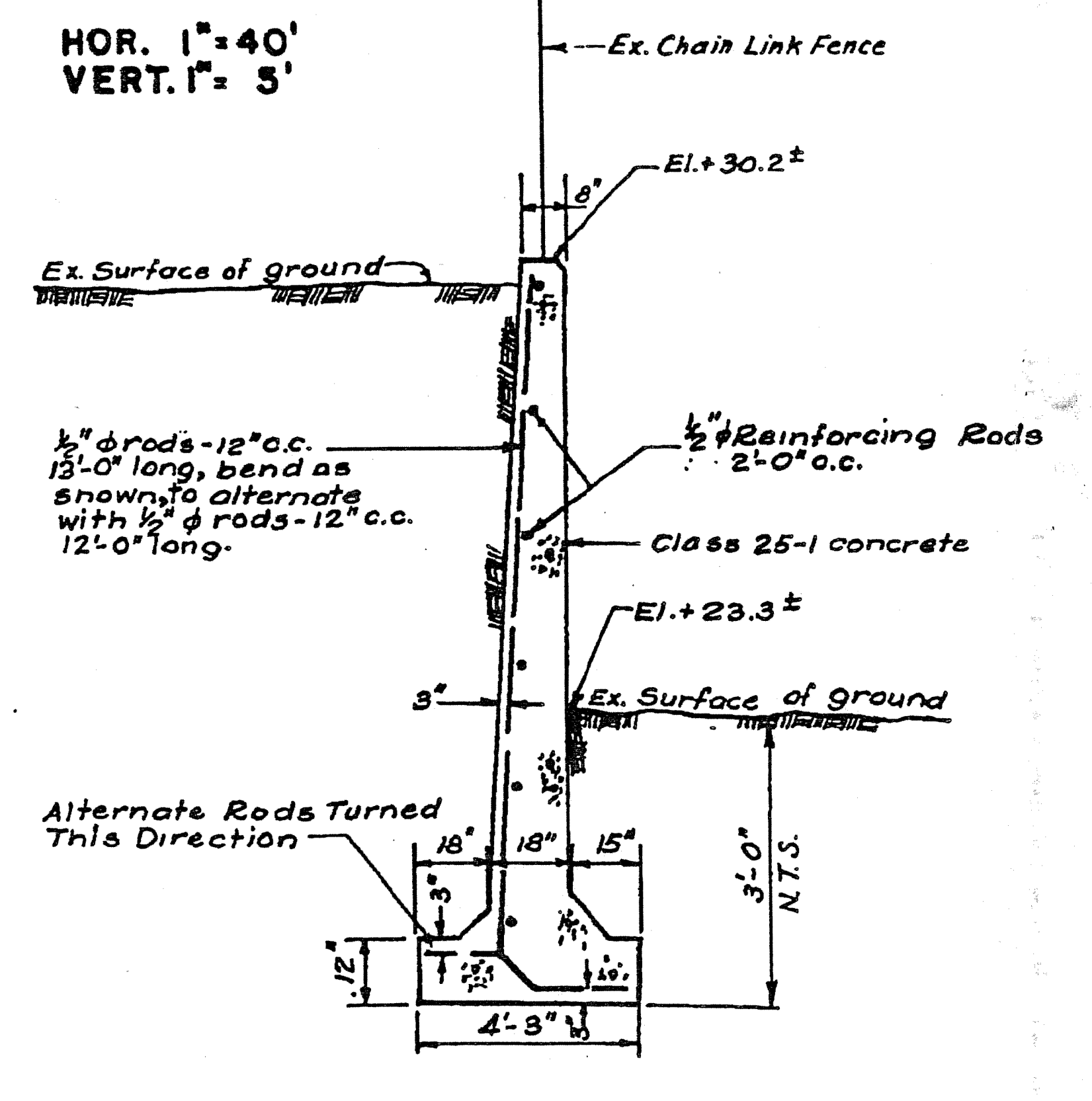


PROFILE ALONG 28TH ST.
SCALE HOR. 1" = 40'
VERT. 1" = 5'

For Notes see Sheet No. 1



SECTION B-B
SCALE ⅛" = 1'-0"



DETAIL OF EX. CONCRETE WALL
SCALE ⅜" = 1'-0"

PROJECT APW-PA-156 G

PASSYUNK RELIEF SEWER

CITY PROPERTY (PHILA. GAS WORKS STATION A) AND IN PRIVATE PROPERTY
NORTH OF PASSYUNK AVENUE
FROM
THE SCHUYLKILL RIVER TO 28TH STREET
AND IN
28TH STREET
FROM
PASSYUNK AVENUE TO 86 FEET± NORTH OF PASSYUNK AVENUE

CITY OF PHILADELPHIA
WATER DEPARTMENT

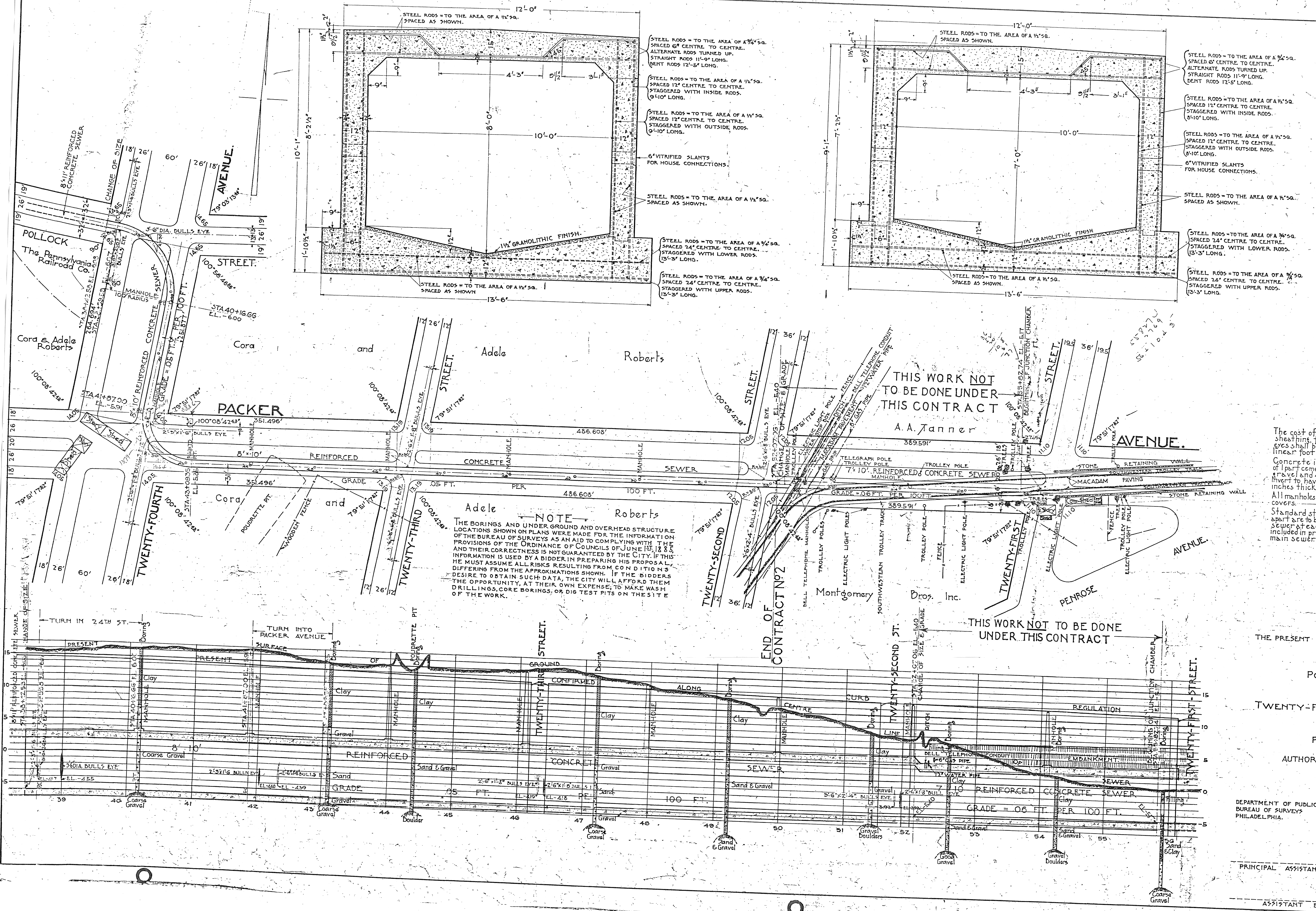
APPROVED A. Finkelstein
CHIEF, DESIGN BRANCH, ENGINEERING BUREAU

SCALE: AS NOTED

WORK NO. S-3117 F

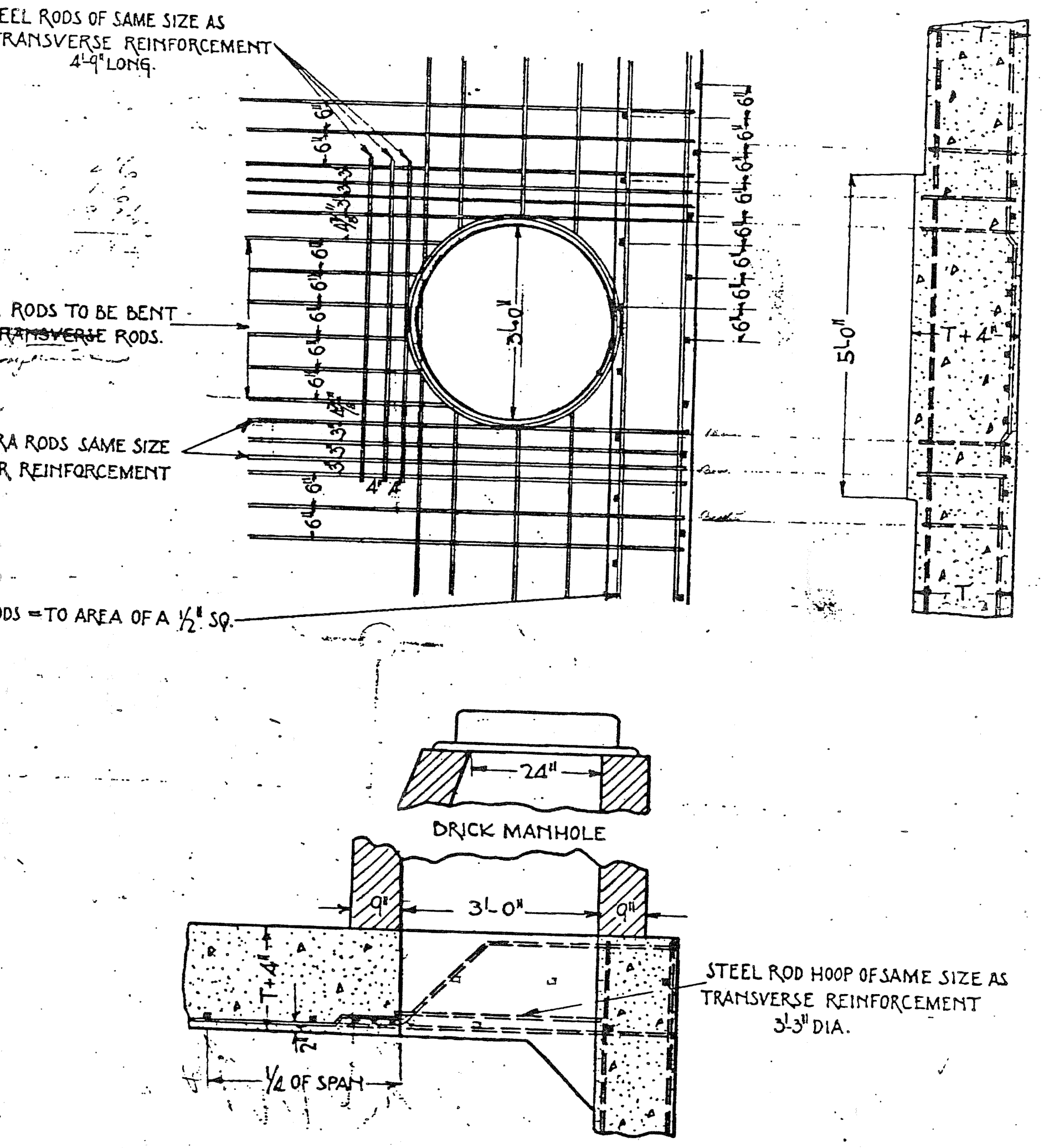
SHEET NO. 2 OF 4 SHEETS

DRAWN BY	J.H. MIRKIL	12-4-62
CHECKED BY	A. Strouse	10 Dec. 1962
SUPERVISOR		12-19-62
HIGHWAY SUPV.		
P.&W. CO.		



—NOTE—

THE BORINGS AND UNDER GROUND AND OVERHEAD STRUCTURE LOCATIONS SHOWN ON PLANS WERE MADE FOR THE INFORMATION OF THE BUREAU OF SURVEYS AS AN AID TO COMPLYING WITH THE PROVISIONS OF THE ORDINANCE OF COUNCILS OF JUNE 1ST, 1885, AND THEIR CORRECTNESS IS NOT GUARANTEED BY THE CITY. IF THIS INFORMATION IS USED BY A BIDDER IN PREPARING HIS PROPOSAL, HE MUST ASSUME ALL RISKS RESULTING FROM CONDITIONS DIFFERING FROM THE APPROXIMATIONS SHOWN. IF THE BIDDERS DESIRE TO OBTAIN SUCH DATA, THE CITY WILL AFFORD THEM THE OPPORTUNITY, AT THEIR OWN EXPENSE, TO MAKE WASH DRILLINGS, CORE BORINGS, OR DIG TEST PITS ON THE SITE OF THE WORK.



DETAILS OF REINFORCING AT ALL MANHOLES
Scale 1/2" = 1'-0"

GENERAL NOTES

The cost of all excavation, shoring, sheathing, forms, manholes and bulls-eyes shall be included in price bid per linear foot of main sewer.

Concrete in sewer shall be composed of 1 part cement, 2 parts sand or Jersey gravel and 4 parts crushed stone. Invert to have a granolithic finish 1½ inches thick.

All manholes to have cast iron closed covers.

Standard steps not more than 14 inches apart are to be built in manhole and sewer at each manhole, the cost to be included in price bid per linear foot of main sewer.

Work under this contract must be started at stations 30+59, 38+42 and 45+00 simultaneously, with sufficient equipment and force of workmen to prosecute the work at maximum speed, and no additional compensation will be allowed for expense incidental to constructing such sections without outlets completed.

It is the intention to complete Contract #1 from the money available. Should the funds remaining be insufficient to complete contract #2 as shown on plans, the low bidder will be determined by the greatest length of sewer that can be built with the money available beginning at station 30+59 and extending eastwardly.

CONTRACT #2
MAIN SEWER
IN
POLLOCK STREET
FROM
THE PRESENT SEWER, NEAR THIRTIETH STREET TO TWENTY-FOURTH STREET.
IN
TWENTY-FOURTH STREET
FROM
POLLOCK STREET TO PACKER STREET.
IN
PACKER STREET
FROM
TWENTY-FOURTH STREET TO COLORADO STREET
AND IN
MOYAMENSING AVENUE
FROM
PACKER STREET TO COLORADO STREET

AUTHORIZED BY ORDINANCE OF COUNCILS JULY 27, 1916.

APPROVED BY THE BOARD OF SURVEYORS JULY 8TH, 1918.

DEPARTMENT OF PUBLIC WORKS
BUREAU OF SURVEYS
PHILADELPHIA.

CHIEF ENGINEER & SURVEYOR

APPROVED

DIRECTOR.

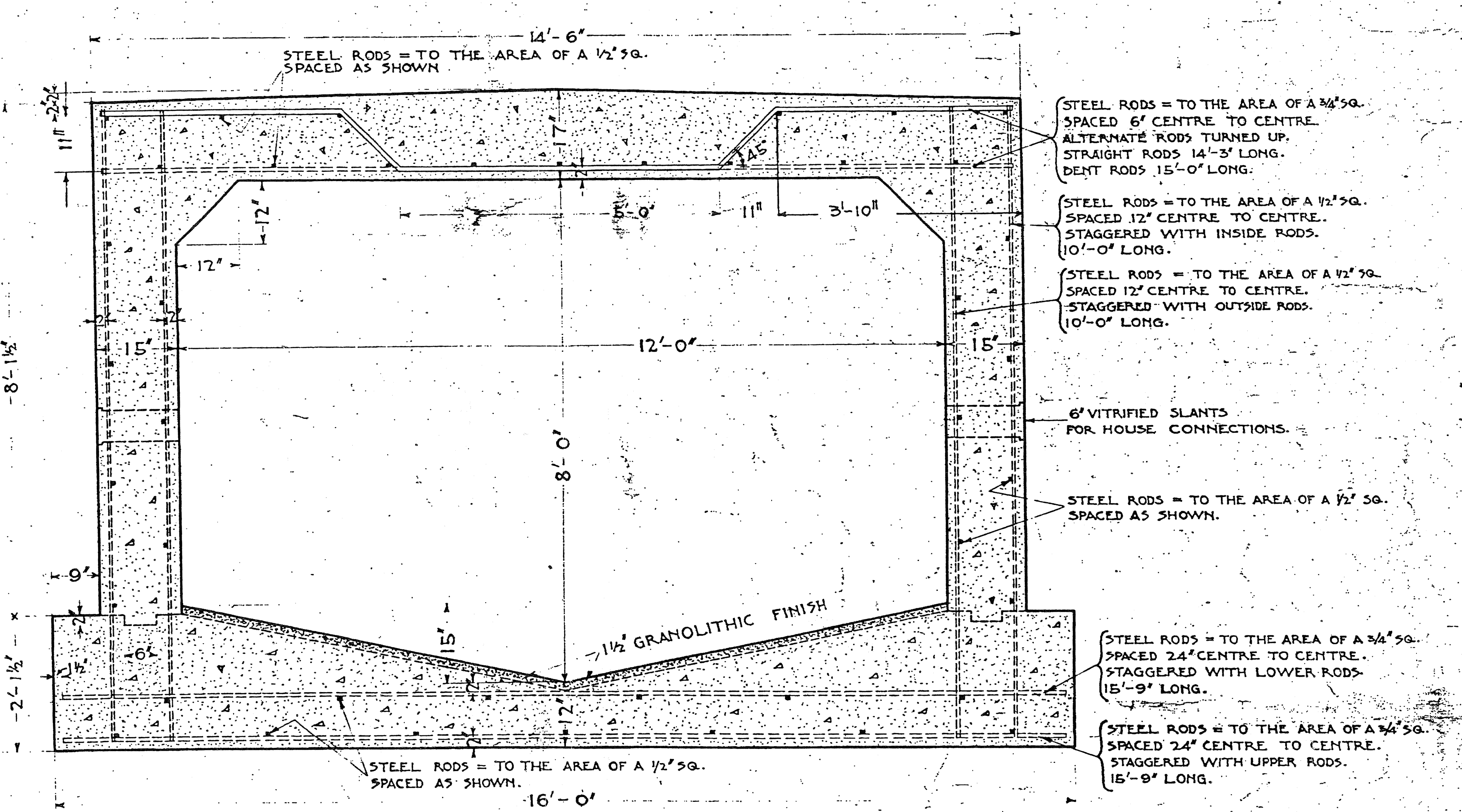
PRINCIPAL ASSISTANT ENGINEER.

ASSISTANT ENGINEER.

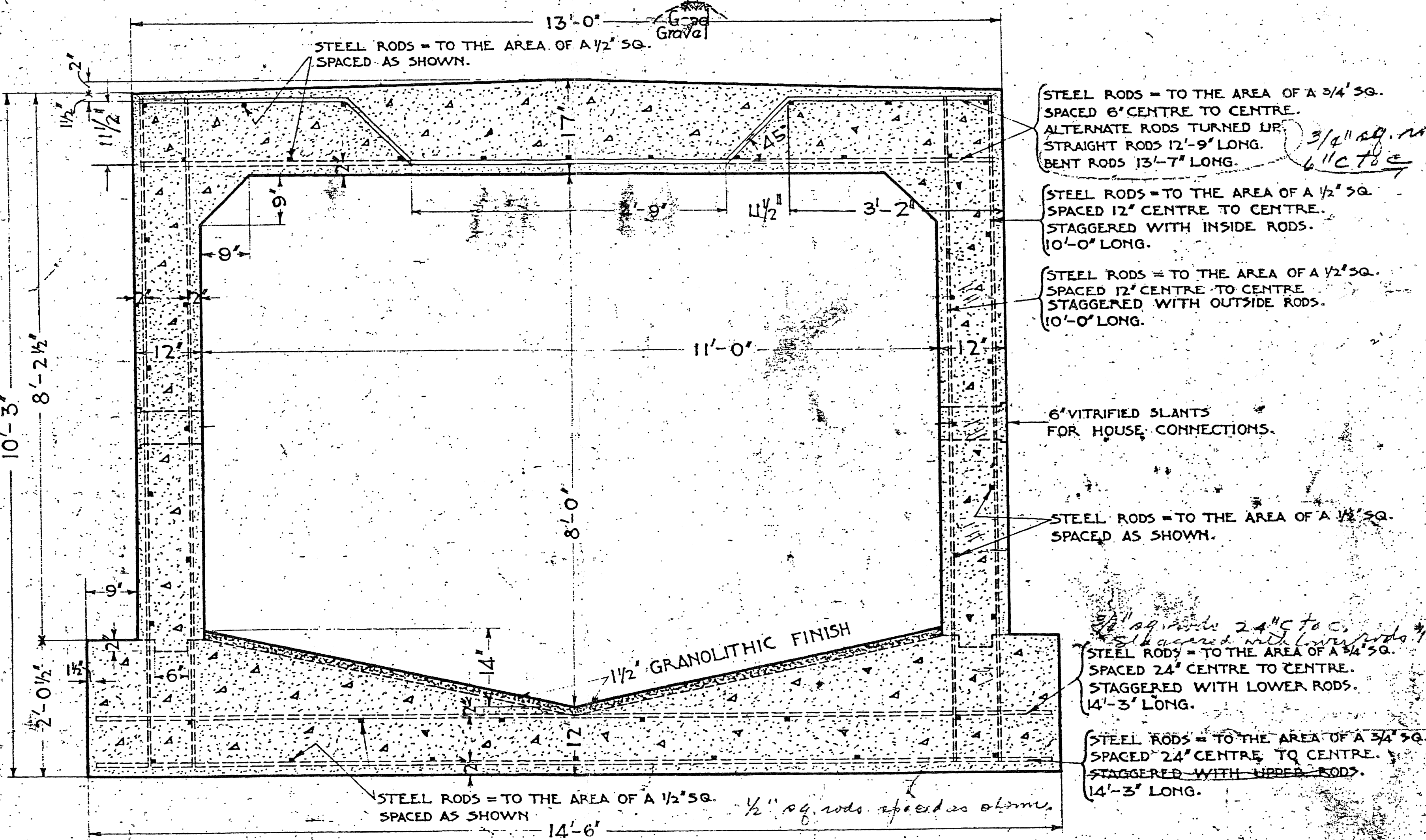
SCALES
PLAN 1" = 50'
PROFILE HOR 1" = 50'
VER 1" = 5'

SEWER DIVISION		
Drawn by		Date
Traced by		Date
Checked by		Date

18C-44



Cross Section
Scale 3/4"=1'-0"



Cross Section
Scale 3/4"=1'-0"

CONTRACTS #1 & 2

MAIN SEWER
IN
POLLOCK STREET
FROM
THE PRESENT SEWER, NEAR THIRTIETH STREET
IN
TWENTY-FOURTH
FROM
POLLOCK STREET TO PACKE
IN
PACKER STR
FROM
TWENTY-FOURTH STREET TO COLORADO STREET
AND IN
MOYAMENSING AVENUE
FROM
PACKER STREET TO COLORADO STREET

AUTHORIZED BY ORDINANCE OF COUNCILS JULY 27, 1916.

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DEPARTMENT OF PUBLIC WORKS
BUREAU OF SURVEYS
PHILADELPHIA.

Chas. E. Albright
CHIEF ENGINEER & SURVEYOR.

APPROVED Geo. E. Datesman
DIRECTOR.

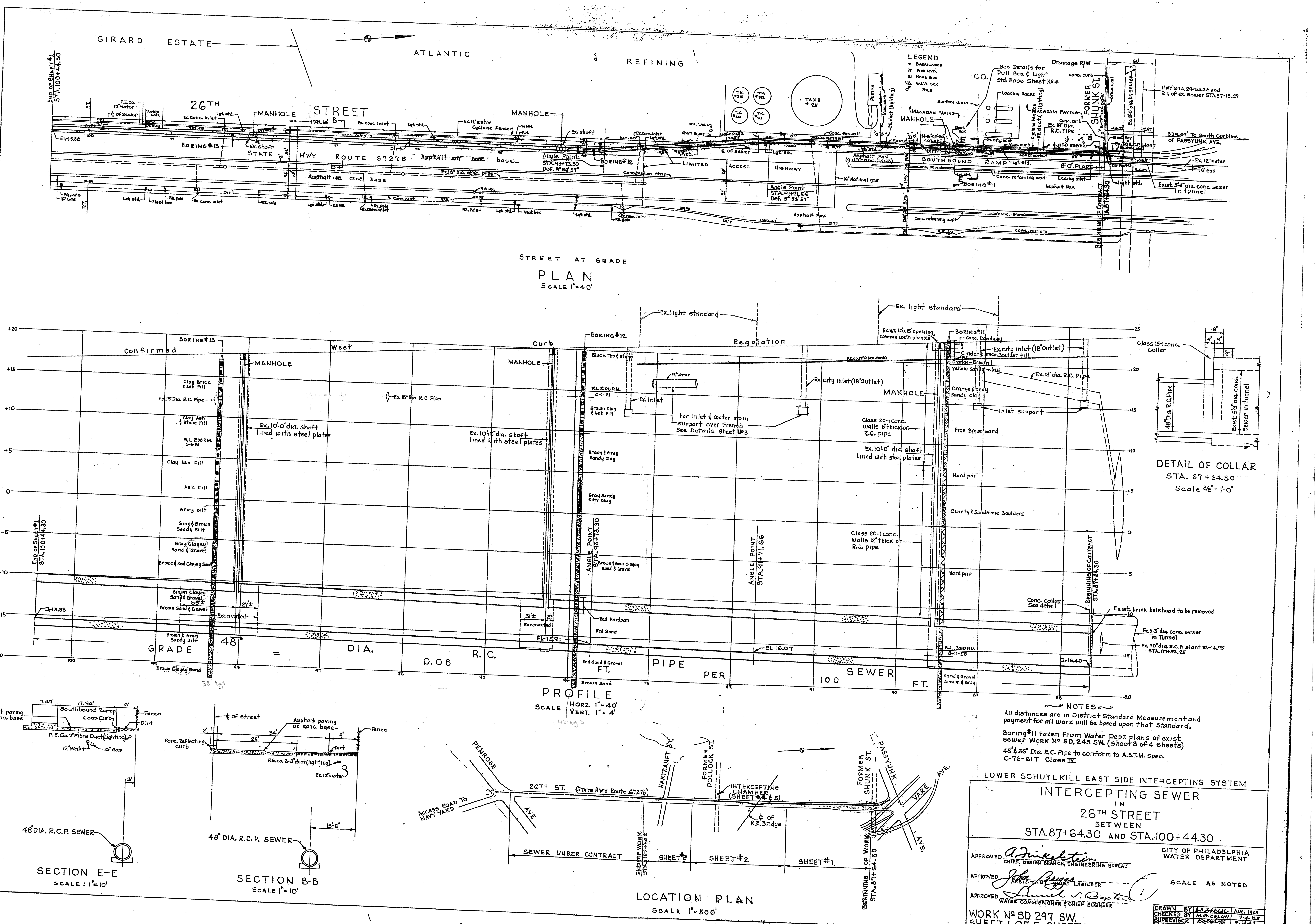
Chas. Frommer
PRINCIPAL ASSISTANT ENGINEER.

John E. Allen
ASSISTANT ENGINEER.

SCALES
PLAN 1" = 50'
PROFILE HOR. 1" = 50'
VER. 1" = 5'

SEWER DIVISION		
Drawn by	J. R. W. Lindley	Date 7-12-16
Traced by	J. R. W. Lindley	Date 7-21-16
Checked by	E. T. Schofield	Date 7-7-19

18C-42



~ NOTES ~

All distances are in District Standard Measurement and payment for all work will be based upon that Standard.

Boring #11 taken from Water Dept. plans of exist. sewer Work No SD. 243 SW. (sheet 3 of 4 sheets)

48" & 36" Dia. R.C. Pipe to conform to A.S.T.M. spec. C-76-61T Class IV

LOWER SCHUYLKILL EAST SIDE INTERCEPTING SYSTEM

INTERCEPTING SEWER
IN
26TH STREET
BETWEEN
STA.87+64.30 AND STA.100+44.30

CITY OF PHILADELPHIA
WATER DEPARTMENT

APPROVED A. Finkelstein
CHIEF, DESIGN BRANCH, ENGINEERING BUREAU

APPROVED John Briggs
ASSISTANT CHIEF ENGINEER

APPROVED Samuel S. Baxter
WATER COMMISSIONER & CHIEF ENGINEER

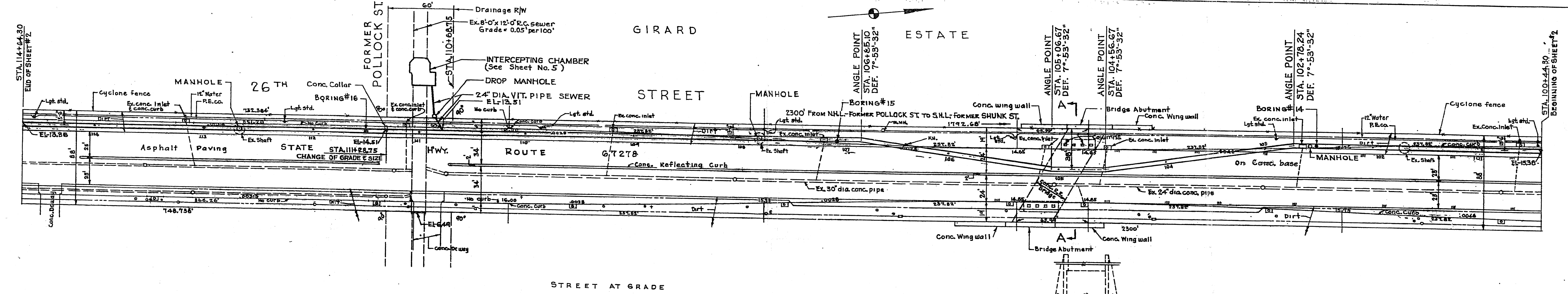
SCALE AS NOTED

WORK No SD 297 SW.
SHEET 1 OF 5 SHEETS

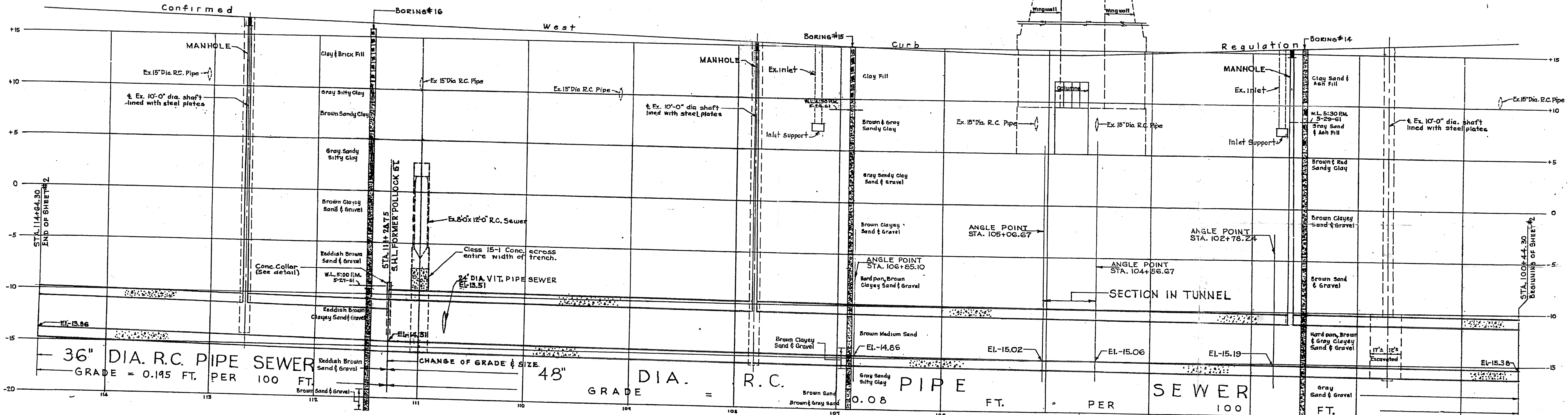
DRAWN BY	A.B. Greene	AUG. 1963
CHECKED BY	M.G. CELONI	9-4-63
SUPERVISOR	Koehler	9-13-63
H'W'Y. SUPV'R.	[illegible]	9-11-63
P.G.W. CO.	[illegible]	9/13/63

2585 -5

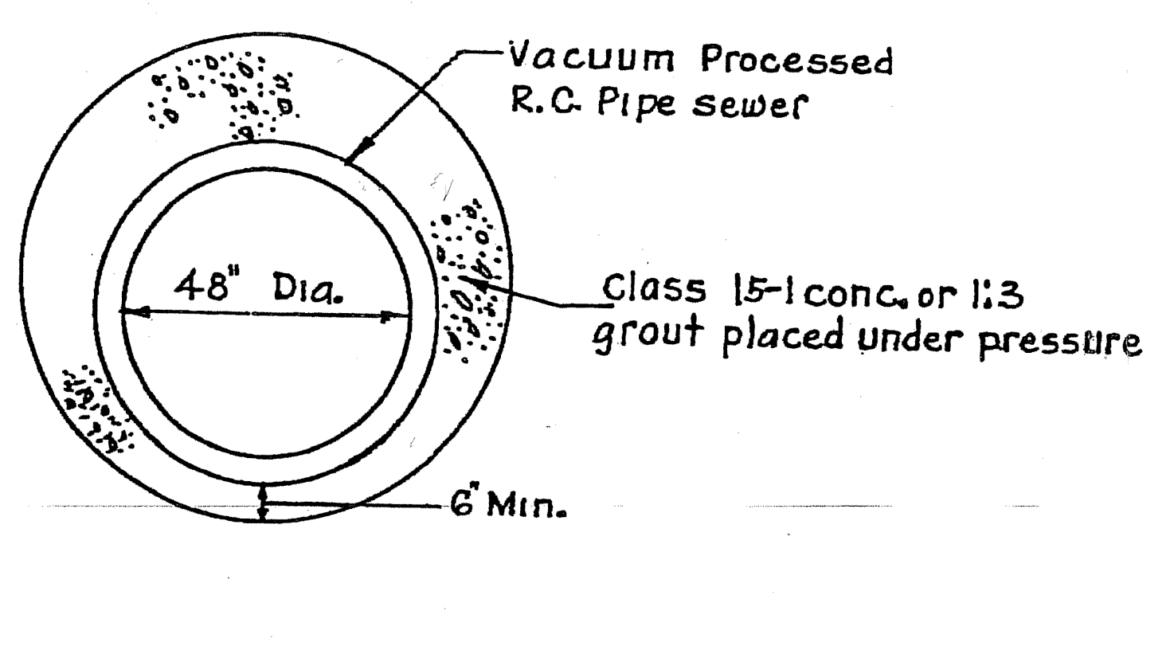
52 C 15A



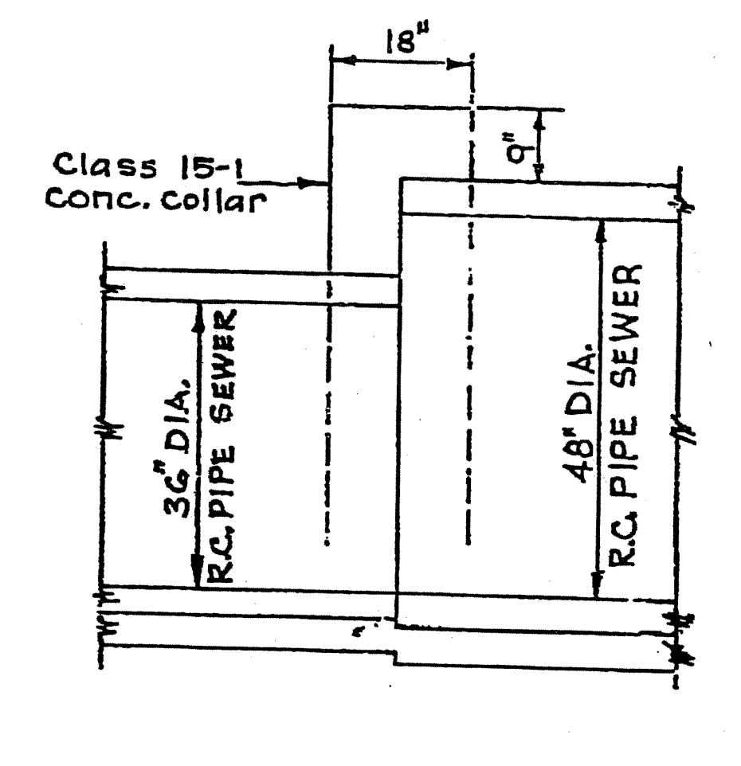
PLAN
SCALE 1"=40'



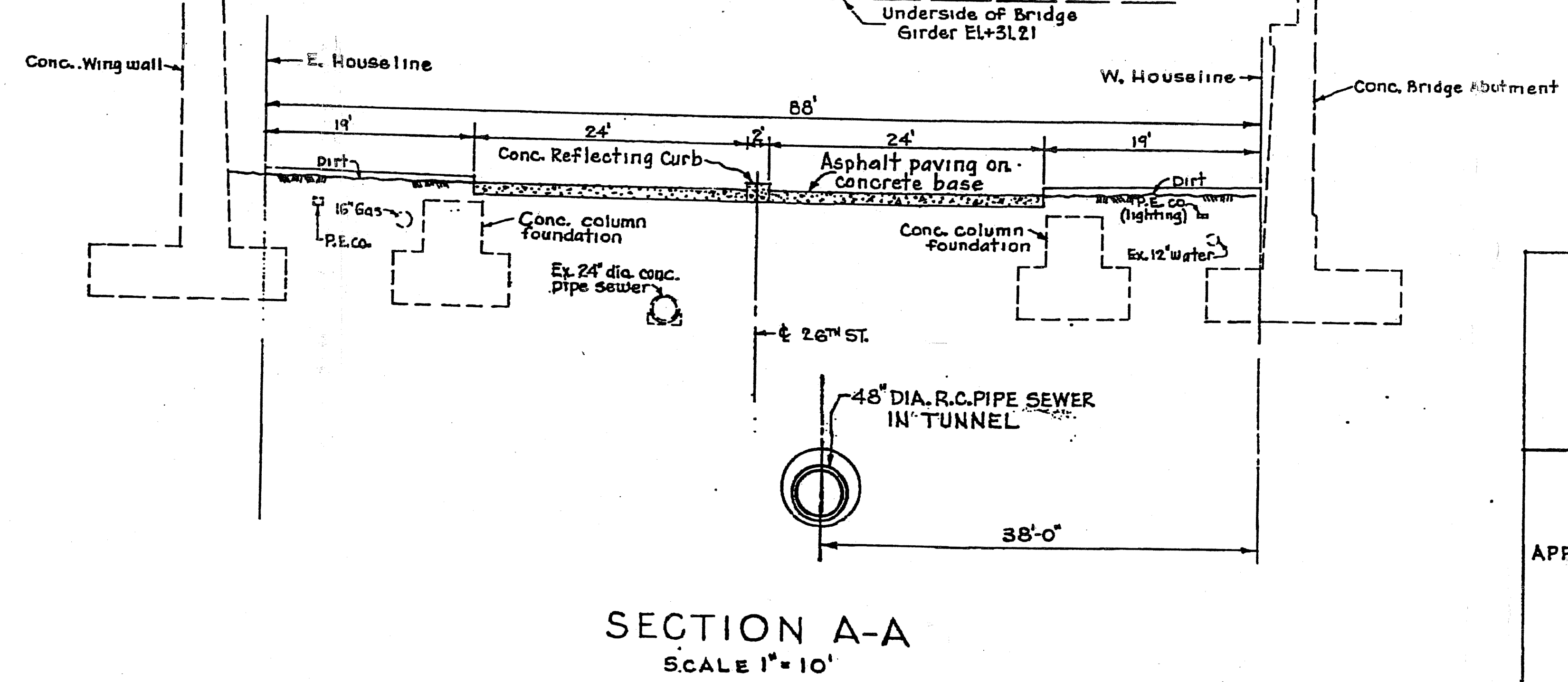
PROFILE
SCALE HORZ. 1"=40'
VERT. 1"=4'



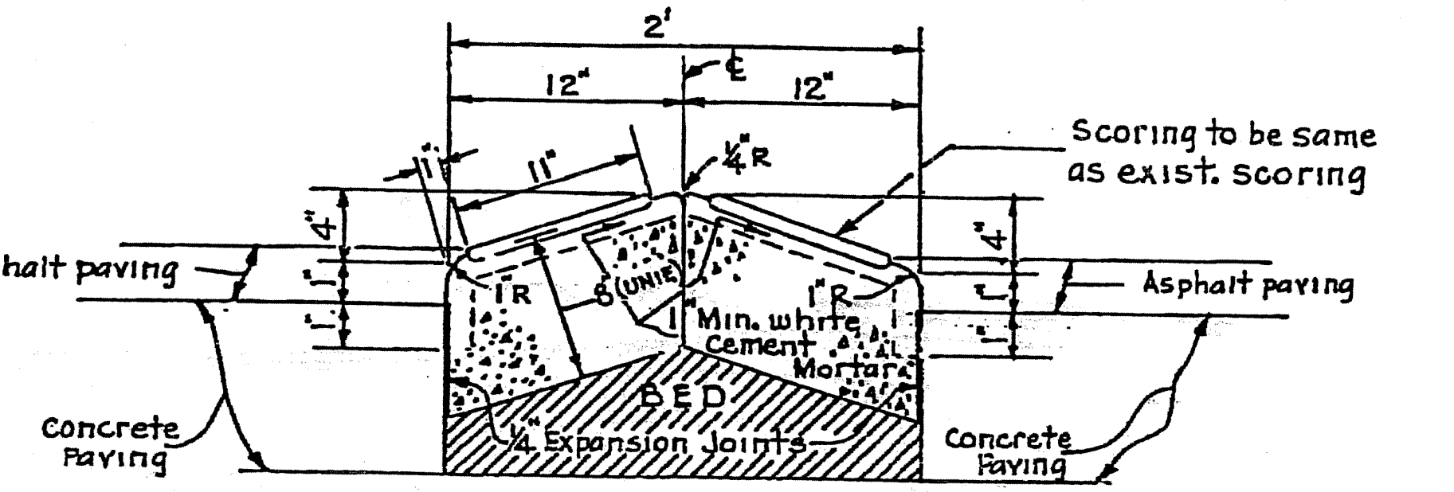
SECTION
48" DIA. R.C. PIPE SEWER IN TUNNEL
NOT TO SCALE



DETAIL OF COLLAR
(STA. 111+28.75)
SCALE ½"=1'-0"



SECTION A-A
SCALE 1"=10'



CONCRETE REFLECTING CURBING
NOT TO SCALE

LOWER SCHUYLKILL EAST SIDE INTERCEPTING SYSTEM

INTERCEPTING SEWER
IN
26TH STREET
BETWEEN
STA. 100+44.30 AND STA. 114+64.30

CITY OF PHILADELPHIA
WATER DEPARTMENT

APPROVED A. Finkelstein
CHIEF, DESIGN BRANCH, ENGINEERING BUREAU

SCALE AS NOTED

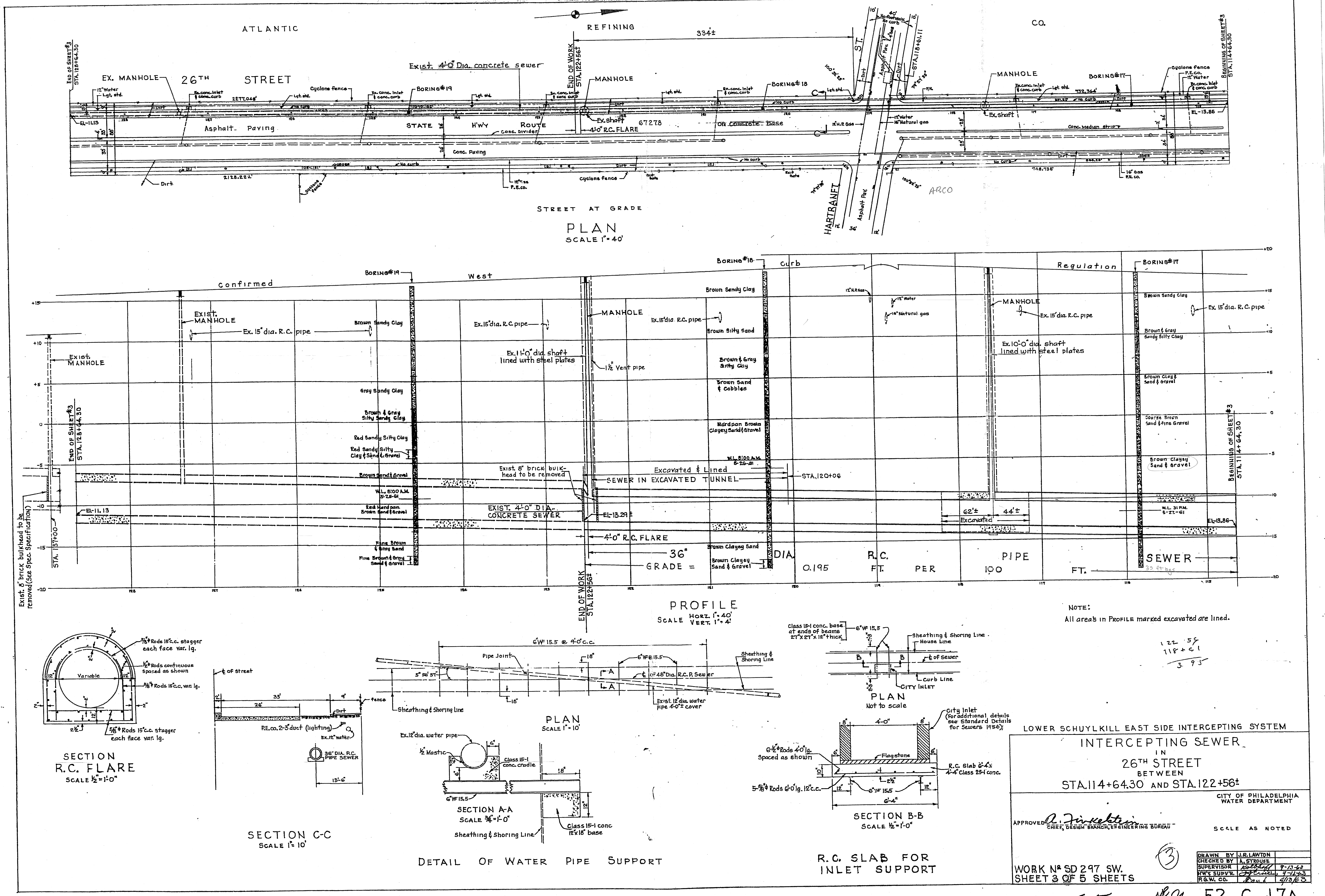
(2)

WORK Nº SD 297 SW.
SHEET 2 OF 5 SHEETS

DRAWN BY	J.R. LAWTON	
CHECKED BY	M.G. CELONI	9-4-63
SUPERVISOR	Kolbhoff	9-13-63
H'W'Y. SUPV'R.	F.J. Cicci	9-11-63
P.G.W. CO.	[illegible]	9/13/63

52 C 16A

AOI 1



LOWER SCHUYLKILL EAST SIDE INTERCEPTING SYSTEM

INTERCEPTING SEWER
IN
26TH STREET
BETWEEN
STA.114+64.30 AND STA.122+56±

CITY OF PHILADELPHIA
WATER DEPARTMENT

APPROVED A. Finkelstein
CHIEF, DESIGN BRANCH, ENGINEERING BUREAU

SCALE AS NOTED

③

DRAWN BY	J.R. LAWTON	
CHECKED BY	A. STROUSE	
SUPERVISOR	Kolbhoff	9-13-63
H'W'Y. SUPV'R.	[illegible]	9-12-63
P.G.W. CO.	[illegible]	9/13/63

WORK Nº SD 297 SW.
SHEET 3 OF 5 SHEETS

3 2585-5

52 C 17A

210.400

12/14/04 ⑤

Date	Well Equip	TD	Blank	[illegible]	Above Fluid Locate	LL	GPM	Oil	Remarks
11/5	1+3	4-12					12	NIL	3,400/5 NIL
	2+4						8	NIL	2380/5 NIL
	1+3	12-8					14	NIL	5 gal/21" NIL
	2+4						6.6	NIL	5 gal/59" NIL
11/6	1+3	8-4					16	?.~~1~~6 B/D	5 gal/15" 3%
	2+4						7	2.4 B/D	5 gal/43" 1%
	1+3	4-12					10		5 gal/33" 10 oil [illegible]
	2+4						7		5 gal/45" 15 oil [illegible]
	1+3	12-8					20		5 gal/14" NIL
	2+4						7		5 gal 45" NIL
11/7	#3	8-4					7		5 gal/43" NIL
	#4						7		5 gal/90" [illegible]
	#3	4-12					7		5 gal/64" [illegible]
	#4						7		5 gal/[illegible] [illegible]
	#3	12-8							
	#4								
11/7/66 AM	#3						6.1	0.24 B/D	8 AM
	#4						4.2	0.6 B/D	
	#3						7.0	NIL	9:30 AM
	#4						5.0	1.2 B/D	
	#1+#3						4.9 7.7	NIL	10 AM
	#2+#4						15.0 [illegible] 10.0	20.0 E 2:45 7.2 4E	

Date	Well Equip	T D	Block	Screen	Above Grade	Locatn	L L	GPM	Oil	Remarks
11/7/66	#3 + #4 In Series									
								PM		
	#1 SP						31'5"	No water		Back on 11/4 -2"
	#1 Piez			Fair			31'4"	31'8"		-1"
	#2 Piez			Good			32'1"	32'8½"		-3"
	#3 SP						11'2"	6'4½" (Not true LL)		-3'3" (?)
*	#3 Piez			Level up			30½"	33'1"		+5"
	#4 SP	[illegible]					40'8"	40'3"		-10'11"
*	#4 Piez			Good (+)			31'½"	31'6½"		-10½"
11/7/66	#1-3 #2-4 In Series									In operation 3½ hours. after reading were taken
11/8				No 3 well down - Well find overflowing.						
Sh {4-12	#1 well							3.3	2.0	
~~[illegible]~~	#2 + 4 wells							5.0	2.4	
12-8	#1 well							4.0	2.1	
	#2 + 4 well							5.0	2.5	
	#1 well only							5.3	6.0	
8:00	#2 + 4 wells only							5.0	3.0	
	#1 SP						No water			Sand in [illegible] location
	#1 Piez			#3 Piez not good			31'11			-3"
	#2 Piez						32'9			-½"
	#3 SP						8'7			-3'3"
	#3 Piez						32'½"			In operation #3 well
	#4 SP	41'0					40'6"			[illegible]
	#4 Piez						31'11"			-4½"
	#1 and #3 wells -							5.0	3.6	½ hr after #3
[illegible]	#5 SP	42' → 41'0 ([illegible])								#1-2-3-4 - [illegible]
	#5 [illegible]	#46	6"							[illegible] gpm -
	#5 Piez	#45'0 → 1½" x 18" U								[illegible]

Date	Well Equip	TD	Blank	Screen	Above Grade	Suction	LL to Top of Casing	GPM	Oil	Remarks
11/8/66 (1PM)	#1+3							7.5	.9B/D	
	#2+4							7.0	2.0B/D	
"	#5 Piez on #4 well not hooked-up.									
"	#6 Well and #6 Piez well pipe installed, no standpipe in #6 well.									
11/9/66	#1, #2, #4 Wells in Operation									
	4-12 #1 Well							3.7	3.6B/D	[illegible]
	4-12 #2+4 Well							7.0	1.2B/D	[illegible]
	12-8 #1 Well							5.8	3.0B/D	
	12-8 #2+4 Wells							6.7	6.6B/D	
11/9	#1 Well				2'		—			
	#1SP				1½'		0			
2:20	#1 Piez	47'0			1½'		31-10			-8'
2:30	#2 Well				6"		—			
2:30	#2 Piez	41'0			1½'	-	32-9			-2'
	#3 Well				2'		—			
[illegible]	#3SP	41'4"			8"	[illegible]	10'½"			
2:10	#3 Piez	45'1"			1'		32'1"			-3'
	#4 Well				1½'			45 [illegible]	[illegible]	
	#4SP	47'7"			3'		40'5"			
	#4 Piez	47'2"			6"		32'1"			-1'9"
#5SP →	#5 Well — 44'3				4'		30'6"	← #5SP		[illegible]
	#5 Piez — 47'11"				2'11"		27'			
	#6 Well — 47'5"		6"	5' [illegible]	[illegible]		17-3			
	#6 Piez — 45'3"				2'					

Date	Well Comp	TD	Blank	Screen	Above Grade	Location	LL	GPM	Oil	Remarks
11/4/66	#10 well				3'		36'			
	#1, 2, 3							16 gpm	7.5 B/D	In service at 11:30 AM - Took rates at 1:30 PM
						(INITIAL) LL. AVE	↓	LL Correction		
11/10/66	#1 Piez				1½'	31'2"	32.0	30'6"		-10"
	#2 Piez				1½'	30'9"	33'0	31'6"		-2'3"
	#3 Piez			-	1'	31'5"	32'8½	31'8½		-P 2½"
	#4 Piez				6"	30'4"	32'11"	32'-5"		-2'7"
	#5 Piez		-		2'	11/9 27'0	27'6"			-6" ~~[illegible]~~
	#6 Piez				2'	11/9 17'3"	14'3			-9' ~~[illegible]~~ #6 well. 8
	#10 well				3'	36'3"	35'9'	33'3"		+6"
11/10/66 7:30 AM	#1, 2, 3 wells							14.7	7.5 B/D	
	#4, 5 wells							11.0	10.0 B/D	#6 Not in Service
PM	#1, 2, 3, wells							18.0	9.0 B/D	
	#4, 5 wells							8.0	3.0 B/D	
										#6 well in Service at 5:30 PM -
11/12	#1, 2, 3, well.							15	3.6 B/D	
	#4, 5, 6 wells							5+	10.0 B/D	
PM -	#1, 2, 3 wells.							18	12 B/D	
	#4, 5, 6 wells.							5	3.0 B/D	

PM Shutdown all wells for accurate Shutdown static liquid levels. at 3 PM.

No Corr. 11/14

Static 11/14 *

7

11/10 ?

Date	Well	Water Tb. Dl.	Initial LL	Corr. LL	True LL		In Service 7-23 ~~[illegible]~~	Oil	GPM	
11/14	Wells shutdown 11/11 @ 3PM to 10AM on 11/14/66									-3 days (shutdown)
"	#1SP	-1½'	31'1"	30'7"						
	#1 Piez	-1½'	31'1"	30'8"			30'6"	+1"		
	#2 Piez	-1½'	31'8½"	30'1½"			31'6"	-1'3½"		
	#3 S.P.	-8"	14'6"	13'10"						
	#3 Piez	-1'	31'4"	30'4"			31'8½"	-1'4½"		
	#4 SP	-3'	32'-7½"	29'7½"						
	#4 Piez	-6"	31'-8"	31'2"			32'5"	-1'3"		
	#5 SP.	-2'	31'-3"	29'3"			-			
	#5 Piez	-2'	28'3"	26'3"			25'6"	+9"		
	#6 Piez	-2'	29'8½	27'8½"			22'3"	+5½"		
	#Well	-3'3"	36'2"	33'2"			32-9	+5"		
AM	#123							3.0B/D	25	In 1 hour
"	#456							1.2B/D	15	In 1 hour
PM	123		—					2.4B/D	20	In 4 hours.
"	#456		—					2.2B/D	10	In 4 hours.
11/15	#1, 2, 3							1.2B/D	15	
	#4, 5, 6,							6.0B/D	7.5	

Date	Well	INITIAL LL	CORR. LL	(*+ or -)	B/D Oil	*Static LL	GPM	Remarks.
11/15	#1SP	0	0	—		30'7"		*Based on original LL 24 hours after SLL. ?
	#1Piez	32-1	30'7"	Same		30'7"		
	#2Piez	32'9½	31'5½"	-14"		30'2½"		
—	#3SP	15'6½"	14'10½	-12"		13-10"		
	#3Piez	32'7½"	31'7½"	-15"		30'4"		
	#4SP	39'11"	33'11"	-4'4"		29'7½"		
	#4Piez	32'4"	31'10"	-8"		31'2"		
—	#5SP	35'0	33'0"	-3'9"		29'3"		
	#5Piez	29'1½"	27'1½	-10½"		26'3"		
	#6Piez	30'5"	28'5"	-8½"		27'9½"		
	#10 Well	35'9	32'9"	-5"		33'2"		Note the increase in static liquid level
PM	1, 2, 3				2.1		13.0	
"	4, 5, 6,				1.5		9.0	
11/16	#1SP		0	0				Based on 11/15 (Further down)
	#1Piez		30'5"	+2"				+ ?
	#2Piez		31'4"	-13½"				+1½" + oil in Piez -
	#3SP		15'11	-1'5"				-10"
	#3Piez		31'4"	-12"				-3" ?
	#4SP		36'10"	-7'2½"				-2'9½"
	#4Piez		32'2"	-15"				+7"
#5Piez	#5SP		33'0"	-3'9"				Same
	#6Piez		26'11" 28'4½"	-6" -6"				-3½" ?
	#10 Wells		32'9"	—				-2
AM	1, 2, 3 Wells				1.4 B/D		12	
	4, 5, 6 Wells				3.2 B/D		9	
PM	1, 2, 3 Wells				3.6 B/D		15-	
	4, 5, 6, Wells				2.4 B/D.		10-	

Date	Well	INITIAL LL	CORR LL	STATIC LL	±	OIL B/D	RATE GPM			Remarks.
11/16	123					1.6	15			
(4-12)	456					5.2	15			
11/17	123					6.9	10			
(12-8)	456					2.4	10			
(3-4)	123					10.0	20			
	456					4.0	10			
11/18	#15P	0	—	30'7	0					
	#1 Piez	31'-10"	30'4	30'7"	+ 3"					
	#2 Piez	32'10"	31'4"	30' 2½	-1'2"					
	#3 3P	11'3"	17'7"	13'10"	-3'9"					
	#3 Piez	32'6"	31'6"	30'4"	-1'2"					
	#4 4P	40'½"	37'½"	29'7½"	-7'5"					
	#4 Piez	32'9"	32'3"	31'2"	-1'1"					
	#5 5P	35'6"	33'6"	29'3"	-4'3"					
	#5 Piez	31'7½"	29'7½"	26'3"	-3'4"					
	#6 Piez	30'10"	28'10"	27'8½"	-1'2"					
	#10 well	33'4	33'9"	33'2"	- 7"					
P.M.	#1-2-3					2.0	7.5			Sample jar collected
"	#4-5-6					1.7	7.5			Sample jar collected
11/18 to 11/20	1-2-3					3.1	12			Shift date
	4-5-6					1.7	8			" "
11/21 to	1-2-3					1.8	12			Shift date
11/	4-5-6					2.3	7.5			" "

Date	Well	Initial LL	Corr. LL	Static LL	±	Oil G/O	Rate GPM			Remarks
11/23/66	1-2-3					2.9	12			
	4-56			[illegible]		3.0	7.5			
	#1SP	0	-	—						
	#1 Piez	31-10	30'4"	-3"						Compared with 11/13 [illegible], [illegible] - Same
	#2 Piez	32-10	31'4"	-1'2"						- Same
	#5SP	21'7"	20'11	-7'1"						- 3'1"
	#3 Piez	32'6"	31'6"	-1'2"						- Same
	#4SP	40'½"	37'½"	-7'8"						- Same
	#4 Piez	32'9	32'-3'	-1'1"						Same
	#5SP	35'6"	33'6"	-4'3"						Same
	#5 Piez	32'2"	30'2"	-3'11"						- 7"
	#6 Piez	31'0	29'0	-1'4"						- 2"
	#10 Well	35'9	32'9"	-7"						Same
11/25/66	1-2-3					1.5	12			Repairing pump. #1-2-3 wells-
	4-5-6					1.5	7.5			
11/24/11/28	1-2-3					2.3	13			Shift Ave
	4-5-6.					2.6	6.5			" Ave.
11/29	1-2-3					2.6	13			AM
	4-56					1.8	6.5			AM
	1-2-3					6.0	13			PM
	4-5-6					2.4	6.5			PM.

Date	Well	Initial LL	Corr. LL	Static LL	Diff. + or −	Oil B/O	Rate GPM			
11/30/		#3 and #4 wells in service only								~~[illegible]~~
"	#1 SP	31'6"	30'6"	30'7"	Same				+6'1"	Based on 11/29 LL's with all pumps on:
"	#1 Piez	31'-3"	30'9"	30'7"	-2"				-8"	
"	#2 Piez	30'9"	29'3"	30'2½"	+11"				+9"	
"	#3 SP	25'6"	24'8"	13'10"	-10'10"				-6"	(#3 well on)
"	#3 Piez	32'0"	31'0"	30'4"	-8"	╳			+1'4"	Not pumping to well.
"	#4 SP	39'8"	36'8"	29'7½"	-7'1"				+5"	
"	#4 Piez	31'6"	31'0"	31'2"	Same	╳			+1'3"	(#4 well on)
"	#5 SP	32'0"	30'0"	29'3"	-9"				+3'7"	
"	#5 Piez	32'0	30'0"	26'3"	-3'9"				-1" Same	
"	#6 Piez	30'10"	28'10"	27'9½"	-1'2"				-1" Same	
"	#10 well	36'1"	33'1"	33'2"						
11/30	#1 well					1.2 4.8+	5 −			after starting well
	#5 well					26.0 4.8+	10			" " "
	#1 well					27.0	5.5			PM
	#5 well					6.6	9.1			PM
12/1	#1 well					10.6	4.0			AM
	#5 well					2.4	5.0			AM
		# 2 and # 6 wells in service only. (10AM).								
12/1	#2	Starting				7.5 3.0	7.6 4.1			Readings immediately and 1 hour after in service
	#6					7.5 2.0	6.7 9.8			
	#2					2.0	4.0			PM —
	#6					NL	9.5			PM —

Date	Well	INITIAL LL	CORR. LL	* STATIC LL	DIFF + - 0	OIL B/D	RATE GPM		
11/29	1-2-3					2.5	12.5		AM
	4-5-6					1.4	6.0		AM
#1 SP	1½'	0	0	30'7"	0				Cased on 11/25/66
#1 Piez	1½'	31'7½	30'1½	30'7"	+5½"				+2"
*#2 Piez	1½'	31'6"	30'0"	30'2½	+2½"				+1' *Added dye at 9:30 AM
#3 SP	8"	24'10"	24'2"	13'10"	-10'4"				-3'3"
#3 Piez	1'	32'5½	3~~2~~1'~~5~~8½	30'4"	-1'1"	✓			-10"
#4 SP	3'	40'1"	37'1"	29'7½	-7'6"				-1"
#4 Piez	6"	32'9"	32'3"	31'2"	-1'1"	✓			Dead
#5 SP	2'	35'7"	33'7"	29'3"	-4'4"				-1"
#5 Piez	2'	31'11½	29'11½	26'3"	-3'8"	✓			-2'9"
#6 Piez	2'	30'8½"	28'8½"	27'8½	-1'	✓			+4"
#10 Well	3'	35'11"	32'11"	33'2"	-9"				-2"

Shutdown #1 and #2 also #5 + 6 wells on 11/29 AM.
(#3 and #4 In service)

11/29	#3					35? 8	6.0? 6.5		#1 and #2 Down
	#4					NIL NIL	4.0 3.3		#5 and #6 Down
	#3					0.6	5.9		PM
	#4					3.6	3		PM
11/30	#3					NIL NIL	6.0 3.3		AM
	#4					0.6 0.7	3.2 3.3		AM

Shutdown #3 and #2 also #4 + 6 wells on 11/30 AM.

Date	Well	INITIAL LL	CORR. LL	STATIC LL	DIFF. + or −	OIL B/O	RATE GPM		REMARKS
12/1	#1 and #5 Wells in Service								
-1½'	#4SP	38'7"	0"	30'7"	-8'				Based on 11/30 with #3 + 4 Wells in Service -6'7" (#1 Well in Serv.)
-½'	#1Piez	31'5"	29-11	30'7"	+8"	X			+10"
1½'	#2Piez	30'10"	29-4	30'2½"	-10"				-1"
8"	#3SP	28'8"	28-0	13'10"	-14'2"				-3'4"
1'	#3Piez	32'0"	31-0	30'4"	-8"				Same
3'	#4SP	33'9"	30-9	29'1½"	-1'2"				-5'11"
6"	#4Piez	31'6"	31-0	31'2"	+2"				Same
2'	#5SP	41'5"	39-5	29'3"	-10'2"				-9'5" (#5 Well in Serv.)
2'	#5Piez	32'5"	30-2	26'3"	-3'11"	X			-2"
2'	#6Piez	31'1"	29-1	27'8½"	-1'5"				-3"
3'	#10 Well	36'1"	33-1	33'2"	+1"				Same
	#2 Well and #6 Well in Service on 12/1/66.								
12/2	#2					1.5	3.3		AM
	#6					0.2	8.5		AM
12/2	#2 and #6 Wells in Service								Readings with 2 + 6 in Serv. Based on 12/1 with #1-#5 Wells
	#1SP	31'7"	30'1"		-8'6"				-6
	#1Piez	31'4"	30'10"		-5"				+5"
	#2Piez	31'2"	30'8"		-6"	X			+4"
	#3SP	25'9"	25'1"		-11'3"				+2 11
	#3Piez	31'9"	30'9"		-5"				+3"
	#4SP	33'9"	30'4"		-1'2"				Same
	#4Piez	32'0"	31'6"		-4"				-2"
	#5SP	32'3"	30'3"		-1'				-9'2"
	#5Piez	[illegible]	[illegible]		-3'4"				[illegible]
	#6Piez	31'2"	[illegible]		-1'6"	X			-1"
	#10 Well	33'1½"	33'1"		+1"				Same
12/2	Put #1, 2, 3, and 4, 5, 6 Wells In Service AM.								
"	1-2-3					30	5.0		AM
						12.5	15.0		PM
"	4-5-6					10	16.0		AM
						6.7	.75		PM

Date	Well	INITIAL LL	CORR. LL	STATIC LL	DIFF. + or -	OIL B/O	RATE GPM			REMARKS -
12 to 12/2	#3+4		3 31'0 4 31'0	3 30'4" 4 31'2"	-8' -2"					Comparison of wells in service in multiples of 2.
	#1+5		31'1 1 30'5 5	30'7" 1 26'2" 5	+8" -4'2" (5)					
	#2+6		30'8" 2 27'2" 6	30'2" 2 27'8" 6	-6" -1'6" (6)					
The	above	based	on initial	static	liquid levels.					
	#3+#4		3 32'4" 4 32'3	3 30'2" 4 31'2"	-2' -11"				+6" -11"	No 3 loss of 6" No 4 pump well - good.
	#1+#5		30'1" 1 29'11 5	30'7" 1 26'3 5	+6" -3'8" (5)				+2" +8"	No 1 pump loss and pump ~~pump~~ really well. No 5 held well in either case
	#2+#6		30'0" 2 28'8" 6	30'2 2 27'9 (6)	-2" -1'0 (6)				+4 +6"	No 2 well loss of 4" No 6 well loss of 6"

The above multiples of (2) based on all wells in service, 1, 2, 3, + 4, 5, 6, (11/2[illegible]).

Date	Well	INITIAL LL	CORR. LL	STATIC LL	DIFF. + or -	OIL B/O	RATE GPM			REMARKS -
						# Ave	# Ave			
12/5	1,2,3					3.6	12.0			~~Shift~~ foreman
						1.4	6.5			Week-end data.
	4,5,6					7.5	14			AM reading
	1,2,3,					2.4	6.2			AM readings
	4,5,6,					1.2	6.0			11AM
	1,2,3					1.6	6.5			11AM.
	4,5,6					4.5 (6.0)	7.5 - 10.9			Valve closed partly
12/6	1,2,3					1.2 - (1.2)	6.0 - 6.9			AM
	4,5,6,									
	#1,2,3					2.0	17.5			Valve wide opened 2:30
	1,2,3,					6.0	15.7			PM
	4,5,6,					1.8	5.7			PM.
12/7	#1,2,3									AM
	#4,5,6									AM.
	1,2,3,	1				6.5	12			Shift foreman. 12-8
	4,5,6,					2.1	6.5			" "
	1,2,3,					3.0	14			PM
	4,5,6,					6.0	6.4			"

3, #4 #5 #6 wells in service am #1 + #2 down.

(#17)

Date	INITIAL LL	CORR. LL	STATIC LL	DIFF. +/-	BSO OIL	RATE GPM				
12/7 PM.		# #	1,2,3,	# 4	5,6	Wells	in Service			Before shutting down # 3 Well.
#1SP	38'8"	30'0"	30'1"	-6'7"					Based on 11/24 Same	
#1Pmp	31'8"	30'2"	30'7"	+5"					Same	
#2Pmp	31'9"	30'3"	30'2½	-1"					-1½"	~~[illegible]~~ Rise
#3SP	28'1"	27'5"	13'10	-14'1"					-4½"	~~[illegible]~~ Rise
#3Pmp	32'8"	31'8"	30'4"	-1'4"					-3"	Dec
#4SP	39'9"	33'9"	29'7½"	-4'2"					+3¼"	T.
#4Pmp	32'11"	32'5"	31'2"	-1'1"					Same	
#5SP	35'2"	33'2"	29'3"	-3'11"					-5"	Dec.
#5Pmp	31'10"	29'10"	26'2"	-3'7"					Same	
#6Pmp	31'2"	29'2"	27'8½	-1'6"					-6"	Rise
#1Well	36'4"	33'4"	33'2" Not Pumping 28'11"	-2" -4'5"					+7"	Static is lower with # 3 well in normal operation without well in Service
12/7	Wells #3				3.0	7.0				~~AM~~ When starting pump out only
	#4,5,6,				6.0	6.5				~~AM~~
12/8	#3				NIL	5.8				AM
	#456				2.4	6.5				AM
12/8	#3				NIL	5.9				Noon
	#456				2.4 12.0	6.6				Noon
12/8	#3				NIL	5.6				~~[illegible]~~ PM
	#4,5,6,				2.4	6.3				PM

No air in any of the above discharge

(18)

		*			12/9	12/9				
Date	INITIAL LL	CORR LL	STATIC LL	DIFF. LL	INITIAL LL	CORR. LL	DIFF T-O	OIL B/O	RATE GPM	REMARKS
12/8 & 10	35'10"	32'4"	33'2"	-2"	35'10"	32'4"	-2"		-1'0"	#10 Well in Service [illegible]
12/9 #3SP	28'6"	27'10"	13'0"	-14'	28'11"	28'3"	-14'5'	[illegible]	-5"	#3 Well in Service
#3Pkg	32'1"	31'1"	30'2"	-9"	32'1"	31'1"	-9"	+7"	Same	#1 & #2 Shutdown for ② days
#1SP	31'6"	30'0"	30'7"	+7"	31'6"	30'0"	+7"	+8"	Same	
#1Pkg	31'4"	30'10"	30'7"	-3"	31'4"	30'10"	-3"	+8"	Same	
#2Pkg	30'8½	29'2	30'2½	+1'	30'8½	29'2"	+1'	+11"	Same	
#4Pkg	32'9"	32'3"	31'2"	-1'1"	32'9"	32'3"	-1'1"	+2"		#4, 5, 6 Wells in Service
#4SP	39'9"	36'9"	29'7½	-7'2"	39'7"	36'7"	-7'	-2'10"		Note: [illegible] #3 Well only [illegible]
#5Pkg	31'9½	29'9½	26'3"	-3'6"	31'9½	29'9½	-3'6"	Same		#3SP - [illegible] 10"
#5SP	38'0"	36'0"	29'3"	-6'9"	38'0"	36'0"	-6'9"	-2'10"		#3Pkg - [illegible] 7" #1SP - [illegible] 8'3"
#6Pkg	31'2"	29'2"	27'3½	-1'6"	31'2"	29'2"	-1'6"	Same		#1Pkg - [illegible] 11" [illegible] = 2'85'

Date				OIL	RATE	REMARKS
12/8	#3 —	(Green Water)		NIL	5.8	Shift [illegible] Rate Arb.
	#4, 5, 6,			2.4	6.3	
	#3 —			NIL	6.0	AM [illegible]
	#4, 5, 6			2.4	6.6	
	#3 —			NIL	5.6	PM [illegible] 3 units
	#4, 5, 6			2.5	6.4	#1 & #2 down
				NIL	5.4	PM
				3.6	6.2	
			One	NIL	5.1	PM Note [illegible] #3 [illegible] = 0 On - 5, 6 [illegible]
			One	3.0	6.4	
	#2	([illegible] #1 & #3 [illegible]) [illegible]		2.48	7.0	
	[illegible]	([illegible] #3 down)		2.4	6.3	
	#1 & 2			~~[illegible]~~	~~[illegible]~~	
				6.0	5.6	

#1 & 2 and #4, 5, 6 Wells

in [illegible] [illegible] [illegible]

19

Date	INITIAL LL	CORR. LL	STATIC LL	DIFF. TOU -	INITIAL LL	CORR. LL	DIFF. TOU -	OIL B/O	RATE G/M	REMARKS —
12/12		# 1, 2 and 4, 5, 6 wells in Service								
	#1 + #2							14.4	6.3	Shut [illegible] [illegible] 12/4 to 12/12
	#4, 5, 6							7.2	6.0	"
	#1 + #2							Down		Pump on #1 + 2 Failed AM
	#4, 5 6							1.8	6.1	AM
	#1 + 2							Down		PM
	#4, 5, 6,							3.6.	5.6	PM
12/13	#4, 5, 6,							2.4	3.6	PM 1, 2, 3, Installed pump by 6PM.
12/14	1 + 2							Nil	3.3	
	4, 5, 6,							4.8	5.6	
	# 1 + 2							Nil	3.5	PM
	4, 5, 6,							4.8	5.6	PM
12/15	#1, 2, 3							3.0	3.3	
	4, 5 6							7.2	5.5	
	#1, 2 3							3.0	3.6	
	4, 5, 6,							1.7	7.8	
12/16	#1 + 2							Nil —	3.9	
	4, 5, 6							3.6	5.9	
12/16	# 1 + 2							4.2	4.8	
	4, 5 6							3.6	5.6	

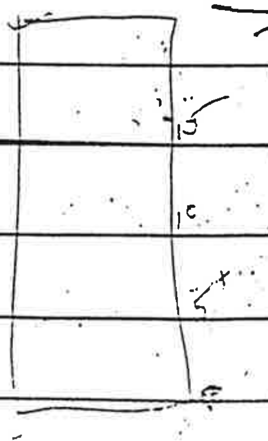
1 + 2 in Service
4, 5, 6, Pumps in Service

OIL RECOVERY WELLS

ELEVATIONS ARE INSTALLED ON CYCLONE FENCE POSTS AT RESPECTIVE WELL PIPES.

W. Long 2/14/67

TD	Well Identity	T.D.	ELEVATION TOP OF PIPE	2/13/67 → SLL	(FT.) CORR.	2/27 Oil Pump in Serv.
1½ 21	#2 Standpipe (2") Well		28.32 ✓	30'6"	30.50'	41.3"
21	#3 Piezometer		28.12 ✓	31'4"	31.33'	32'9"
22	#1 Standpipe		27.98 ✓	31'1"	31.10'	38.8½"
22	#1 Piezometer		27.79 ✓	31'0"	31.00'	31'7"
23	#2 Piezometer		27.88 ✓	31'11"	31.92'	33'4"
24	#4 Piezometer (1½")		26.19 ✓	30'4"	30.33'	—
24	# ~~4~~ Standpipe		26.10 ✓	30'5"	30.42'	37'11½"
25	#5 Piez		28.03 ✓	31'3"	31.33'	32'5"
25	#5 Standpipe		? 25.61 ✓?	29'7"	29.58'	33'11"
26	#6 Piez		27.27 ✓	30'9"	30.75'	31'5"
	#26 TK Casing		34.70'	36'0"	36.00'	
	#10 Well (ACTIVE)		30'17'	26'0"	36.00'	35'11½"
	#8 Well (ACTIVE)		33'53'	43'5"	43.42'	



→

43.3
28.3'
15.0

−
30.50
+28.30
2.20

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARKS
9/3													Trace	27	
9/4													Trace	22	
9/5													Trace	23	
9/6													0.5	25	
9/9													Trace	24	
9/10													0.5	25	
9/11													0.5	25	
9/12													Trace	25	
9/13			Down		In Service								Trace	24	
9/16				"	Down								Trace	24	
9/17				"		"							0.4	23	
9/18				"		"							0.3	23	
9/19				"		"							0.3	23	
9/20			In Service		In Service Down PM								1.6	20	
9/23					Down								1.3	25	
9/24						"							Trace	25	
9/25						"							0.8	21	
9/26						"							1.2	20	
9/27						"							Trace	20	
9/30						"							Trace	22	

DATE	#21 OIL B/O	#21 WATER GPM	#22 OIL B/O	#22 WATER GPM	#23 OIL B/O	#23 WATER GPM	#24 OIL B/O	#24 WATER GPM	#25 OIL B/O	#25 WATER GPM	#26 OIL B/O	#26 WATER GPM	#21-26 OIL B/O	#21-26 WATER GPM	REMARK
7/22													Trace	25	
7/23													Trace	27	
7/24													Trace	25	
7/25					Down								Trace	25	
7/26					"								Trace	23	
7/29					"								Trace	22	
7/30					"								Trace	27	
7/31					"								Trace	25	
8/1					"								Trace	23	
8/2					"								0.3	25	
8/5					"								Trace	25	
8/6					"								Trace	30	
8/7					"								Trace	30	
8/8					"								Trace	30	
8/9					"								Trace	22	Vacatio
8/23					"								Trace	22	
8/26					"								Trace	23	
8/27													Trace	23	
8/28													Trace	23	
8/29													Trace	23	
8/30													Trace	23	
8/[illegible]															
8/12	Trace	25													
8/13	Trace	25													
	Trace	23													
	Trace	23													
	[illegible]	[illegible]													

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARK
6/17/88													0.4 Trace	25	
6/18													0.3 Trace	30	
6/19													0.3 Trace	25	
6/20													Trace	25	
6/21													Trace	25	
6/24													Trace	25	
6/25													Trace	25	
6/26													Trace	30	
6/27													Trace	25	
6/28													Trace	25	
7/1													0.3	25	
7/2													Trace	25	
7/3													Trace	25	
7/5													0.2	25	
7/8													0.2	25	
7/9													0.2	25	
7/10													0.2	25	
7/11													Trace	25	
7/12													Trace	25	
7/15													0.3	25	
7/16													Trace	25	
7/17													Trace	25	
[illegible]													Trace	23	
													0.3	25	

WELL DATA

DATE	#21		#22		#23		#24		#25		#26		#21-26		REMARKS
	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	
5/15					Well Down								Trace	25	
5/16													0.3	25	
5/17													0.3 Trace	25	
5/20													0.3 Trace	25	
5/21													0.3 Trace	25	
5/22													0.3 Trace	25	
5/23													0.3 Trace	25	
5/24													0.3 Trace	25	
5/27													0.3 Trace	25	
5/28													0.3 Trace	25	
5/29													0.3 Trace	25	
5/30													0.3 Trace	25	[illegible]
5/31													0.3 Trace	25	
6/3													0.3 Trace	25	
6/4													0.3 Trace	25	
6/5													0.2 Trace	20	
6/6													0.2 Trace	20	
6/7													0.2 Trace	25	
6/10													0.3 Trace	21	
6/11													1.0	25	
6/12													0.3 Trace	25	
6/13													0.3 Trace	25	
6/14													0.3 Trace	25	

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARKS
4/10/68					Down								0.5	25	
4/11/68					″								0.6	25	
4/15					″								0.8	27	
4/16					″								0.5	25	
4/17					″								0.3	27	
4/18					″								0.3	27	
4/19					″								0.3	27	
4/22					″								Trace	25	
4/23					″								Trace	25	
4/24					″								0.5	25	
4/29					″								Trace	25	
4/30					″								Trace	25	
5/1					″								0.4 Trace	25	
5/2					″								Trace	26	
5/3					″								Trace	26	
5/6					″								Trace	25	
5/7					″								Trace	25	
5/8					″								Trace	25	
5/9					″								0.75	25	
5/10					″								0.5	25	
5/13					″								0.5	25	
5/14						″							0.5	25	
[illegible]						″							Trace	25	

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARKS
3/8/68													3.0	30	
3/11													1.8	30	
3/12													2.0	33	
3/13	0	5.5	NIL 0	4.2	0	5.0	0.2	5.2	0.5	5.7	0	5.0	1.5	25	
3/14													1.8	30	
3/15													1.8	30	
3/18													1.1	37	
3/19													1.5	37	
3/20	0	6.0	NIL	3.1	0	4.0	0.1	3.1	0.6	6.5	0	4.8	1.2	30	
3/21													1.0	30	
3/22													1.1	33	
3/25													1.3	33	
3/26													1.2	30	
3/27													1.8	30	
3/28													1.2	30	
3/29													0.6	30	
4/1													1.1	29	
4/2													0.7	30	
4/3													0.6	30	
4/4													Trace	30	
4/5													0.6	30	
4/8					DOWN								1.2	39	
4/9					"								0.7	33	

DATE	#21		#22		#23		#24		#25		#26		#21-26		REMARK
	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	
2/2													1.9	38	
2/5													1.8	30	
2/6													2.4	30	
2/7													2.4	30	
2/8	0	2.8	0	1.5	0	3.0	0.4	2.3	1.2	5.7	0	5.0	4.5	38	
2/9													2.4	30	
2/12													2.4	30	
2/13									Down O.L.				1.0	25	
2/14	0	3.6	0	2.2	0.5	4.4	0.3	2.5	Down O.L.		0	2.5	1.5	25	
2/15									"				1.0	25	
2/16									"				1.0	25	
2/19									"				1.0	25	
2/23									"				1.1	27	
2/26	0	6.1	0	2.1	0.4	4.6	0.4	2.6	Down		0	5.0	1.5	25	
2/26										"			1.1	27	
2/27										"			1.0	20	
2/28	0	6.0	0	2.1	Down		0.3	2.5	"		0	4.8	0.8	20	
2/29					In Service				In Service				7.0	30	LEAK?
3/1													6.0	27	
3/4													5.4	30	
3/5													5.0	27	
3/6													3.0	30	
3/7													4.8	30	

WELL DATA

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARKS
12/28	0.9	15	Down		Down		Down		1.2	5.0	0	6.0	0.9	15	Gen. Down Repairing Belts.
1/2/68			Down		Down		Down						2.4	20	
1/3			Down		Down		Down						1.6	20	
1/4			Installed		Installed		Installed						2.0	20	22, 23 24 Installed 1/4/68
1/5					Pump Frozen		Pump Frozen						3.0	30	
1/8					"		"						2.4	20	
1/9						"	"						2.0	20	
1/10	0	5.2	0	8		"	"		1.5	4.8	0	5.0	2.6	25	
1/11						"	"						3.0	25	
1/12						"	"						2.4	20	
1/15						"	"						0.9	18	
1/16			Overloaded Down			"	"						1.2	20	
1/17	0	6.5	Overloaded Down			"	"		0.9	5.6	0	5	1.5	20	
1/18													1.2	20	
1/22													2.0	25	
1/23													3.9	37	
1/24	0	5.5	0	3.0	0	4.8	1.1	4.9	0.8	5.2	0	4.8	2.3	37	
1/25													1.8	30	
1/26					Overloaded Down								1.5	30	
1/29					"	"							1.8	25	
1/30					In Service								4.5	38	
1/31													4.5	38	
2/1													[illegible]	38	

DATE	#21		#22		#23		#24		#25		#26		#21-26		REMARK
	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	
11/6/67													1.8	35	
11/7/67													2.0	30	
11/8													1.3	25	
11/9													1.5	25	
11/10													1.5	25	
11/27					Down								1.5	18	
11/29					//								1.5	25	
11/30					//		Down frozen				Down		2.3	25	
12/1					//						Back in Service		1.3	17	
12/4			Down		Down		Down						1.0	12	
12/5			//		//		//						1.8	20	
12/6			//		//		//						2.6	20	
12/7			//		//		//						2.4	20	No rates
12/8			//		//		//						2.0	20	
12/11			//		//		//						2.0	20	
12/13				//		//	//						1.6	20	
12/14				//		//	//						3.6	20	
12/15				//		//	//						2.0	20	
12/18				//		//	//						2.0	20	
12/19	0	6.0	—	//	—	// —	—	// —	1.5	4.7	NIL	5.0	2.4	20	Rates
12/20	0	5.8	—	//	—	// —	—	// —	1.5	4.8	NIL	6.0	2.0	20	Rates
12/21				//		//	//						—	—	
12/26				//		//	//				[illegible]		—	—	
12/27				//		//	//						—	—	(Rates)

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARK
10/2					Down								1.5	21	All wells down on 10/1
10/3					Down								1.6	24	
10/4					Down								2.0	20	
10/5					Down								1.5	25	
10/6					Down								1.8	25	
10/9					Down								2.0	25	
10/10					In Service								1.0	20	#23 well In Service
10/11					"	"							1.7	43	
10/12					"	"							1.4	23	
10/13					"	"							1.5	30	
10/16					"	"							1.8	30	
10/17	No Oil	6.0	0.3	2.5	Nil	2.4	0.2	2.5	0.9	5.0	No Oil	5.0	1.8	30	#23 well Down Noon on 10/18
10/18					Down								1.8	30	
10/19					"								1.5	30	
10/20					"								1.8	23	
10/23					"								1.1	18	
10/24					"								1.3	25	
10/25					"								1.0	25	
10/26					Back In Service								5.2	31	
10/27	No Oil	26	0.1	2.3	Nil	2.3	0.2	2.2	1.6	5.0	No Oil	5.0	1.5	25	
10/30													2.0	25	
10/31													1.5	30	
11/1													2.3	35	
11/2													1.5	25	

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARKS
8/20	—	—	—	—	—	—	—	—	—	—	—	—	2.2	20.0	
8/25	—	—	—	—	—		—				—	—	1.9	25.0	
8/28	—	—	—	—					—	—		—	1.7	28.0	
8/29	—	—		—		—		—		—		—	1.2	26.0	
8/30	0	4.3	.10	2.5	0	5.0	0.1	2.5	0.1	3.7	0	4.3	1.6	20.0	
8/31	—	—		—	—	—	—	—	—	—	—	—	1.7	25.0	
9/1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9/4	—	—	—	—	—	—	—	—	—	—	—	—	1.9	25.0	
9/5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9/6	0	6.0	.15	2.8	0	3.0	1.0	2.6	1.6	5.0	.8	4.8	2.4	2.0	
9/7	—	—	—	—	—	—	—	—	—	—	—	—	1.5	26.0	
9/10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
9/11	—	—	—	—	—	—	—	—	—	—	—	—	3.0	20.0	
9/12	—	—	—	—	—	—	—	—	—	—	—	—	1.0 —	25.0 —	
9/13	—	—	—	—	—		.9	24	1.0	3.0	0	5.8	2.0	20.0	
9/14	0	6.0	.20	3.0	0	2.5	—	—	—	—	—	—	—	—	
9/15	—	—	—	—	—	—							1.0	18.0	
9/18															
9/19	0	—	—	—	—	—	—	—	—	—	—	—	1.0	22	
9/20	0	6.0	1.8	3.0	0	2.6	1.0	2.4	1.2	3.7	0	4.6	2.2	23	
9/21	0	—	—	—	—	—	—	—	—	—	—	—	2.0	25	
9/22													2.0	23	
9/25							—	—	—	—	—	—	1.5	26.0	
9/26	—	—		—		—	—				—	—	2.0	23.0	
9/27	0	5.8	2.0	3.1	0	2.6	1.0	2.4	1.0	3.5	0	4.8	2.2	23.0	
9/28													1.9	25.0	
9/29															

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARK
6/26	0	2.4	0.5	2.5	0.5	2.5	0.8	2.9	43	10	0	9.0	99	33	#25 down 3 time
6/27	0	2.3	0.6	3.0	0.5	2.6	0.9	2.4	2.0	10	0	9.0	5.0	25	#10 well down f 6/23
6/28	0	2.4	0.6	2.6	0.4	2.5	0.7	2.5	1.0	9	0	8.0	2.4	25	
6/29	0	2.9	0.5	2.5	0.5	2.5	0.6	2.4	2.1	8	0	7.0	3.0	30	
7/1-7/12	—	—	—	—	—	—	—	—	—	—	—	—	1.8	30	0.6 to 3 B/
7/13	—	—	—	—	—	—	—	—	—	—	—	—	2.0	33	
7/12	Down		—	—	—	—	—	—	—	—	—	—	2.5	25	#10 well in Service
7/13	Down		—	—	—	—	—	—	—	—	—	—	3.7	37	
7/14	Down		—	—	—	—	—	—	—	—	—	—	3.0	25	
7/17	Down		—	—	—	—	—	—	—	—	—	—	4.0	35	
7/18	Down		—	—	—	—	—	—	—	—	—	—	2.4	20	
7/19	Down		0.1	2.8	.05	2.6	0.9	2.6	1.4	5	NIL	6.6	2.4	20	Sand in #25 Well
7/20	Down		—	—	—	—	—	—	—	—	—	—	2.0	20	
7/21	Down		—	—	—	—	—		—	—	—	—	3.0	25	
7/24	Down		—	—	—	—	—	—	—	—	—	—	2.7	25	
7/25	Down		—	—	—	—	—	—	—	—	—	—	2.0	25	#26 well down -
7/26	Down		—		—	—	—	—	—	—	—	—	2.0	25	
7/27	Down		—	—	—	—	—	—	—	—	—	—	2.0	25	
7/28	Down		—	—	—	—	—	—	—	—	—	—	3.0	25	
7/31	Down		—	—	—	—	—	—	—	—	—	—	2.5	25	
8/1	Down		—	—	—	—	—	—	—	—	—	—	4.0	15	
8/2	Down		NIL	2.5	NIL	2.5	1.3	4.7	1.6	4.9	.05	5.8	3.2	20	
8/3	Down		—	—	—	—	—	—	—	—	—	—	3.0	25	
8/4	Down		—	—	—	—	—	—	—	—	—	—	1.5	25	
8/7	Down		—	—	Down		—	—	—	—	Down		2.4	12	
8/8	—	—	—	—	Down		—	—	—	—	—	—	1.0	25	#21-26 well in servi
8/9	—	—	—	—	Down		—	—	—	—	—	—	2.5	25	
8/10	—	—	—	—	Down		—	—	—	—	—	—	3.0	30	
8/11	—	—	—	—	Down		—	—	—	—	—	—	1.5	25	
8/14	—	—	—	—	Down		—	—	—	—	—	—	4.2	30	
8/15		—	—	—	Down		—	—	—	—	—	—	1.6	30	
8/15	0	5.2	0	2.3	Down		0.6	2.6	0.8	2.4	0	7.5	2.4	30	
8/16	—	—	—	—	Down		—	—	—	—	—	—	3.0	30	
8/17	—	—	—	—	Down		—	—	—	—	—	—	[illegible]	30	
[illegible]	—	—	—	—	Down		—	—	—	—	—	—	[illegible]	25	
[illegible]	—	—	—	—	Down		—	—	—	—	—	—	[illegible]	[illegible]	
[illegible]	—				Down			—	—	—	—	—	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARK
5/3	—	CHECK TBL 1.7	—	—	CHECK TBL 1.8	—	CHECK TBL 0.5	—	CHECK TBL 0.5	—	—	—	5.5	28	5/2 Backwash
5/4	OK	5.5	3.1	24	0.3	4.0	2.0	5	1.9	3.9	N-OIL	5.0	5.5 6.0	28 30	Spand Purg on all wells
5/8	—	—	—	—	—	—	—	—	—	—	—	—	6.2	30	
5/9	—	—	—	—	—	—	—	—	—	—	—	—	3.6 4.8	30 30	
5/10	Dsl Odor	5.9	1.2	2.2	0.2	3.0	1.2	2.0	1.1	2.6	T-OIL	5.5	4.8 4.2	30 30	Only 4.2 B/O
5/11	—	—	—	—	—	—	—	—	—	—	—	—	3.6	25	
5/12	—	—	—	—	—	—	—	—	—	—	—	—	4.2		
5/15	Down		Added 300 ML of 6OL Stock soap in #4's								Down		4.0 3.4	25 25	*
5/16	Down		—	—	—	—	—	—	—	—	Down		4.8 6.8	30 37	Shutdown #21 and #2 wells on 5/
5/17	Down		4.2	4.0	0.2	3.0	0.9	3.0	1.1	4.0	Down		5.2 6.3 10.8	12 12 20	@ 7:30 Am 6.7 B/O
5/18	Down		—	—	—	—	—				Down		5.4	17	
5/19	Down	—	—	—	—	—	—	—	—	—	Down		6.9 5.0	25 12	
5/22	Down	—	—	—	—	—	—	—	—	—	Down		5.3 3.7	15	
5/23	Down										Down		6.0 2.8	17 20	
5/24	Down		0.4	2.5	0.1	3.0	1.3	3.0	1.1	3.2	Down		5.1 4.5 9.0	20 15 15	Am-Spot. 7 B/O
/25	Down		—	—	—	—	—	—	—	—	Down		5.1	16	
5/26	Down		—	—	—	—	—	—	—	—	Down		5.1	16	
5/26	#21 and #26 wells back in service on 5/26												4.6 4.0	12 13	
	0	7									20	15	—		
	0	6		Soap in #22 and #25 wells.							17	9	48.0	30	
5/26 PM	-0	6	—	—	—	—	—	—	—	—	NIL	8.2	4.2	30	2PM
5/29	SOAP	2.6PPM	—	2.0PPM	—	4.5PPM	—	4.8PPM	—	3.5PPM	—	4.0PPM	4.8 5.4	40 40	ABS DATA
5/31	—	—	—	—	—	—	—	—	—	—	—	—	3.5 3.0	25 25	
6/2	—	—	—	—	—	—	—	—	—	—	—	—	2.0 2.4	30 30	
6/6	—	—	—	—	—	—	—	—	Down Stuck on	—	Down Stuck on	—	4.5		
6/7	0	6.0	1.6	2.1	0.1	2.5	1.0	2.4	3.6	6.7	0	5.0	8.2	38	
6/8	—	—	—	—	—	—	—	—	—	—	—	—	2.6	35	
6/12	—	—	—	—	—	—	—	—	—	—		—	2.4	30	
6/13	—	—	—	—	—	—	—	—	—	—	—	—	1.6	43	
6/14	—	—	—	—	—	—	—	—	—	—	—	—	2.0 0.7	42	
6/16	0	4.5	1.0	3.1	0.1	3.1	0.8	3.0	3.5	6.0	0	5.9	1.6 2.4	20 30	
6/19	—	—	—	—	—	—	—	—	—	—	—	—	3.4	42	Found #26 Down
6/20	—	—	—	—	—	—	—	—	—	—	—	—	3.7	38	
6/21	—	—	—	—	—	—	—	—	—	—	—	—	1.6 2.0	40 25	
6/22	—	—	—	—	—	—	—	—	—	—	—	—	3.6 4.0	30 32	
/23	—	—	—	—	—	—	—	—	—	—	—	—	3.6	32	

	#21		#22		#23		#24		#25		#26		#21-26		
DATE	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	OIL B/O	WATER GPM	REMARK
3/27	—	—	—	—	—	—	—	—	—	—	—	—	7.0	30	Shift
3/27	—	—	—	—	—	—	—	—	—	—	—	—	9.0	30	PM
3/28	—	—	—	—	—	—	—	—	—	—	—	—	6.0 8.4	30 32	Shift
3/29	0	5.0	1.5 Green	2.6 Water	0.1	3.0	0.7 Pink Sand	2.5 Sludge	1.2+ Heavy	4.0− Sludge	0	7.5	5.0 7.0 13.8	32 37 30	Shift AM
3/30													7.5 8.0	37 37	
3/31													9.0 9.5	38 38	
4/3/67	—	—	—	—	—	—	—	—	—	—	—	—	6.4	37	
4/4/67	—	—	—	—	—	—	—	—	—	—	—	—	7.5	37	
4/5/67	—	—	—	—	—	—	—	—	—	—	—	—	7.2 9.6	30 37	
"	0	3.2	3.0	2.0	0.9	2.7	1.2	2.5	1.8	3.2	NIL	6.6	5.0 6.9 10.2	37 30 30	(6.9)-(20.2)
4/6/67	—	—	—	—	—	—	—	20% air	—	—	—	—	7.0 7.6	30 37	
4/7/67	—	—	—	—	—	—	—	—	—	—	—	—		37	
4/7 to 4/10	—	—	—	—	—	—	—	—	—	—	—	—	9.0	27	
4/10/67	—	—	—	—	—	—	—	—	—	—	—	—	6.6	30	Wk End
4/11/67	—	—	—	—	—	—	—	—	—	—	—	—	5.5	30	
4/12/67	—	—	—	—	—	—	—	—	—	—	—	—	7.5 8.7 6.6	30 30 30	ADDED RE OIL DYE
4/13													9.0 7.8 6.0	25 25	
4/13	NIL	5.4	3.0	1.8	0.6	2.2	1.3	2.3	2.4	3.0	NIL	5.0	6.8	25	
4/14	ADDED OIL + WATER DYE (#1 Farm No 3 TK)														ADDED VR WATER DY
4/14-17	—	—	—	—	—	—	—	—	—	—	—	—	7.0 7.8	30 30	
4/17	—	—	—	—	—	—	—	—	—	—	—	—	7.2	25	Wk End
4/18	—	—	—	—	—	—	—	—	—	—	—	—	7.8	30	
4/19	—	—	—	—	—	—	—	—	—	—	—	—	6.6 6.0	25 30	
4/19	Burning Gas Odor	5.2	2.0	2.5	0.8	3.0	OIL 400' [illegible] 1.0	2.5	1.0	4.0	NIL	6.0	5.3 7.0 9.0	25 25 38	Air in most Wells
4/20													5.5 5.5	25	
4/21	—	—	—	—	—	—	—	—	—	—	—	—	6.6 7.0	25 25	Collection Sampled
4/21-24													5.5 6.5	25 25	on 4/21
4/25	—	—	—	—	—	—	—	—	—	—	—	—	6.0 6.5	25 25	#22, 23, 24 #25, [illegible]
4/28	—	—	—	—	—	—	—	—	—	—	—	—	6.5	25	16TK [illegible] Well
4/1	—	—	—	—	—	—	—	—	—	—	—	—	5.5 6.5	25 25	
[illegible]	—	—	—	—	—	—	—	—	—	—	—	—	5.5	25	

Individual Wells

	#21		#22		#23		#24		#25		#26		21-26		
DATE	#3		#1		#2		#4		#5		#6		#1-6		REMARKS
	OIL B/D	WATER GPM	OIL B/D	WATER GPM	OIL B/D	WATER GPM	OIL B/D	WATER GPM	OIL B/D	WATER GPM	B/D	WATER GPM	OIL B/D	WATER GPM	
2/20											NIL	8.0	—	—	1,2,3, wells installed on 2/21/67 4,5,6, wells installed on 2/24/67
2/21	0.6	3.3	0.7	4.0	0.1	3.0	0.5	4.6	1.3	3.2	NIL	8.6	8.4	60	
2/23	NIL	8.3	NIL	3.1	NIL	3.0	0.7	3.5	1.2	4.3	NIL	9.1	3.2	40	
2/24	NIL	10.0	0.2	1.0	0.1	1.0	0.4	2.0	1.0	3.0	NIL	10.0	2.8	35	
2/27	NIL	9.0	0.1	2.5	0.6	2.6	1.2	3.1	1.3	4.0	NIL	7.5	4.8	30	
2/28	NIL	5.7	2.4	2.1	1.8	3.8	1.2	2.3	1.8	3.7	NIL	6.9	7.5	30	
3/1	NIL	5.2	3.6	2.2	1.5	2.0	2.4	2.9	1.8	2.6	NIL	8.0	3.6	30+	9.3 B/D oil
3/2	NIL	7.0	3.0	2.1	1.2	2.2	1.8	2.3	3.0	4.3	NIL	8.1	5.4	30	9.0 B/D oil
3/3	NIL	8.0	3.6	1.8	0.6	2.1	1.2	2.3	2.4	3.5	Scum 0.5	8.0	4.2	30	8.3 B/D oil
3/6	—	—	—	—	—	—	—	—	—	—	—	—	4.2	30	
3/7	—	—	—	—	—	—	—	—	—	—	—	—	4.8	30	
3/8	NIL	4.2	1.2	2.3	NIL	2.7	0.3	2.8	2.4	2.9	1.0	8.2	3.0	37	
3/9	—	—	—	—	—	—	—	—	—	—	—	—	3.6	30	
3/10	—	—	—	—	—	—	—	—	—	—	—	—	6.0	30	
3/13	0	4.3	2.1	GREEN 2.0	0.6	2.1	1.5	2.6	3.6	3.5	NIL	7.4	8.4	30	
3/14	—	—	—	—	—	—	—	—	—	—	—	—	5.4	30	(10 [illegible])
3/15	—	—	—	—	—	—	—	—	—	—	—	—	7.2	30	Greenish water from 3/13 to 3/17 pm
3/16	0	4.8	2.1	GREEN 2.4	0.9	2.5	1.8	2.4	4.8	4.0	NIL	7.3	8.0 8.0 12.0	30 30 37	
3/17	—	—	—	—	—	—	—	—	—	—	—	—	6.0	30	
3/18-20													5.0	30	Week-end ave
3/20													8.0	30	
3/21	—	—	—	—	—	—	—	—	—	—	—	—	4.0 7.0	25 30	
3/22	0	5.0	4.8	GREEN 2.7	0.7	3.3	0.7	2.5	3.0	3.7	NIL	7.5	4.0 8.4	25 30	Wells - Perf. - 45' 45' 10' Screen 5' Screen 6' Blank
3/23	—	—	—	—	—	—	—	—	—	—	—	—	4.0 6.6	30 30	
3/27	—	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	Green water in #2 well on 3/22

Date	Well Equip	TD	Blank	Screen	Above Grade	Location	LL	GPM	Oil	Remarks
11/4		All wells shutdown for 1 hour+ (Several LL) #1 and 3 wells and # 4 and 2 wells (manifolded)								
	#1 well						—			
	#1 SP						31'3"			
	#1 Piez						31'3"			
	#2 well						—			
	#2 Piez						30'8½			
	#3 well						—			
	#3 SP						7'11"			
	#3 Piez						31'5½"			
	#4 well						—			
	#4 SP						29'9"			
	#4 Piez						30'2"			
	#10 well						34'3"			In service 3' drawgauge -2' -?-
		Wells in service #1-3 #2-4								
3PM	#1-3 wells							21 gpm 14 gpm	Continuous 15 B/O	
	#2-4 wells							15 gpm 12 gpm	60 B/O Emul from 3+ B/O "	
D.E. 11/5	4-12 12-8	1-3 2-4 + 1-3 2-4		See No 5 Sheet						
11/6	8-4 4-12 12-8 - -	1+3 2+4 1+3 2+4 2+2								

Date	Well Equip.	T.D.	Blank	Screen	Above Grade	Location	LL	GPM	Oil	Remarks
11/3/66	#1 Well						—	PM 4.5 AM 3.8	PM 4.8 B/O AM 0.6 B/O	
	#1 S.P.						No water 38'7"	—	—	No LL
	#1 Piez						31'1½"	—		1½" lower LL
	#2 Well						—	PM 5.6 AM 5.0	PM-1.2 B/O AM 2.4 B/O	
	#2 Piez						26'5"	—		1' lower LL
	#3 Well						—	—		Not in service
	#3 S.P.						7'2"	—		
	#3 Piez						31'9½"	—		
	#4 Well	48'9"	6"	5' #30	✓		—	—		Not in service
	#4 S.P.	42'		—			—	—		at Grade
	#4 Piez	47'11"		1½"x18" #30			—	—		
11/4/66	#1 Well	—					—	3.5	3.0	
	#1 SP	38'7"					No water			
	#1 Piez	47'8"					31'3½"			added Green Clay at 9:30 AM -1½"
	#2 Well	—					—	5.0	0.6	
	#2 Piez	40'11"					31'5"			Mud at 40'9"
	#3 Well	—					—	5.9	Trace+	In service at 10 AM
	#3 SP	39'4"					7'11"			
	#3 Piez	48'1"					32'			
	#4 Well	45'9"	✓					5.9	Trace	In service [illegible] AM
	#4 SP	37'9"					19' [illegible]			[illegible]
		[illegible]					[illegible]			

Date	Well Equip	TD	Blank	Screen	Above Grade	Isolation	LL	GPM	OIL	Remarks
11/1 (12-8)	#1 Well							4.7	2 B/O.	—
11/1	#1 Well	—	—	—	—	—	—	6.6 6.6	4.8 B/O 7.2 B/O PM 6.0 B/O	
	# Well Standpipe						No LL			no water Present
	#1 Piez	47'8"	✓				30'11"			
	#2 Piez	44'1"	✓				21'8"	(water from #2 well.		Mud hit @ 43-10 Inner pipe installed
	#2 Well	(In service at 4:15 PM.					—			
				PM				5.0	6 B/O	Avg 5.1 gpm " 16 B/D
11/1	#3 Well	Installed (Pump not hooked up)								
11/1	#3 Piez	Installed		No reading because of water in casings & other wells.						
11/2	#1 Well						—	3.4 (12-8) 5	5.4 B/O	
	#1 SP.	38'8"					38'8" No water			
	#2 Well						—	5+ (12-8) 5-	1.8+ B/O	
22'10"	#1 Piez	47'8"					29'11"			
23	#2 Piez	mud 43'9"					25'5"			mud at 42'4"+
?	#3 Well 48.5	47'10" 44'10" 03' cut =		✓ 44'10" 5' #4			31'2"	—		not in service
21'10"	#3 SP.	39'4"					6'6"			
	#3 Piez	48'1"		5' 3			31'9½"			
11/2	No work accomplished raining.							—		
11/3	#4 Well	Installed								Not in service

Permanent Wells

10/25 – Getting Equip ready

DATE	WELLS EQUIP.	T.D	BLANK	Screen	Above Grade	Location	LL	GPM	OIL	REMARKS
10/26 22	#2 Big Installed	46'6" 45'5"	5'	5' #30	18"	✓				
10/27 22R	#1 Big Installed	46'6" 47.8	5'	5' #30	18"	✓				
								Well	Same 1'	
10/28 22W	#1 Well Installed	48'10" 46'1"	1'	5' #40	○		20'3"			16" Casing 42' TD – 16'2 LL
10/28 22W	#1 Big	47'8"					30'7"			
11/3	#2 Big						22'4"			
22W	#1 Well Standpipe	38'8"					20'7"			
11	#1 Well	in service (pumping)	#40	(PM)			—	7	0	
10/30								5	5B/D	
10/31 w	#1 Big	47'6"					31'3"	—	—	
23W	#2 Big	45'5"					31'½"	—	—	Mud hit @ 43'10"
22W	#1 Well Standpipe	38'7"					No Water	—	—	
	#1 Well	—					11	4	48B/D 3.0B/D	

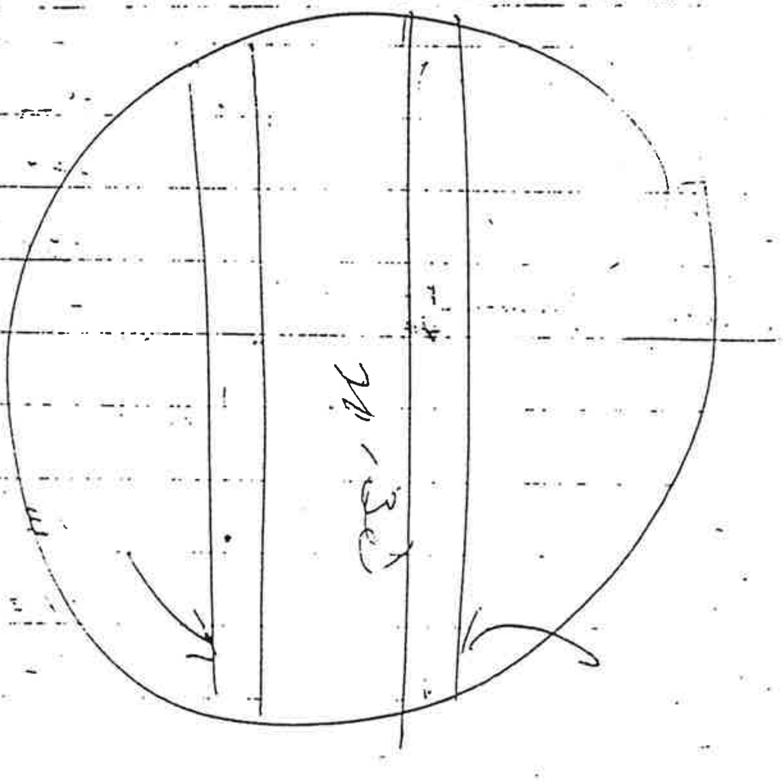
Shutdown #1 Well c̄ (7 HRS.) for Check on LL (3.3gpm) (1.4B/D)

DATE	WELLS EQUIP.	T.D	BLANK	Screen	Above Grade	Location	LL	GPM	OIL	REMARKS
10/31	#1 Big						31'1"			Rise of 2"
	#2 Big						30'10"			Rise of 2½"
	#1 Well Standpipe						38'7" 31'2" 11AM PM 30'11" @ 2PM			Rise of 6"

Electrical Shutdown —

DATE	WELLS EQUIP.	T.D	BLANK	Screen	Above Grade	Location	LL	GPM	OIL	REMARKS
11/2 23W	#2 Well Installed	40'	1'	5' #[illegible]	✓					16" Casing Installed [illegible]

11



12

Date	Wells	Initial SLL *	ARCO EL.	CORR.ᴹ EL.
2/6/67	#10	35'9"	30'17" →	30'2"
	#3W		29'57" →	29'7"
21	#3SP	30'6"		
	#3PIEZ	31'5"		
22	#1W		28'33" →	28'4"
	#1SP	31'2"		
	#1PIEZ	31'1"		
	#2PIEZ	32'0"		
23	#2W		26'21" →	26'3"
	#4PIEZ	30'4"		
	#4W		26'79" →	26'10"
	#4SP	30'6"		
	#5W		28'71" →	28'11"
	#5PIEZ	31'9"		
	#5SP	[illegible]9"		
	#6PIEZ	30'11"		
	#6W		28'44" →	28'5"
	#26TK.	36'1"		
	#8WELL	45'6"	33'53" →	33'6"
	#30WELL		25'18 →	25'2"
	#6WELL		14'50 →	14'6"

* Wells down 14 days

Meas. to Top of casing.

DATE	WELLS	CORR. ~~STATIC~~ ~~[illegible]~~ LL	1st 24 Hrs Corr ~~[illegible]~~ LL	4th 1 48 Hrs Corr at Grade STATIC LL	4th 1 (25) 96 Hrs Corr at Grade ~~[illegible]~~ LL		(7 days) Corr to Grade	(14 days Corr to grade)	(21 days) OIL B/O	RATE GPM	
1/20	#1, 2						1" of Rain 1/17		5.4	HA	1/20 — 4,5,6, Wells Shutdown Wally AM. ~~[illegible]~~ Failure.
	#4,5,6								2.4	1.3	
1/21-1/23	#1+2					1/27			3.0	8.3	
1/23 AM	#1+2				TH [illegible]	AECC ELI			6.8	7.1	1/23 Shutdown #1, 2 wells down Contractor
		All Wells Down — Static Level									
-?'0"	(ACTIVE) #10 WELL	1/22 32'2"	1/24 32'6"	1/24 32'7"	1/27 33'3 32'4"		1/30 32'1"	1/6 32'5"	2/1 32'11"	2/1 36.5	
-5'	#3 SP	13'10"	29'11"	30'0"	30'7 29'11"	#3 well 29.57	29'10"	29'10"	29'10"	30'6"	
-1'	#2 Piez	30'4"	30'5"	30'5"	31-4 30'4"		30'6"	30'5"	30'5"	31'5"	
-1'2"	#1 SP	30'7"	29'8"	29'8"	31-1 29'7"	7 well 28.33 Green Water	29'9"	29'8"	29'8"	31'2"	NOTE —
-1'2"	#1 Piez	30'7"	29'7"	29'9"	31-0 29'6"		29'7"	29'7"	29'7"	31'1"	Contractor installing
-2"	#2 Piez	30'2½"	30'6"	30'6"	32-0 30'6"	#2 well 26.21 Green Water	30'6"	30'6"	30'6"	32'0"	pumps,
-6"	#4 Piez	31'2"	30'3"	29'11"	30'4 29'10"		29'11"	29'11"	29'11"	30'—	piping etc from 1/18
-3' +24"	#4 SP	29'7½"	29'7"	29'7"	32-6 29'6"	#4 well 26.79	29'7"	29'6"	29'6"	30'6"	to 1/1/67
-2'	#5 Piez	26'3"	29'8"	29'8"	31-8 29'8"		29'7"	29'7"	29'7"	31'7"	Oil 1/26 —
-1' +15"	#5 SP	29'3"	29'1"	29'1"	31-0 29'0"	#5 well dw 7.5' 28.91	29'1"	29'0"	29'1"	29'10"	#1 Piez
-2'	#6 Piez	27'8½"	28'10"	28'10"	30'10" 28'10"	#6 well 28.44	28'7"	28'11"	28'10"	30'10"	#2 Piez #5 SP
	20TK.	29'8"			29'10"		29'11"				
	Artesian	—	36'0"	—							[illegible] 50 dip.
-1'	#8 well act.	41'0"	—	41'5"			39'5"		No Pumping 30'5"	(rate 11' rise)	
-1'6"	#20 well						29'4"				
-?	#6 well						-27'1				

DATE	WELLS	INITIAL LL	CORR LL	STATIC LL	DIFF + or -				OIL E/O	RATE GPM	-REMARKS
1/13-1/16	#1+2		--						2.4	7.9	Ave [illegible]
	#4,5,6								1.2	2.3	Ave ''
AM	#1+#2								10	9.4	
	#4,5,6.								0.5	1.1	Green water
PM	#1+#2								11.0 4.8	8.2 8.0	
	#4,5,6								7.2 4.2	1.4 1.6	Tank kicked out of line
1/17/67	#1+2 #4,5,6.								9.2 1.2	7.1 1.9	
1/18/67	1+2 #4,5,6.								7.2 1.2	7.8 1.6	Contractor installing well Equip. on 1/18/67
		With #1 and 2 and 4,5 6 wells in Service									
1/18/67 AM	#10 well	36'5"	32'11	32'2"	-9"						*- No Green water in #456 -
	#3SP	30'10"	30'2"	13'10"	-16'4'						
	#3Plug	32'4"	31'4"	30'4'	-1'						
	#1SP	38-10	36'4"	30'7'	-5'9"						
	#1Plug	31'6"	30'0"	30'7"	+7"						
	#2Plug	32'10"	30'9"	30'2½"	-7"						
	#4Plug	31'4"	31'5"	31'2"	-3"						
	#4SP	31'9"	33'9"	29'7½"	-4'2"						
	#5Plug	31'9"	29'9"	26'3"	-3'6"						
	#5SP	31'11"	29'11"	29'3"	-8"						
	#6Plug	30'10"	28'10"	27'8½"	-1'2"						
1/18	#3SP - 3 Plug - 3 Well	20'-11" 32-7" only	> levels taken after pumping 2 hours all pumps down						NIL	110	Grey -
	#4SP 4 Well #4Plug	39-8 only 21-0c	level taken 2 hours after pumping, all other pumps down						30.0	5.0	heavy oil
1/19	#1+2 #4,5,6								7.2 0.6	6.1 .4	

DATE	WELLS	INITIAL LL	CORR. LL	STATIC LL	DIFF. FOR -	INITIAL LL	CORR. LL	DIFF. FOR -	OIL E/D	RATE E/M	REMARKS
1/11/67	#1-3								9.6	15	Pm [illegible]
	#4,5,6								4.5	4	[illegible]
1/12/67	#1-#3								0.2	15	Am
	#4,5,6								2.4	3.8	Am
	#1-3								0.6	12.2	Pm
	#4,5,6								1.2	3.5	Pm [illegible]
1/13/67	#1-3								NC 0.5	12.0 12.0	
	#4,5,6								3.6 3.0	2.9 3.1	
	#1,2,#3	Bad Overflows with 3 wells on.							40+ 25	45 43	Pm #2 [illegible] Produce
	#1,#2					Note			7.0	8	
1/13/67	(With #1 & 3 and 4,5,6 wells in Service)										
						CONTRACTOR AT GRADE	TO TOP OF CSG.		OUGS TO TOP OF CASING		
-36"	#10	26'0"	32'6"	32'2"	-4"						
-8"	#35P	30'11"	30'3"	13'10"	-16'5"	3W- 45'	+1½	(46½') →	46'[illegible]"		?
						45	+3"	(45')			
-1'	#3Plug	32'10"	31'10"	31'4"	-6"	35'5"	+1'	(36'5)			
-1½'	#1SP	38'9"	37'3"	30'7"	-6'8"	4W 45'	+2'	(47') →	46'7"		
						45'	+1½	(46½')			
-1½'	#1Plug	31-6"	31'0"	31'7"	+7"	45'	+1½	(46½')			
						2W 45'	+2	(45½) →	45'6"		
-1½'	#2Plug	32'3"	30'9"	30'2½"	-7"	45'	+1½	(46½)			
-6"	#4Plug	32'3"	31'9"	31'2"	-7"	45'	-6"	(44½)			
-3'	#4SP	38'6"	35'6"	29'7½"	-5'11"	4W 45'	+1½	(46½') →	45'9"		
						45'	+3'	(48'0)			
-2'	#5Plug	31'5"	29'5"	26'3"	-3'2"	52.5	+2'	(54½')			
-2'	#5SP	32'2"	30'2"	29'3"	-11"	5W 45'0	+4'	(49') →	46'6"		?
						45'0	+2'	(47')			
2'	#6Plug	30'9"	28'9"	27'8½"	-1'1"	45'0	+2'	(47')			
						6W 45'0	+3½	(48½') →	48'8"		

Date	Wells	INITAL LL	CORR LL	STATIC LL	DIFF. TO-	INITAL LL	CORR LL	DIFF TO-	OIL B/O	RATE GPM	REMARKS
12/23		#1, 2, 3 also	#4, 5, 6 Wells in [illegible]						Pump 17 (4-7/16 [illegible] Rate 6GPM)		#5 [illegible] in place on 12/22/66
-3'6"	#1L	35'10½"	32'4"	33'2"	-2"	— V S —		-2"	[illegible]		[illegible]
-2"	#3SP	29'5"	28'9"	31'10"	-1'4"			-1'4"	4" [illegible]		Blockage:
-1'	#3 Pmp	31'8"	30'8"	32'4"	-4"			-1'4"	1' [illegible]		3 Pmp 5" [illegible] " " 9" [illegible] " " 1" [illegible] 1, 2, 3 — [illegible]
-1'2"	#1SP	32'0"	30'6"	30'9"	[illegible]			-6'1"	6" [illegible]		
-1'2"	#1 Pmp	31'2"	29'8"	30'7"	+11"			-5"	6" [illegible]		
-1'2"	#2 Pmp	32'1"	30'7"	32'2½"	-5"			-1"	4" [illegible]		
-6"	#4 Pmp	31'3"	30'9"	31'2"	+5"			-1'1"	8" [illegible]		
-3'	#4SP	36'11"	33'11"	29'7½"	-4'4"			-4'2"	Same		
-2'	#5 Pmp	31'7"	29'7"	26'3"	-3'4"			-3'7"	3" [illegible]		
-2'	#5SP	33'8"	31'8"	29'3"	-2'5"			-3'11"	1'6" [illegible]		Green water in 456 Tank.
-2'	#6 Pmp	31'2½"	29'2"	27'5½"	-1'6"			-1'6"	Same		
12/23	1,2,3, 4,5,6, 1,2,3, & 456								Nil 3.6 0.6 4.5	2.1 4.2 2.0 3.5	 AM PM
12/23 & 1/4/67	1,2,3 4,5,6								Trace 9.0	1.8 2.7	[illegible] [illegible] changing
1/4/67	1,2,3 4,5,6								0.3 2.2	1.6 2.1	Green water in 123, 456 wells from 1/4 to 1/6 inc.
1/5/67	1,2,3, 4,5,6,								Trace 1.2	1.5 2.4	Green dye now returned in #1,2,5 wells. No color in #10 wells.
1/5/67 PM	1,2,3, 4,5,6								0.3 2.4	1.5 3.2	manipulated valves & [illegible] on [illegible]
1/6/67	1,2,3 4,5,6								0.3 2.4	1.1 2.9	26TK [illegible] no water, dry well.

Date	INITIAL LL	CORR LL	STATIC LL	DIFF TN-	INITIAL LL	CORR LL	DIFF TN-	OIL B/D	RATE GPM		Remarks
12/16/66		#1 + 2 [illegible], [illegible] #4,56 [illegible]:									#1, 2 #4,56 [illegible]
#[illegible]:	36'5"	33'5"	32'2"	-1'3"							
#3SP	29'3"	28'7"	13'10"	-14'9"							
#3Plg	31'9"	30'9"	30'4"	-5"							
#1SP	32'5"	31'11"	30'7"	-1'4"							
#1Plg	30'10½"	29'4½"	30'7"	+1'5"							
#2Plg	31'-6"	30'0"	30'2½	+2½"							
#4Plg	32'2"	31'8"	31'2"	-6"							
#4SP	38'9½"	35'9½"	29'7½"	-6'2"							
#5Plg	31'10½"	29'10½"	26'3"	-3'7"							
#5SP	34'5"	32'5"	29'5"	-3'2"							
#6Plg	31'5½"	29'3½"	27'8½"	-1'7"							
12/16	#1 + #2							2.4	3.9		[illegible] ~~[illegible]~~ 4,3 [illegible] avg
	#4,5,6,							0.6	3.6		[illegible] 6 avg.
12/19	1 + 2							2.4	3.6		
	#4,5,6,							0.6	3.9		
12/20	1 + 2							3.8	0.6		~~[illegible]~~ [illegible]
	4,5,6							4.0	3.6		
12/2[illegible]	1 + 2							1.0	3.6		Collector # [illegible] [illegible] — [illegible]
								Nil	~~2.2~~		
	4,5,6,							1.5	4.3		
								2.6	4.1		
	1, 2							7.2	3.0		#
12/22	4,5,6,							3.0	4.0		[illegible] — 4,5,6,
	1,2,3,							Nil	2.7		
	4,5,6							7.2	7.0		[illegible] + [illegible] [illegible]
	4,5,6,							45.0	40.0		
	#3 only							0.4	5.0		
	1,2,3,							0.9	2.2		1, 2 [illegible] —
1/23	1,2,3,							Nil	2.1		[illegible]
	4,5,6,							3.6	4.2		[illegible]

DATE	WELLS	INITIAL LL	CORR. LL	STATIC LL	DIFF. [illegible]	INITIAL LL	CORR LL	DIFF. [illegible]	[illegible]	RATE [illegible]	REMARKS
1/8/67	1,2,3,								7	1.7	Slight [illegible]
	4,5,6,								.4	2.5	clear.
1/9	1,2,3,								[illegible]	1.5	
	4,5,6								4.1	2.1	
	#1, #2 ~~[illegible]~~ #3CN [illegible] (1/10/67 [illegible] #1 + #2 Pumps)										[illegible]
1/9 -3'	#1C	35'8"	32'2"	32'2'	[illegible]	36'5'	34'11"	-3			[illegible]
-8"	#3SP	29'9"	29'1"	13'10"	-1'5"	29'10"	29'2"	[illegible]			
-1'	#3 Piez	31'7"	30'9"	30'4"	-5"	32'4"	31'4"	-1'0			#1, #3, [illegible]
-1½'	#1SP	30'11½	29'5"	30'7"	+1'2"	38'9"	31'3"	[illegible]			[illegible]
-1½'	#1 Piez	31'1"	29'7"	30'7"	-1'0	31'6"	30'6"	+7"			½" of oil
-[illegible]	#2 Piez	32'2"	30'8"	30'2½	-6"	32'9"	31'3"	+1'1"			½" of oil
-6"	#4 Piez	31'3½"	30'9"	31'2"	+5"	33'9"	32'1"	+1"			
-3'	#4SP	37'8"	34'8"	29'7½"	-5'1"	39'10"	36'9"	-[illegible]			
-2'	#5 Piez	31'2"	29'2"	26'3"	-2'11"	31'4"	29'4"	-[illegible]			
-2'	#5SP	32'6"	30'6"	29'3"	-1'3"	35'2"	31'2"	-1'11"			
-2'	#6 Piez	30'8"	28'8"	27'8½	-1'0"	30'10"	29'10"	-1'1"			[illegible]
1/9 PM	1, 2								4.0	9.2	[illegible]
	4,5 6								4.8	2.7	[illegible]
1/10/67	#1 + 2								1.0	8.6	Not green, [illegible]
	#4,5,6.								1.2	2.4	Water green
PM	1 + 2								7.0	11.0	
	4,5,6,								10.0	4.5	
PM	1 + 2								2.8	10.0	
	4,5,6								4.8	4.5	
1/11/67	#1, + 2								2.4	8.0	~~Slight foam~~
	#4,5,6								1.2	4.0	
AM	1, + 2								3.0	6.7	
	4,5,6.								4.8	4.0	Note ½" oil
PM	1, + 2								1.9	7.0	on #2 Piez.
	#4,5,6								2.4	4.1	

Put in service #3 and #1 Pumps

SUN DOCUMENT REVIEW FORM
(EPA INQUIRY)

DOCUMENT CONTROL NO. :

DATE: Jan '67

AUTHOR:

RECIPIENT(S):

CC'S:

RE / SUBJECT LINE:

DERIVED SUBJECT: Results of well tests
(If no Re line)

ANNOTATIONS: YES [✓ NO]
(Circle one)

RESPONSIVENESS

1. SUN 8/21/92 LETTER: 1 2 3
(Circle appropriate categories)

2. IF OIL RECOVERY: HRP OOR ORP
(Category 2 - circle one)

3. PRIVILEGE: ATTORNEY/CLIENT
(Circle one) WORK PRODUCT

4. CRITICAL DOCUMENT CRITERIAL: 1 2 3 4 5 6 7 8
(Circle appropriate categories)

5. COMMENTS:

PGW V. ATLANTIC, ET AL.

EPA INQUIRY KEYWORD CHECKLIST

KEY WORD CATEGORIES:

- SPILLS
  - tank leak
  - surface leak
  - product and/or crude line spills
  - leaks
  - remediation
  - removal
- SOIL
  - borings
  - excavation
  - samples
  - trenches
  - fill
- GROUNDWATER
  - perched water
  - deep aquifer
  - dissolved phase
  - underground water
  - shallow aquifer
  - aquifer
  - monitoring wells
  - testing wells
  - SEWERS all refinery sewers including:
    - Pollack
    - Jackson
    - 26 Street

Rambo Creek

Repeat

WELL.	INITIAL DATE		3/13/68 DATE		3/20/68 DATE		3/21/68 DATE		DATE		DATE		DATE		DATE	
	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −
27W	31-5															
27P	30-0		30-0	0	29-2	+10"	30-1									
28W	29-10															
28P	30-2		30-3	-1"	29-1	+11"	29-4									
29W	24-6															
29P	32-5		32-0	+5"	31-3	+15"	31-6									
20W	30-8		30-0	+8"	30-7	+1"	30-8									
30P	34-5		33-10	+7"	33-8	+9"	33-5									
30W	34-4															
31P	35-1		33-11	+14"	34-0	+11"	34-0									
31W	34-0															
27CASH	29-4															
					RAIN											

LIQUID LEVELS

WELL	12/18/6 DATE		1/10/68 DATE		1/17/68 DATE		1/31/68 DATE		2/8/68 DATE		2/14/68 DATE		2/28/68 DATE		3/6/68 DATE	
	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -
27W																
27P	29-9		29-10		30-2		29-7		29-10		29-8		30-0		30-2	+2"
28W																
28P	30'1"		30-2		30-3		30-0		30-0		30-0		30-1		30-2	0
29W																
29P	32'1"		32-2		32-3		32-0		32-1		32-2		32-0		31-11	+1"
20W	30-1		30-2		30-3		30-2		30-2		30-0		30-2		30-1	+1"
30P	33-11		34-1		34-2		33-11		34-0		34-0		34-4		34-1	+3"
30W																
31P	34-4		34-3		34-6		34-4		34-1		34-0		34-0		34-0	+1"
31W																
21CAS.																

City Interceptor
Backed up on
1/26/68

#27 to 31 wells

WELL	Initial SL DATE		12/28/67 DATE		1/10/68 DATE		1/17/68 DATE		DATE		DATE		DATE		DATE	
Initial	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −
27W	31'5		—		—		—									
27P	30'0"		30'6"		29-10		30-2									
28W	28'10		—		—		—									
28P	30'2"		30'11"		30-2		20-3									
29W	29'6"		—		—		—									
29P	32'5"		33'6"		32-2		32-3									
20W	30'8"				30-2		30-3									
30P	34'5"		32'9"		34-1		34-2									
30W	34'4"		—		—		—									
31P	35'1"		30'1"		34-3		34-6									
31W	34'0		—		—		—									
#2 King			—		—		—									
			#31 well down		All wells In operation		All wells in operation									

LEVEL
#27 to 31 wells.

WELL	Initial DATE		9/20/67 DATE		9/27 DATE		10/17 DATE		10/30 DATE		11/15 DATE		12/7 DATE		12/18 DATE	
	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −
27W	31'5															
27P	30'0		30'2"		30'1"		29'11"		29'11"		30'0"		29'9"		29'9"	
28W	28'10"															
28P	30'2"		30'6"		30'8"		30'3"		30'3"		30'3"		30'1"		30'1"	
29W	29'6"															
29P	30'3"		32'8"		32'8"		32'3"		32'3"		32'4"		32'0		32'1"	
20W	30'8"		30'0		31'4"		30'3'		30'4"		—		30'1"		30'1"	
30 P	34'5'		34'6"		34'4"		34'0'		34'1"		34'4"		33-10		33-11	
30W	34'4"						Down									
31P	35'1"		34'10"		35'0'		34'5"		34'7"		33'0'		34'4"		34'4"	
31W	34'0															

Note
~~11/27~~

Note:
~~12/1~~

Note
~~well~~

#31 well
down on
11/29/67

STATIC LEVELS

[illegible] SLL

WELL	5 day 6/4 DATE		Only 21-31 [illegible] 6/7 DATE		Initial SLL 24 HRS all well 6/16/67 Drawn.. DATE		Initial 4 Days 6/19 DATE		Initial 5 days* 6/20 DATE		INITIAL 2-5 Days DATE		Vacation All well off. 6/29/67 DATE		7/13/67 DATE	
	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −
27W					31'5"				~~[illegible]~~		31'5"					
27 Piez	30'3"		30'-0"		31'0"				30'0"		30'0"		30'4"		30'4"	
28W					28'10"				~~[illegible]~~		28'10"		~~[illegible]~~		~~[illegible]~~	
28 Piez	30'5"		30'2"		30'2"				30'2"		30'2"		30'9"		30'9"	
29W					29'6"				—		29'6"					
29 Piez	32'9"		32'6"		32'5"				32'5"		32'5"		32'9"		32'9"	
20W	30'11"		30'8"		30'8"				30'7"		30'8"		—		~~[illegible]~~	
30 Piez	34'8"		34'7"		34'6"				34'5"		34'5"		32'9"		34'7"	
30W					34'3"		34'4"		34'[illegible]		34'4"					
31 Piez	35'0"		35'3"		35'1"				34'7"		35'1"		35'3"		35'2"	
..W.					34'0"		34'0"		—		34'0"					
[illegible]	OLD SITE Adjacent to fence.						28'1"		28'2"		28'2"					

Suspect leakage in #30 well -

RAIN 1½"

Use the above data
*

FLUID LEVELS

WELL	5/5/67 DATE		5/10/67 DATE		5/17/67 DATE		5/17/67 Material in Casing DATE		5/23/67 DATE		Only 30-31 hrs 5/31/67 DATE		DATE		(Initial) * 3 Day DATE	
	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -	SLL	DIFF. + -
27P	30'8"	-5"	30'8"	-5"	30'8"	-[illegible]	OIL	OIL	30'7"	-4"	30'1"	+6"			30-3	
28P	30'6"	-5"	30'11"	-6"	30'11"	-[illegible]	W	W	30'11	-6"	30'4"	+7"			30-5	
29P	33'1"	-5"	32'10"	-2"	33'0"	-4"	W	W	32'11"	-3"	32'8"	+3"			32-8	
20W	31'2"	-3"	31'1"	-20"	30'11"	—	OIL	OIL	31'0"	—	30'10"	-2"			30'11"	
30P	34'11"	-3"	34'11"	-3"	34'11"	-3"	W	W	34'11"	-3"	34'8"	+3"			34'8"	
31P	35'7"	-7"	35'6"	-6"	35'6"	-6"	W	W	35'8"	-8"	35'1"	+1"			35'0"	
											5 DAYS [illegible] on 5/25/67					

Initial
(3 days)

WELL	3/14/67 DATE		3/16/67 DATE *		3/27/67 DATE		3/30/67 DATE		4/5/67 DATE		4/13/67 10AM DATE		DATE		4/24 DATE	
#1 Fu	SLL	DIFF. + − (EXT.)	SLL	DIFF. + − CORR.	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −	SLL	DIFF. + −
#27P	29'8"		29'9"	30'10	30'10"		30'10"	Water	30'8"	Water	30'9"	+1" WATER	30'9"	INITIAL	30'3"	OIL −6"
#28P	29'7"		29'8"	31'1"	30'11"		31'1"	Water [illegible]	30'11"	Water	31'0	+1" WATER	30'11"		30'5"	H_2O −6"
#29P	30'4"		30'6"	33'0	33'3"		33'3"	Water	33'1"	Water	33'2"	−2" WATER	33'1"		32'8"	H_2O −5"
#20W	31'4"	—	31'4"	31'4"	31'6"		31'3"	Oil	31'1"	Oil	31'3"	+1" OIL	31'2"		30'11"	OIL −3"
#30P	32'5		32'4"	35'2"	35'1"		35'1"	OIL NIL	35'1"	OIL NIL	35'0"	+1" WATER	35'0"		34'8"	H_2O −4"
#31P	35'5"	—	35'8"	35'8"	35'8"		35'8"	Water	35'7"	Water	35'8"	−0" WATER	35'7"		35'0	H_2O −7"
	All wells in Service		All wells in Service		Added Extension To Piez.		All wells in Service		all wells in Service		All wells recharge air and surge back except #21				Wells out of Service for three days only	

OIL WELL RECOVERIES B/MO.

MO.	#538-46 TO 519TK	#963 TO 7266TK	#6 TO 49TK	#8 TO 7302TK	#10 TO 7304TK	#4 FARM TO 7309TK	#5 SEP. TO 75[illegible]	# TOTAL 1FRM. 2 21-26	
JAN	To SEWER 0	0	45	153	75	0	EST. 25	69	77
FEB	To SEWER 0	760	DOWN	108	65	380	50	42	1
MAR	To SEWER 0	To SEWER 200	DOWN	DOWN	DOWN	1440	25	Down	675
APR	0	0	0	DOWN	DOWN	1120	25	Down.	710
MAY	0	0	0	[illegible] 5/21 0	DOWN	880	0	DOWN	77
JUN.									
JUL									
AUG									
SEP.									
OcT									
NOV.									
DEC									

JAN								
FEB								
MAR								
APR.								
MAY								
JUN.								
JUL								
AUG								
SEP.								
OCT.								
NOV.								
DEC								

410.422

WELLS	INITIAL OIL AVE B/D	CURRENT OIL AVE B/D	INITIAL WATER RATES	CURRENT WATER RATES	Remarks
21-26	43 - 41 -32,33,34	(0.6) T - 6.0	12-40 gpm	Avg 0 gpm	#23 well down – #26/
27-34	10 - 30	(27) 20-38	50-100 gpm	+32,35,34 Ave 10 gpm	
#10	0 - 5.2	? 0-3.0			a period of two years, no
#8	10 - 15	(7.0) 6-1.3			
#16	NIL	DOWN 0	—		
# 6	5 - 7	(2.0) 0.7 - 3.0			
# 20	0 - .33	NIL			
#963	6 - 20	(10)			
#546 #538	—	—			
#5 Separator	—	(1.0) 0.8 - 3.0			

Company Confidential

Atlantic Refining & Marketing Corporation

Product Recovery Project
Production Data (Barrels)

	WR-1 (14")			PNEUMATICS (2-6")			
DATE	LAST WEEK	MTD	YTD	LAST WEEK	MTD	YTD	TOTAL
DECEMBER '87							
12/14/87	0.0	407.9	1971.1	0.0	19.6	1971.4	3942.5
12/21/87	195.0	602.9	2166.1	0.0	19.6	1971.4	4137.5
12/30/87	357.1	1001.5	2564.7	241.9	261.5	2215.3	4778.0
JANUARY '88							
01/04/88	201.5	201.5	201.5	81.9	81.9	81.9	283.4
01/18/88	168.5	370.0	370.0	0.0	81.9	81.9	451.9
01/25/88	216.5	586.5	586.5	0.0	81.9	81.9	668.4
01/31/88	92.0	678.5	678.5	0.0	81.9	81.9	760.4
FEBRUARY '88							
02/08/88	115.0	115.0	793.5	0.0	0.0	81.9	875.4
02/16/88	208.3	323.3	1001.8	0.0	0.0	81.9	1083.7
02/24/88	336.0	659.3	1337.8	0.0	0.0	81.9	1419.7
02/29/88	162.1	821.4	1499.9	0.0	0.0	81.9	1581.8
MARCH '88							
03/07/88	315.2	315.2	1815.1	0.0	0.0	81.9	1897.0
[illegible]6/88	414.9	730.1	2230.0	0.0	0.0	81.9	2311.9
03/22/88	296.9	1027.0	2526.9	0.0	0.0	81.9	2608.8
03/31/88	228.3	1255.3	2755.2	0.0	0.0	81.9	2837.1
APRIL '88							
04/11/88	74.4	74.4	2829.6	0.0	0.0	81.9	2911.5
04/18/88	61.7	136.1	2891.3	0.0	0.0	81.9	2973.2
04/25/88	146.2	282.3	3037.5	0.0	0.0	81.9	3119.4
04/30/88	170.7	453.0	3208.2	0.0	0.0	81.9	3290.1
MAY '88							
05/04/88	55.5	55.5	3263.7	0.0	0.0	81.9	3345.6
05/09/88	182.0	237.5	3445.7	30.5	30.5	112.4	3558.1
05/16/88	354.1	591.6	3799.8	131.4	161.9	243.8	4043.6
05/24/88	408.3	999.9	4208.1	68.6	230.5	312.4	4520.5
05/27/88	149.4	1149.3	4357.5	49.6	280.1	362.0	4719.5
05/31/88	168.6	1317.9	4526.1	49.5	329.6	411.5	4937.6
JUNE '88							
06/06/88	362.1	362.1	4888.2	90.5	90.5	502.0	5390.2
06/14/88	63.4	425.5	4951.6	51.4	141.9	553.4	5505.0
06/20/88	201.8	627.3	5153.4	0	141.9	553.4	5706.8
06/27/88	420.4	1047.7	5573.8	40.1	182.0	593.5	6167.3
06/30/88	207.0	1254.7	5730.8	49.5	231.5	643.0	6423.8

Company Confidential

Atlantic Refining & Marketing Corporation

Product Recovery Project
Production Data (Barrels)

DATE	WR-1 (14") CURRENT WEEK	MTD	YTD	PNEUMATICS (2-6") CURRENT WEEK	MTD	YTD	TOTAL
DECEMBER '87							
12/30/87	357.1	1001.5	2564.7	241.9	261.5	2215.3	4778.0
JANUARY '88							
01/31/88	92.0	678.5	678.5	0.0	81.9	81.9	760.4
FEBRUARY '88							
02/29/88	162.1	821.4	1499.9	0.0	0.0	81.9	1581.8
MARCH '88							
03/31/88	223.3	1255.3	2755.2	0.0	0.0	81.9	2837.1
APRIL '88							
04/30/88	170.7	453.0	3208.2	0.0	0.0	81.9	3290.1
MAY '88							
05/31/88	168.6	1317.9	4526.1	49.5	329.6	411.5	4937.6
JUNE '88							
06/30/88	207.0	1254.7	5780.8	49.5	231.5	643.0	6423.8
JULY '88							
07/31/88	0.0	1062.2	6843.0	80.0	476.2	1119.2	7962.2
AUGUST '88							
08/08/88	19.3	19.3	6862.3	68.6	68.6	1187.8	8050.1
08/15/88	28.9	48.2	6891.2	25.9	94.5	1213.7	8104.9
08/22/88	52.2	100.4	6943.4	24.8	119.3	1238.5	8181.9
08/29/88	32.4	132.8	6975.8	0.0	119.3	1238.5	8214.3
SEPTEMBER '88							
09/01/88	28.4	28.4	7004.2	5.7	5.7	1244.2	8248.2

TOTAL OF '87 THROUGH '88 13026.4

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Atlantic Refining & Marketing Corporation

Product Recovery Project
Production Data (Barrels)

DATE	WR-1 (14")			PNEUMATICS (2-6")			
	CURRENT WEEK	MTD	YTD	CURRENT WEEK	MTD	YTD	TOTAL
DECEMBER '87							
12/30/87	357.1	1001.5	2564.7	241.9	261.5	2215.3	4778.0
JANUARY '88							
01/31/88	92.0	678.5	678.5	0.0	81.9	81.9	760.4
FEBRUARY '88							
02/29/88	162.1	821.4	1499.9	0.0	0.0	81.9	1581.8
MARCH '88							
03/31/88	228.3	1255.3	2755.2	0.0	0.0	81.9	2837.1
APRIL '88							
04/30/88	170.7	453.0	3208.2	0.0	0.0	81.9	3290.1
MAY '88							
05/31/88	168.6	1317.9	4526.1	49.5	329.6	411.5	4937.6
JUNE '88							
06/30/88	207.0	1254.7	5780.8	49.5	231.5	643.0	6423.8
JULY '88							
07/31/88	0.0	1062.2	6843.0	80.0	476.2	1119.2	7962.2
AUGUST '88							
08/29/88	32.4	132.8	6975.8	0.0	119.3	1238.5	8214.3
SEPTEMBER '88							
09/01/88	23.4	23.4	7004.2	5.7	5.7	1244.2	8248.2
09/06/88	96.6	125.0	7100.8	1.9	7.6	1246.1	8346.9
09/08/88	54.3	179.3	7155.1	1.9	9.5	1248.0	8403.1
09/12/88	85.6	350.5	7240.7	7.6	17.1	1255.6	8496.3
09/19/88	274.4	624.9	7515.1	0	17.1	1255.6	8770.7
09/26/88	282.3	907.2	7797.4	0	17.1	1255.6	9053.0
09/30/88	76.2	983.4	7873.6	0	17.1	1255.6	9129.2
OCTOBER '88							
10/03/88	43.9	43.9	7841.3	11.4	11.4	1267.0	9108.3
				TOTAL OF '87 THROUGH '88			13962.5

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Atlantic Refining & Marketing Corporation

Product Recovery Project
Production Data (Barrels)

DATE	WR-1 (14") CURRENT WEEK	MTD	YTD	PNEUMATICS (2-6") CURRENT WEEK	MTD	YTD	TOTAL
DECEMBER '87							
12/30/87	357.1	1001.5	2564.7	241.9	261.5	2215.3	4773.0
JANUARY '88							
01/31/88	92.0	678.5	678.5	0.0	81.9	81.9	760.4
FEBRUARY '88							
02/29/88	162.1	821.4	1499.9	0.0	0.0	81.9	1581.8
MARCH '88							
03/31/88	228.3	1255.3	2755.2	0.0	0.0	81.9	2837.1
APRIL '88							
04/30/88	170.7	453.0	3208.2	0.0	0.0	81.9	3290.1
MAY '88							
05/31/88	168.6	1317.9	4526.1	49.5	329.6	411.5	4937.6
JUNE '88							
06/30/88	207.0	1254.7	5780.8	49.5	231.5	643.0	6423.8
JULY '88							
07/31/88	0.0	1062.2	6843.0	80.0	476.2	1119.2	7962.2
AUGUST '88							
08/29/88	32.4	132.8	6975.8	0.0	119.3	1238.5	8214.3
SEPTEMBER '88							
09/30/88	76.2	933.4	7873.6	0	17.1	1255.6	9129.2
OCTOBER '88							
10/03/88	43.9	43.9	7917.5	11.4	11.4	1267.0	9184.5
10/10/88	129.9	173.8	8047.4	5.7	17.1	1272.7	9320.1
10/17/88	140.7	314.5	8188.1	24.8	41.9	1297.5	9485.6
10/24/88	298.1	612.6	8486.2	9.6	51.5	1307.1	9801.7
10/31/88	312.9	925.5	8799.1	7.6	59.1	1314.7	10113.8
NOVEMBER '88							
11/01/88	54.2	54.2	8853.3	0	0	1314.7	10168.0
11/07/88	273.4	327.6	9126.7	0	0	1314.7	10441.4
11/14/88	309.1	636.7	9435.8	13.3	13.3	1328.0	10763.8

TOTAL OF '87 THROUGH '88 15541.8

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Atlantic Refining & Marketing Corporation

Product Recovery Project
Production Data (Barrels)

DATE	WR-1 (14") CURRENT WEEK	MTD	YTD	PNEUMATICS (2-6") CURRENT WEEK	MTD	YTD	TOTAL
DECEMBER '87							
12/30/87	357.1	1001.5	2564.7	241.9	261.5	2215.3	4778.0
JANUARY '88							
01/31/88	92.0	678.5	678.5	0.0	81.9	81.9	760.4
FEBRUARY '88							
02/29/88	162.1	821.4	1499.9	0.0	0.0	81.9	1581.8
MARCH '88							
03/31/88	228.3	1255.3	2755.2	0.0	0.0	81.9	2837.1
APRIL '88							
04/30/88	170.7	453.0	3208.2	0.0	0.0	81.9	3290.1
MAY '88							
05/31/88	168.6	1317.9	4526.1	49.5	329.6	411.5	4937.6
JUNE '88							
06/30/88	207.0	1254.7	5780.8	49.5	231.5	643.0	6423.8
JULY '88							
07/31/88	0.0	1062.2	6843.0	80.0	476.2	1119.2	7962.2
AUGUST '88							
08/29/88	32.4	132.8	6975.8	0.0	119.3	1238.5	8214.3
SEPTEMBER '88							
09/30/88	76.2	983.4	7873.6	0.0	17.1	1255.6	9129.2
OCTOBER '88							
10/31/88	312.9	925.5	8799.1	7.6	59.1	1314.7	10113.8
NOVEMBER '88							
11/29/88	343.6	1320.5	10119.6	0.0	13.3	1328.0	11447.6
11/30/88	41.4	1361.9	10161.0	0.0	13.3	1328.0	11489.0
DECEMBER '88							
12/01/88	36.2	36.2	10197.2	0.0	0.0	1328.0	11525.2
				TOTAL OF '87 THROUGH '88			16303.2

Atlantic Refining & Marketing Corporation

Product Recovery Project
Production Data (Barrels)

DATE	WR-1 (14") CURRENT WEEK	MTD	YTD	PNEUMATICS (2-6") CURRENT WEEK	MTD	YTD	TOTAL
DECEMBER '87							
12/30/87	357.1	1001.5	2564.7	241.9	261.5	2215.3	4778.0
JANUARY '88							
01/31/88	92.0	678.5	678.5	0.0	81.9	81.9	760.4
FEBRUARY '88							
02/29/88	162.1	821.4	1499.9	0.0	0.0	81.9	1581.8
MARCH '88							
03/31/88	228.3	1255.3	2755.2	0.0	0.0	81.9	2837.1
APRIL '88							
04/30/88	170.7	453.0	3208.2	0.0	0.0	81.9	3290.1
MAY '88							
05/31/88	168.6	1317.9	4526.1	49.5	329.6	411.5	4937.6
JUNE '88							
06/30/88	207.0	1254.7	5780.8	49.5	231.5	643.0	6423.8
JULY '88							
07/31/88	0.0	1062.2	6843.0	80.0	476.2	1119.2	7962.2
AUGUST '88							
08/29/88	32.4	132.8	6975.8	0.0	119.3	1238.5	8214.3
SEPTEMBER '88							
09/30/88	76.2	983.4	7873.6	0.0	17.1	1255.6	9129.2
OCTOBER '88							
10/31/88	312.9	925.5	8799.1	7.6	59.1	1314.7	10113.8
NOVEMBER '88							
11/29/88	343.6	1320.5	10119.6	0.0	13.3	1328.0	11447.6
11/30/88	41.4	1361.9	10161.0	0.0	13.3	1328.0	11489.0
DECEMBER '88							
12/01/88	36.2	36.2	10197.2	0.0	0.0	1328.0	11525.2
12/05/88	161.6	197.8	10358.8	0.0	0.0	1328.0	11686.8
12/12/88	32.2	230.0	10391.0	0.0	0.0	1328.0	11719.0
12/19/88	17.4	247.4	10408.4	0.0	0.0	1328.0	11736.4
12/30/88	271.3	518.7	10679.7	0.0	0.0	1328.0	12007.7

26TH STREET
PR-1 OIL RECOVERY

12/19/88 - 12/25/88

FLOW = 3.6 GALLONS/MINUTE
PRODUCT % = 2.7 %

DATE	HOURS PUMPING	BARRELS PRODUCT
12/19	24	3.33
12/20	24	3.33
12/21	24	3.33
12/22	24	3.33
12/23	24	3.33
12/24	24	3.33
12/25	24	3.33
	168	23.33

TOTAL PRODUCTION WEEK 12/05/88-12/11/88 = 23.33
TOTAL PRODUCTION YEAR TO DATE = 436.02

12/26/88 - 01/01/89

FLOW = 3.6 GALLONS/MINUTE
PRODUCT % = 4.00 %

DATE	HOURS PUMPING	BARRELS PRODUCT
12/26	24	4.94
12/27	24	4.94
12/28	24	4.94
12/29	24	4.94
12/30	24	4.94
12/31	24	4.94
01/01	24	4.94
	168	34.56

TOTAL PRODUCTION WEEK 12/12/88-12/18/88 = 34.56
TOTAL PRODUCTION YEAR TO DATE = 470.58

26TH STREET
PR-1 OIL RECOVERY

12/05/88-12/11/88

FLOW = 3.6 GALLONS/MINUTE
PRODUCT % = 4.08 %

DATE	HOURS PUMPING	BARRELS PRODUCT
12/05	24	5.04
12/06	24	5.04
12/07	24	5.04
12/08	24	5.04
12/09	24	5.04
12/10	24	5.04
12/11	24	5.04
	168	35.25

TOTAL PRODUCTION WEEK 12/05/88-12/11/88 = 35.25
TOTAL PRODUCTION YEAR TO DATE = 379.86

12/12/88-12/18/88

FLOW = 3.6 GALLONS/MINUTE
PRODUCT % = 3.8 %

DATE	HOURS PUMPING	BARRELS PRODUCT
12/12	24	4.69
12/13	24	4.69
12/14	24	4.69
12/15	24	4.69
12/16	24	4.69
12/17	24	4.69
12/18	24	4.69
	168	32.83

TOTAL PRODUCTION WEEK 12/12/88-12/18/88 = 32.83
TOTAL PRODUCTION YEAR TO DATE = 412.69

26TH STREET
PR-1 OIL RECOVERY

11/21/88-11/27/88

FLOW = 3.6 GALLONS/MINUTE
PRODUCT % = 2.5 %

DATE	HOURS PUMPING	BARRELS PRODUCT
11/21	24	3.09
11/22	24	3.09
11/23	24	3.09
11/24	24	3.09
11/25	24	3.09
11/26	24	3.09
11/27	24	3.09
	168	21.60

TOTAL PRODUCTION WEEK 11/21/88-11/27/88 = 21.60
TOTAL PRODUCTION YEAR TO DATE = 309.36

11/28/88-12/04/88

FLOW = 3.6 GALLONS/MINUTE
PRODUCT % = 4.08 %

DATE	HOURS PUMPING	BARRELS PRODUCT
11/28	24	5.04
11/29	24	5.04
11/30	24	5.04
12/01	24	5.04
12/02	24	5.04
12/03	24	5.04
12/04	24	5.04
	168	35.25

TOTAL PRODUCTION WEEK 11/28/88-12/04/88 = 35.25
TOTAL PRODUCTION YEAR TO DATE = 344.61

26TH STREET
PR-1 OIL RECOVERY

11/14/88-11/20/88

FLOW = 3.56 GALLONS/MINUTE
PRODUCT % = 3.85 %

DATE	HOURS PUMPING	BARRELS PRODUCT
11/14	0	0.00
11/15	0	0.00
11/16	24	4.70
11/17	24	4.70
11/18	24	4.70
11/19	24	4.70
11/20	24	4.70
	120	23.50

TOTAL PRODUCTION WEEK 10/24/88-10/30/88 = 23.50
TOTAL PRODUCTION YEAR TO DATE = 287.76

11/21/88-11/27/88

FLOW = 3.6 GALLONS/MINUTE
PRODUCT % = 2.5 %

DATE	HOURS PUMPING	BARRELS PRODUCT
11/21	24	3.09
11/22	24	3.09
11/23	24	3.09
11/24	24	3.09
11/25	24	3.09
11/26	24	3.09
11/27	24	3.09
	168	21.60

TOTAL PRODUCTION WEEK 10/24/88-10/30/88 = 21.60
TOTAL PRODUCTION YEAR TO DATE = 309.36

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26TH STREET
PR-1 OIL RECOVERY

11/07/88-11/13/88

FLOW = 3.56 GALLONS/MINUTE
PRODUCT % = 2.5 %

DATE	HOURS PUMPING	BARRELS PRODUCT
11/07	21	2.67
11/08	24	3.05
11/09	24	3.05
11/10	24	3.05
11/11	24	3.05
11/12	24	3.05
11/13	24	3.05
	165	20.98

TOTAL PRODUCTION WEEK 10/24/88-10/30/88 = 20.98
TOTAL PRODUCTION YEAR TO DATE = 264.26

11/14/88-11/20/88

FLOW = 3.56 GALLONS/MINUTE
PRODUCT % = 3.85 %

DATE	HOURS PUMPING	BARRELS PRODUCT
11/14	0	0.00
11/15	0	0.00
11/16	24	4.70
11/17	24	4.70
11/18	24	4.70
11/19	24	4.70
11/20	24	4.70
	120	23.50

TOTAL PRODUCTION WEEK 10/24/88-10/30/88 = 23.50
TOTAL PRODUCTION YEAR TO DATE = 287.76

26TH STREET
PR-1 OIL RECOVERY

10/31/88-11/06/88

FLOW = 3.75 GALLONS/MINUTE
PRODUCT % = 5.4 %

DATE	HOURS PUMPING	BARRELS PRODUCT
10/31	24	6.94
11/01	24	6.94
11/02	24	6.94
11/03	24	6.94
11/04	24	6.94
11/05	24	6.94
11/06	24	6.94
	168	48.60

TOTAL PRODUCTION WEEK 10/24/88-10/30/88 = 48.60
TOTAL PRODUCTION YEAR TO DATE = 243.29

11/07/88-11/13/88

FLOW = 3.56 GALLONS/MINUTE
PRODUCT % = 2.5 %

DATE	HOURS PUMPING	BARRELS PRODUCT
11/07	21	2.67
11/08	24	3.05
11/09	24	3.05
11/10	24	3.05
11/11	24	3.05
11/12	24	3.05
11/13	24	3.05
	165	20.98

TOTAL PRODUCTION WEEK 10/24/88-10/30/88 = 20.98
TOTAL PRODUCTION YEAR TO DATE = 264.26

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26TH STREET
PR-1 OIL RECOVERY

10/17/88-10/23/88

FLOW = 2.83 GALLONS/MINUTE
PRODUCT % = 16.7 %

DATE	HOURS PUMPING	BARRELS PRODUCT
10/17	24	16.20
10/18	24	16.20
10/19	24	16.20
10/20	24	16.20
10/21	24	16.20
10/22	24	16.20
10/23	24	16.20
	168	113.43

TOTAL PRODUCTION WEEK 10/17/88-10/23/88 = 113.43
TOTAL PRODUCTION YEAR TO DATE = 147.82

10/24/88-10/30/88

FLOW = 2.83 GALLONS/MINUTE
PRODUCT % = 6.9 %

DATE	HOURS PUMPING	BARRELS PRODUCT
10/24	24	6.69
10/25	24	6.69
10/26	24	6.69
10/27	24	6.69
10/28	24	6.69
10/29	24	6.69
10/30	24	6.69
	168	46.86

TOTAL PRODUCTION WEEK 10/24/88-10/30/88 = 46.86
TOTAL PRODUCTION YEAR TO DATE = 194.69

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26TH STREET
PR-1 OIL RECOVERY

10/10/88-10/16/88

FLOW = 3.79 GALLONS/MINUTE
PRODUCT % = 3.85 %

DATE	HOURS PUMPING	BARRELS PRODUCT
10/10	24	5.00
10/11	24	5.00
10/12	24	5.00
10/13	24	5.00
10/14	21	4.38
10/15	24	5.00
10/16	24	5.00
	165	34.39

TOTAL PRODUCTION WEEK 10/10/88-10/16/88 = 34.39
TOTAL PRODUCTION YEAR TO DATE = 34.39

10/17/88-10/23/88

FLOW = 2.83 GALLONS/MINUTE
PRODUCT % = 16.7 %

DATE	HOURS PUMPING	BARRELS PRODUCT
10/17	24	16.20
10/18	24	16.20
10/19	24	16.20
10/20	24	16.20
10/21	24	6.20
10/22	24	5.20
10/23	24	.20
	168	113.43

[illegible]
69 % product
10/20/88

TOTAL PRODUCTION WEEK 10/17/88-10/23/88 = 113.43
TOTAL PRODUCTION YEAR TO DATE = 147.82

26TH STREET
PR-1 OIL RECOVERY

02/13/89 - 02/19/89

FLOW = 3.79 GALLONS/MINUTE
PRODUCT % = 1.00 %

DATE	HOURS PUMPING	BARRELS PRODUCT
02/13	24	1.30
02/14	24	1.30
02/15	24	1.30
02/16	24	1.30
02/17	24	1.30
02/18	24	1.30
02/19	24	1.30
	168	9.10

TOTAL PRODUCTION WEEK 02/13/89-02/19/89 = 9.10
TOTAL PRODUCTION YEAR TO DATE = 589.45

02/20/89 - 02/26/39

FLOW = 3.79 GALLONS/MINUTE
PRODUCT % = 1.03 %

DATE	HOURS PUMPING	BARRELS PRODUCT
02/20	24	1.34
02/21	24	1.34
02/22	24	1.34
02/23	24	1.34
02/24	24	1.34
02/25	24	1.34
02/26	24	1.34
	168	9.37

TOTAL PRODUCTION WEEK 02/20/89-02/26/89 = 9.37
TOTAL PRODUCTION YEAR TO DATE = 598.82

25TH STREET
[illegible]-1 OIL RECOVERY

02/06/89 - 02/12/89

FLOW = 3.79 GALLONS/MINUTE
PRODUCT % = 1.60 %

DATE	HOURS PUMPING	BARRELS PRODUCT
02/06	24	2.08
02/07	24	2.08
02/08	24	2.08
02/09	24	2.08
02/10	24	2.08
02/11	24	2.08
02/12	24	2.08
	168	14.55

TOTAL PRODUCTION WEEK 02/06/89-02/12/89 = 14.55
TOTAL PRODUCTION YEAR TO DATE = 580.35

02/13/89 - 02/19/89

FLOW = 3.79 GALLONS/MINUTE
PRODUCT % = 1.00 %

DATE	HOURS PUMPING	BARRELS PRODUCT
02/13	24	1.30
02/14	24	1.30
02/15	24	1.30
02/16	24	1.30
02/17	24	1.30
02/18	24	1.30
02/19	24	1.30
	168	9.10

TOTAL PRODUCTION WEEK 02/13/89-02/19/89 = 9.10
TOTAL PRODUCTION YEAR TO DATE = 589.45

Versar INC.

January 18, 1995

DER-RECEIVED
SOUTHEAST REGION
JAN 26 1995

Mr. Roger Souser
CENAP-EN-MM
U.S. Army Corps of Engineers
Wanamaker Building
100 Penn Square East
Philadelphia, Pennsylvania 19107-3390

SUBJECT: Minutes of January 5, 1995, Phase I RI/FS Progress/Phase II Scoping Meeting Held at the U.S. Army Corps of Engineers' Wanamaker Building Office in Philadelphia, Pennsylvania

Dear Roger:

I have prepared these minutes of the above-referenced meeting to ensure that everyone in attendance has a written record of the topics discussed. The meeting was held at the Corps' office in the Wanamaker Building in Philadelphia, Pennsylvania, at 1000 on January 5, 1995. The main objectives of the meeting were for Kemron and Versar to present the status of the Phase I RI and to discuss preliminary Phase II scoping activities based on the Phase I data obtained to date. Versar prepared an agenda, which summarized the topics of conversation for the meeting, and this agenda was provided to all of the attendees. A copy of the meeting agenda is attached to these minutes.

The following individuals attended the meeting:

- Mr. Roger Souser - U.S. Army COE, Philadelphia
- Mr. Paul Gaudini - U.S. Army COE, Philadelphia
- Mr. David Basko - Versar, Inc.
- Mr. Dan Morganelli - Versar, Inc.
- Mr. Robert Murphy - Versar, Inc.
- Mr. Dana S. Jackson - Kemron Environmental Services, Inc. (via telephone)
- Mr. William M. Stem - DPSC-YE, Environmental/Fire Protection
- Mr. Mohamad Mazid - PADER

The meeting was initially led by Mr. Souser, who subsequently turned the meeting over to Mr. Morganelli for his presentation of preliminary findings from the Phase I RI. The following issues were discussed:

1) Mr. Morganelli began his presentation by summarizing the progress of the Phase I RI. He indicated that all of the shallow groundwater monitoring wells had been installed as of the end of December 1994, and that we are currently installing the two on-site deep wells and awaiting access approval for the installation of the monitoring wells on the Conrail property. Mr. Morganelli also indicated that we initiated the development of the completed shallow monitoring wells during the first week of January 1995.

2) Mr. Souser suggested that we continue to move forward with the development of the shallow wells during the installation of the deep and Conrail wells, so that we can generate a synoptic water level map for the shallow wells as soon as possible.

3) Mr. Morganelli summarized the active soil gas, SCAPS, and Hydropunch results for Mr. Stem, who was not present when Mr. Morganelli summarized these results at the last

progress meeting. Mr. Morganelli indicated that the soil gas survey did a very good job in delineating the gasoline free product plume in the southern portion of the DPSC site. He also indicated that the SCAPS and Hydropunch surveys, although limited by the geological characteristics underlying DPSC, accomplished their objectives and provided extremely valuable data that was used to site the groundwater monitoring wells. Of particular interest from the SCAPS/Hydropunch survey was the identification of unexpected free product near the commander's headquarters along 20th Street and the lack of a free product plume along the western property boundary of DPSC.

4) Mr. Morganelli then summarized the preliminary soil data obtained from the monitoring well installations. There is a remarkable diversity of hydrocarbons found in the soil, and there is a wide variation in the gasoline to diesel ratios found in the soils. In addition, a totally new and unexpected chemical signature representative of "jet lubricating oil" was identified at the southeast corner of the DPSC property. This diversity in location and chemical composition of the free product petroleum hydrocarbon plumes suggests that there may be several potentially responsible parties involved, not just SUN.

5) Mr. Morganelli indicated that during the installation of monitoring well MW-12 (along 20th street near the commander's headquarters), free product was found.

6) Mr. Murphy stated that based on the preliminary data and initial calculations, the free product petroleum hydrocarbon plume appears to contain approximately 10,000,000 gallons of product. Based solely on the volume, this finding suggests that DPSC and most of the surrounding properties could not have caused a plume of this size and that a major off-site source is responsible for the plume.

7) Mr. Souser indicated that the NIKE missile assembly area, formerly in Building 26, may be a potential source of the "jet lubricating oil" contamination, and he suggested that this area should be investigated during the Phase II RI/FS.

8) Mr. Gaudini asked whether we had enough evidence to go after SUN as a PRP right now. Mr. Morganelli stated that we do not have enough evidence, particularly because there is not a good geometric connection of the free product plume to the SUN property. Therefore, we have to develop a chemical connection of the plumes to the SUN property to have sufficient evidence. Based on available information,. SUN conducted a soil gas survey on their property, but have not done any other characterization of the site. Kemron and Versar must get access to the SUN property and obtain samples for hydrocarbon fingerprinting analyses and/or conduct a passive soil gas survey to develop the chemical correlation of the plumes.

9) Mr. Jackson summarized the preliminary DDT sampling results. He stated that they were getting hits of 2 to 20 parts per million (ppm) DDT with the field analytical test kits in the soil from beneath the concrete slab of the mixing room. He also indicated that there was no DDT or volatile organic solvents detected in the groundwater surrounding the DDT underground storage tanks (USTs). Mr. Jackson said that the DDT data should be available sometime during the first or second week of January 1995.

10) Mr. Morganelli stated that with the exception of petroleum-related compounds and some polynuclear aromatic hydrocarbons (PAHs), no elevated levels of volatile organic compounds, semi-volatile organic compounds (i.e., base-neutral/acid extractables),

pesticides/PCBs, or metals have been found in the soil samples collected thus far during monitoring well installation.

11) Mr. Basko then summarized the activities required for the Phase II RI/FS. He indicated that the following tasks were necessary to complete the Phase II RI/FS at DPSC: (1) additional PRP research, (2) groundwater sampling on the DPSC site and surrounding properties for hydrocarbon fingerprinting analyses, (3) additional monitoring well installation and sampling to characterize and delineate the dissolved phase contamination within the water table aquifer, (4) completion of a full passive soil gas survey on the DPSC property and surrounding properties of potential concern, and (5) investigation of the other areas of concern identified in the May 1994 Project Operations Work Plan, including USTs/ASTs, PCB equipment, RCRA storage areas, storm drains, railroad track beds, former incinerator, Building 30 maintenance facility, and gas detection/migration wells. Mr. Basko stated that following completion of the Phase II activities, a complete RI/FS report, including the risk assessment, will be completed; the PRPs will be known; removal/remedial actions can be developed and proposed; and the project may be separated into two parts: (1) The BRAC team can move forward toward remedial design and implementing removal/remedial actions and (2) Versar can assist DPSC and the Corps with litigation support during PRP determination and cost allocation and recovery proceedings.

12) Mr. Gaudini questioned why we should spend government money to do additional PRP research and sampling. He suggested the other PRPs should spend their own money doing their own research.

13) Mr. Murphy indicated that the more definitive information we obtain, the stronger our case becomes for PRP identification and cost allocation. Developing a strong PRP case is well worth the initial investment because the PRPs can be forced to pay not only remediation costs, but also the investigation costs.

14) Mr. Souser stated that we should include two additional tasks with our proposed Phase II activities: a search for additional, unknown USTs around Building 46 and an investigation of the former NIKE missile assembly area in Building 26.

15) Mr. Gaudini stated that he wanted all of the historical and technical data from the Phase I and Phase II RI/FS to be combined and represented graphically in the final RI/FS report to show how they complement one another and strengthen the overall PRP case.

16) Mr. Mazid and Mr. Stem asked what the Phase I groundwater modeling program, SpillCAD, will produce as a final product. Mr. Morganelli indicated that it would interpret the movement and distribution of the free product plume.

17) Although the cost will be substantial, Mr. Souser suggested that everyone should consider using a three-dimensional model, namely MODFLO, following completion of the Phase II RI/FS to develop a detailed regional interpretation of the groundwater flow regime and the dissolved phase contaminant migration using actual boundary conditions (i.e., the Delaware and Schuylkill Rivers).

18) Mr. Souser and Mr. Gaudini requested Kemron and Versar to develop and submit a Phase II RI/FS Scope of Work as soon as possible. The scope should be telefaxed to all BRAC team members for their review. They stated that we must move quickly to ensure that the Phase II is awarded prior to the expiration of Kemron's contract with the Baltimore Corps.

19) Mr. Stem requested that project progress meetings be held monthly throughout the duration of the Phase I RI/FS. Mr. Souser agreed with this request.

20) Mr. Souser informed Mr. Morganelli that a meeting was scheduled with SUN for January 30, 1995. He requested that Mr. Morganelli develop a list of information to be requested from SUN and that he attend the meeting. Mr. Souser also said that Mr. Morganelli should be prepared to discuss which SUN wells we would like to sample and the analytical methods to be used.

Based on the discussions summarized above and additional general issues that were raised during the meeting, the following action items were developed:

1) Versar will continue to develop the recently completed shallow groundwater monitoring wells during the installation of the deep wells and Conrail wells so that a synoptic water level map can be developed for the shallow wells as soon as possible.

2) Mr. Souser will work to obtain the final clearance for the installation of the groundwater monitoring wells on the Conrail property.

3) Mr. Morganelli will develop a list of information to request from SUN and will attend the January 30, 1995, meeting.

4) Versar will prepare a Scope of Work for the Phase II RI/FS at DPSC. This Scope of Work will be completed no later than January 11, 1995, and will be telefaxed to Mr. Souser, Mr. Stem, Mr. Mazid, Mr. Jones, and Mr. Orenshaw for their review and concurrence.

5) At the request of Mr. Stem with Mr. Souser's concurrence, project progress meetings will be held monthly for the duration of the Phase I RI project.

If you have any questions or comments regarding this letter, please contact me at (215) 788-7844.

Sincerely,

David A. Basko

David A. Basko
Program Manager

DAB/dab: 2727MIN5.001

cc: Mr. Dana Jackson, Kemron
Mr. Dan Morganelli, Versar
Mr. William Stem, DPSC
Mr. Mohamad Mazid, PADER
Mr. Dennis Orenshaw, U.S. EPA

Versar INC.

May 5, 1995

Mr. Roger Souser
CENAP-EN-MM
U.S. Army Corps of Engineers
Wanamaker Building
100 Penn Square East
Philadelphia, Pennsylvania 19107-3390

DER-RECEIVED
SOUTHEAST REGION
MAY 31 1995

SUBJECT: Minutes of March 15, 1995, Phase I RI/FS Progress Meeting Held at the Pennsylvania Department of Environmental Resources (PADER) Offices in Conshohocken, Pennsylvania

Dear Roger:

I have prepared these minutes of the above-referenced meeting to ensure that everyone in attendance has a written record of the topics discussed. The meeting was held at the PADER office in Conshohocken, Pennsylvania, at 0900 on March 15, 1995. The main objective of the meeting was for Versar to present findings to date and the status of the Phase I RI. Versar prepared an agenda and a status summary table, which summarized the topics of conversation for the meeting. The agenda and the summary table were provided to all of the meeting attendees, and copies of these materials are attached to these minutes.

The following individuals attended the meeting:

- Mr. Roger Souser - U.S. Army COE, Philadelphia
- Mr. Jeffrey Waugh - USAEC
- Mr. Wayne Fox - USACHPPM
- Mr. David Basko - Versar, Inc.
- Mr. Dan Morganelli - Versar, Inc.
- Mr. Dennis Orenshaw - U.S. EPA, Region III
- Ms. Barbara Rudnick - U.S. EPA, Region III
- Mr. William M. Stem - DPSC-YE, Environmental/Fire Protection
- Mr. Elek A. Fenyes - DPSC-GL
- Mr. Richard Bell - DPSC-YE
- Mr. Mohamad Mazid - PADER ✓
- Mr. David Burke - PADER
- Mr. Michael Homiak - PADER
- Ms. Sarah Pantelidou - PADER
- Mr. Irwin Lourie - PADER

The meeting opened with introductions of the attendees and was initially led by Mr. Souser, who stated that this was a project status meeting and subsequently turned the meeting over to Mr. Morganelli for his presentation of preliminary findings from the Phase I RI. The following issues were discussed:

1) Mr. Morganelli began his presentation by summarizing the RI status table (see attached). He briefly summarized each task, its status, the date(s) it was performed, and the preliminary findings from the task. Mr. Morganelli stressed that these findings are preliminary and that groundwater sampling, slug testing, and modeling results would not be available until April. Mr. Morganelli also indicated that the report is expected to be complete in mid-May.

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2) Mr. Morganelli then presented a more detailed summary of the active soil gas, SCAPS, and initial water table elevation data and presented work maps showing total VOCs from the active soil gas survey, SCAPS survey with initial interpretation of free product distribution at DPSC, and initial interpretation of water table elevation data, preceding installation of the new Phase I RI wells.

3) Mr. Morganelli then summarized the subsurface soil analytical results, and indicated that, for the most part, only petroleum hydrocarbon contamination was noted at the site, and most of the contamination was at or near the saturated zone.

4) Mr. Morganelli provided preliminary information concerning the aquifer system at DPSC. He indicated that the reported near surface clay layer appears to be breached or absent at some locations on the DPSC site, and therefore, the upper and lower aquifer may be hydraulically interconnected.

5) Mr. Morganelli then discussed the horizontal and vertical hydraulic gradients at the site and presented a figure showing the March 1995 water table elevations at DPSC. In general, this figure indicated south-southeast hydraulic gradient, although there appeared to be anomalies, including a mounding effect at the southern portion of the site.

6) Mr. Morganelli subsequently discussed the occurrence of free product in the groundwater at DPSC and presented a figure showing the apparent free product distribution and thickness in March 1995. Mr. Morganelli indicated that the free product appeared to be limited to the southern portion of the site in the area of the identified groundwater mound.

7) Finally, Mr. Morganelli provided the meeting attendees with a data summary table showing subsurface soil analytical results, draft DPSC soil boring logs, and a DPSC base map depicting all well locations. Mr. Morganelli indicated that, in general, the preliminary results available to date do not show a strong geometric correlation to the SUN south yard as a source, however, he indicated that the groundwater data, when available, may provide some additional information on this matter. He indicated that once all of the technical data is available sometime in mid-April, we should have a better idea of the potential source.

8) Following Mr. Morganelli's presentation, Mr. Basko then summarized the activities required for the Phase II RI/FS. He indicated that the following tasks were necessary to complete the Phase II RI/FS at DPSC: (1) additional PRP research, (2) installation of gas detection/ soil vapor extraction test wells, (3) groundwater sampling on the DPSC site and surrounding properties for hydrocarbon fingerprinting analyses, (4) additional monitoring well installation and sampling to characterize and delineate the dissolved phase contamination within the water table aquifer, (5) completion of a full passive soil gas survey on the DPSC property and surrounding properties of potential concern, and (6) investigation of the other areas of concern identified in the May 1994 Project Operations Work Plan, including USTs/ASTs, PCB equipment, RCRA storage areas, storm drains, railroad track beds, former incinerator, Building 30 maintenance facility, and gas detection/migration wells. Mr. Basko stated that following completion of the Phase II activities, a complete RI/FS report, including the risk assessment, will be completed; the PRPs will be known; and removal/remedial actions can be developed and proposed.

9) Following Versar's presentation of findings and recommendations for future work, there was an open discussion regarding appropriate follow-on investigatory tasks. DPSC questioned why additional plume investigation tasks were proposed for Phase II, and

Versar responded that although there was significant evidence that the petroleum hydrocarbon plume did not originate from DPSC, there was not a strong geometric connection to the SUN property. Therefore, a chemical connection needs to be established based on fingerprinting and dissolved phase analyses. PADER also expressed concern that it appears the southern boundary of the petroleum hydrocarbon plume has not been determined, which may result in subsequent liability. DPSC questioned whether they would be liable for any contamination identified south of their site; PADER said that they would be held liable.

Based on the discussions summarized above and additional general issues that were raised during the meeting, the following action items were developed:

1) Versar will continue to work toward completion of the Phase I RI report, which should be completed in mid-May 1995.

2) Another progress meeting will be scheduled for late April or early May 1995 following Versar's receipt of the outstanding technical data. This meeting will allow Versar to present updated findings based on groundwater sampling and analysis, slug testing, and groundwater modeling.

If you have any questions or comments regarding this letter, please contact me at (215) 788-7844.

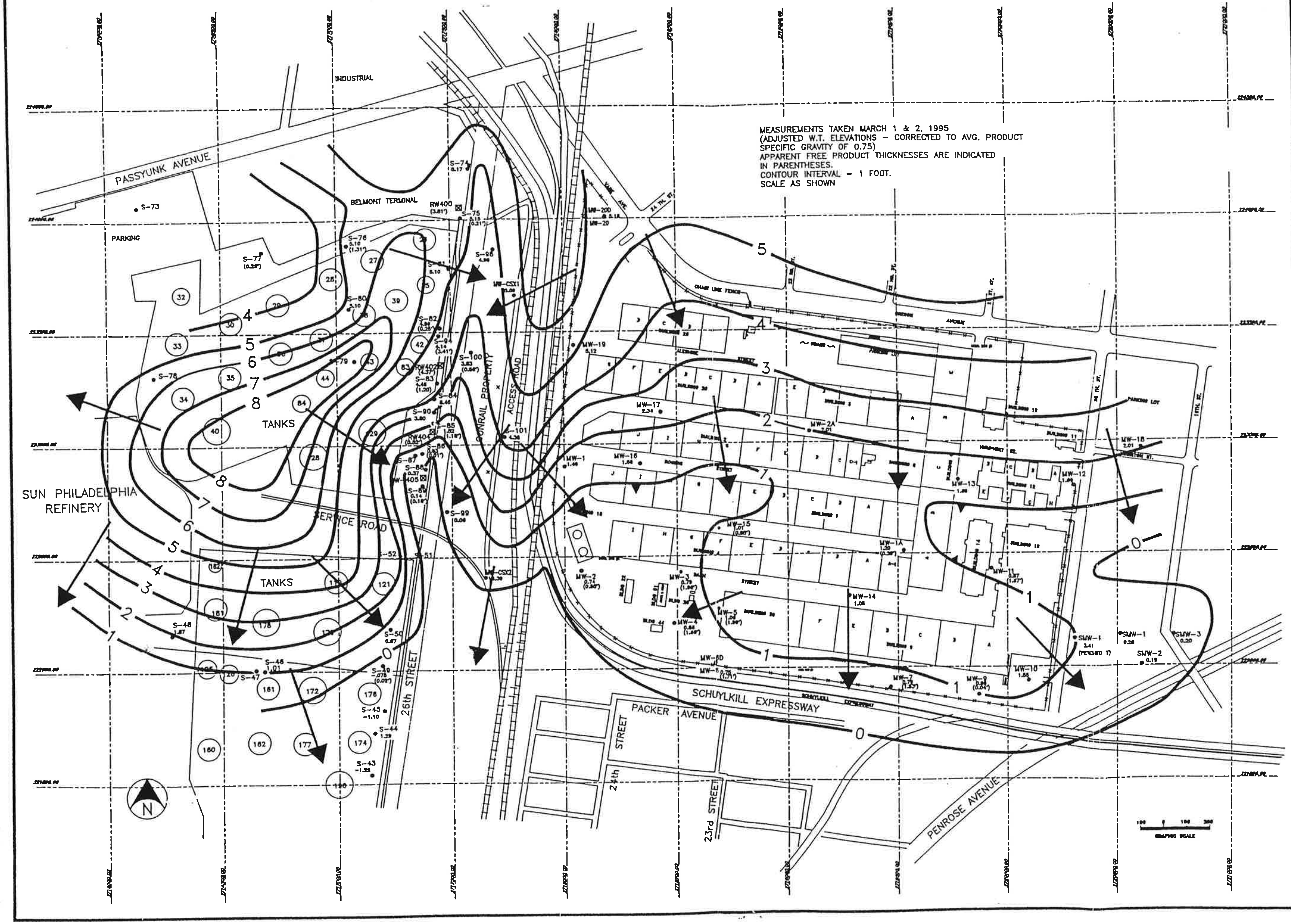
Sincerely,

David A. Basko

David A. Basko
Program Manager

DAB/dab: 2727MIN6.001

cc: Mr. Dana Jackson, Kemron
Mr. Dan Morganelli, Versar
Mr. William Stem, DPSC
Mr. Mohamad Mazid, PADER
Mr. Dennis Orenshaw, U.S. EPA



MEASUREMENTS TAKEN MARCH 1 & 2, 1995
(ADJUSTED W.T. ELEVATIONS – CORRECTED TO AVG. PRODUCT
SPECIFIC GRAVITY OF 0.75)
APPARENT FREE PRODUCT THICKNESSES ARE INDICATED
IN PARENTHESES.
CONTOUR INTERVAL = 1 FOOT.
SCALE AS SHOWN

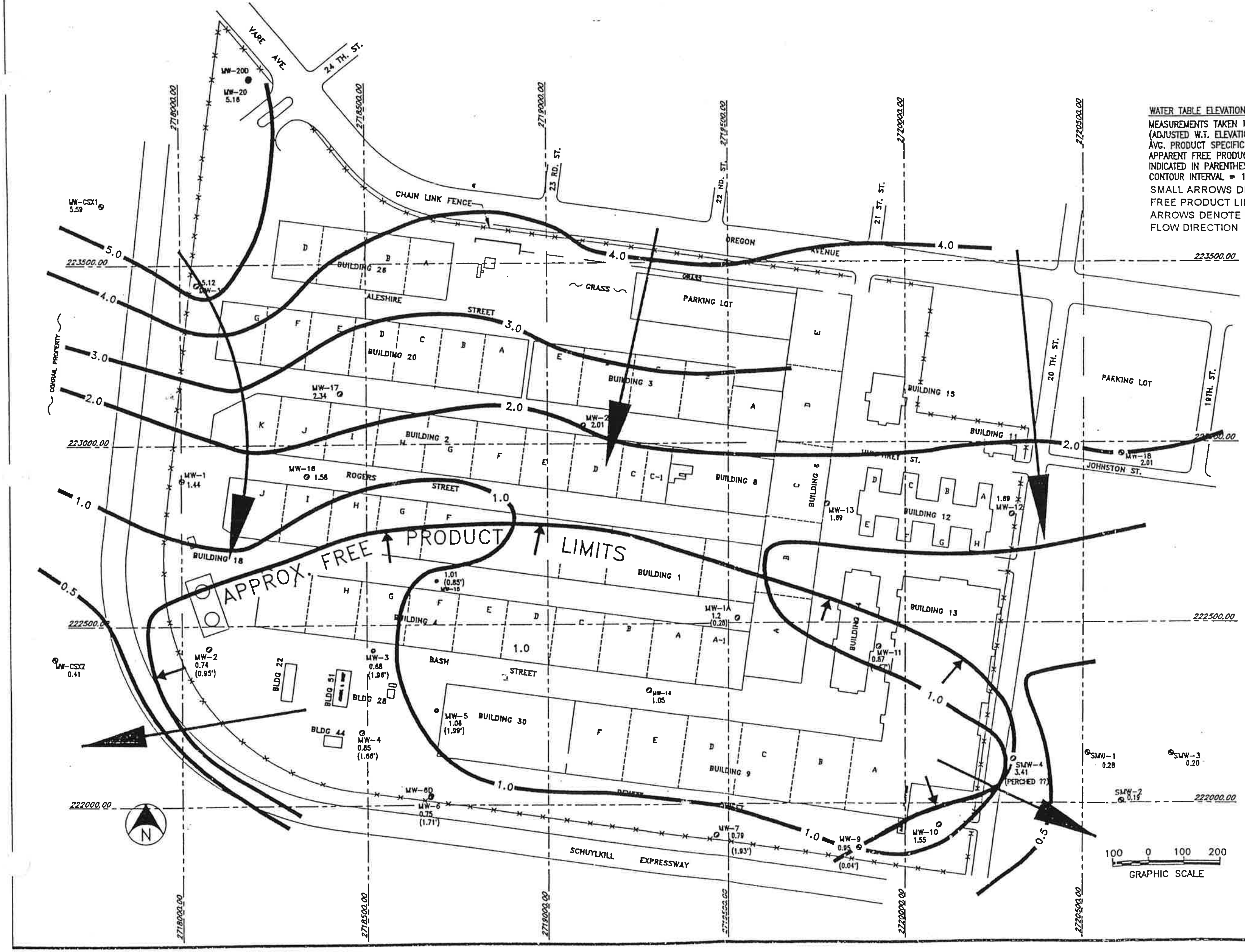
Versar INC.
1900 FROST ROAD, SUITE 110
BRISTOL, PA 19007
(215) 788-7844

DATE: 04/15/95
SCALE: AS SHOWN
DWG. BY: V.S.

FIGURE 6-1

WATER TABLE ELEVATION MAP AND FREE PRODUCT THICKNESSES IN DPSC, SUN OIL REFINERY AND SEPTA MONITORING WELLS (MARCH 1995)

DEFENSE PERSONNEL SUPPORT CENTER



WATER TABLE ELEVATION MAP

MEASUREMENTS TAKEN MARCH 1 AND 2, 1995 (ADJUSTED W.T. ELEVATIONS – CORRECTED TO AVG. PRODUCT SPECIFIC GRAVITY OF 0.75) APPARENT FREE PRODUCT THICKNESS ARE INDICATED IN PARENTHESES.
CONTOUR INTERVAL = 1'
SMALL ARROWS DENOTE APPROXIMATE FREE PRODUCT LIMITS AND LARGE ARROWS DENOTE GROUNDWATER FLOW DIRECTION

FIGURE 6-2

DATE: 05/15/95
SCALE: AS SHOWN
DWG. BY: D.M.

WATER TABLE ELEVATION MAP AND FREE PRODUCT THICKNESS IN DPSC MONITORING WELLS (MARCH 1995)

DEFENSE PERSONNEL SUPPORT CENTER

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NAPL TRANSPORT MODELING BACKGROUND

Immiscible multi-phase transport modeling of NAPL at the study area was performed using Environmental Science & Technology's ARMOS (Areal Multiphase Organic Simulator) code. For the proposes of this evaluation, the ARMOS modeling was used as a tool to validate our understanding of the physical world as it exists in the study area, not to find a source or to quantify any particular process. Before initiating the modeling efforts, available data were analyzed, hypotheses were developed and tested, and conclusions were drawn. The modeling was used to test the truth of these conclusions. It was also used to test many different scenarios using even more conservative and implausible input parameters to force, if possible, a hypothetical refinery source to give rise to a NAPL plume on DSCP with approximately the configuration and morphology currently observed. However, the none of the scenarios even approached the current configuration and morphology. Thus, the model was also used to ensure that our analysis had not missed potential scenarios that may have led to the conclusion that the DSCP plume was sourced on the refinery. None were found.

ARMOS is a dimensional numerical model designed to simulate water or NAPL flow in an unconfined aquifer. The ARMOS modeling approach is based on the concept of vertical equilibrium pressure distributions analogous to the Dupuit-Forsheimer assumption of conventional groundwater hydrology. A highly non-linear, three-dimensional multiphase flow equation is reduced to a mildly non-linear two-dimensional problem.

ARMOS can model the migration of lighter-than-water hydrocarbon under natural gradient conditions during and following a spill or leakage from storage facilities. The only limitation is that vertical flow through the unsaturated zone is not explicitly considered. ARMOS considers soil capillarity with a general model that is applicable to a broad range of soil types. The model also fully considers the retention of residual hydrocarbon in the unsaturated and saturated zones, associated with changes in fluid-table elevations over time, thereby providing for simulation of smear zone formation and the associated NAPL volume and mass reduction.

Flow Equations

ARMOS simulates multi-phase flow of oil and water through the use of Darcy's Law. The flow equations (ES&T 1994a) for oil and water are:

(Equation 5-3)

$$q_{w_i} = -K_{wij}\left(\frac{\partial h_w}{\partial x_j} + \frac{\partial Z}{\partial x_j}\right)$$

(Equation 5-4)

$$q_{o_i} = -K_{oij}\left(\frac{\partial h_o}{\partial x_j} + \rho_{ro}\frac{\partial Z}{\partial x_j}\right)$$

Where: x_j = Cartesian spatial coordinates (j=1,2,3)
q_{wi} = Darcy velocity in the *i*-direction for water (ft/d)
q_{wo} = Darcy velocity in the *i*-direction for oil (ft/d)
h_w = water height-equivalent pressure head (ft) (water)
h_o = water height-equivalent pressure head (ft) (oil)
ρ_{ro} = ratio of oil to water density
K_p = the p-phase conductivity (ft/d)
Z = elevation (ft)

Gas-phase flow is neglected in the ARMOS model, assuming atmospheric boundary control. The oil conductivity is evaluated using the oil-phase conductivity expression:

(Equation 5-5)

$$K_{oij} = \frac{k_{ro} K_{swij}}{\eta_{ro}}$$

Where: k_{ro} = the relative permeability of oil
η_{ro} = the ratio of oil to water viscosity
K_{swij} = saturated conductivity for water

ARMOS calculates the oil relative permeability based on the van Genuchten (1980) model, but it accounts for a reduction in oil permeability due to the irreducible oil saturation. ARMOS calculates the oil permeability (k_{ro}) using the following expression:

(Equation 5-6)

$$k_{ro} = \left(\bar{S}_t - S_w \right)^{1/2} \left(\left(1 - S_w^{1/m} \right)^m - \left(1 - \bar{S}_t^{1/m} \right)^m \right)^2$$

(Equation 5-7)

$$\text{Where : } \bar{S}_t = \left(S_w + S_o - S_m \right) / \left(1 - S_m \right)$$

Not surprisingly, the oil transmissivity varies almost linearly or directly with the amount of free oil in the pore spaces (ES&T 1994a). This is a manifestation of the requirement for a continuous oil-filled or saturated pathway for NAPL to migrate.

ARMOS calculates saturation and the continuity of flow using the following equations (ES&T 1994a) for water and oil, respectively:

(Equation 5-8)

$$\phi \frac{\partial S_w}{\partial t} = -\frac{\partial q_{w_i}}{\partial x_i} + J_w$$

(Equation 5-9)

$$\phi \frac{\partial S_o}{\partial t} = -\frac{\partial q_{o_i}}{\partial x_i} + J_o$$

Where: ϕ = porosity
S_p = p-phase saturation (p = o,w)
t = time
x_j = Cartesian spatial coordinates (j=1,2,3)
J_p = p-phase volumetric source-sink terms

These equations state that p-phase fluid flow is a function of the p-phase saturation of the pores, permeability and pressure relations (ES&T 1994b).

ARMOS can also simulate entrapment of oil (residual oil) both in the saturated and unsaturated zones. Residual oil is oil that is not free to move, whereas free oil is mobile. Residual oil in the saturated zone occurs as hydraulically discontinuous globules trapped within the larger pores within the continuous water phase. Residual oil in the unsaturated zone occurs as thin films and pendular rings at particle contacts (ES&T 1994a).

The trapped oil specific volume (*Vot*) is a function of the porosity (ϕ) and the trapped oil saturation (*Sot*) in the saturated zone (ES&T, 1994a) as defined by the following equation:

(Equation 5-10)

$$V_{ot} = \int_{Z_l}^{Z_u} \phi \; S_{ot} \; dz$$

Where: Z_u = The upper bounds of the liquid saturated zone.
Z_l = The lower bounds of the liquid saturated zone

Changes in oil-water capillary head, which controls water saturation, will control the trapped oil specific volume. At any given elevation, the trapped oil saturation is estimated using the empirical relationship given by Land (1968):

(Equatio

n 5-11)

$$S_{ot} = (1 - S_m)\left\{ \frac{1 - \bar{S}_w^{\min}}{1 + R_{ow}\left(1 - \bar{S}_w^{\min}\right)} - \frac{1 - \tilde{S}_w}{1 + R_{ow}\left(1 - \tilde{S}_w\right)} \right\}$$

Where: $$R_{ow} = \frac{1 - S_m}{S_{or}} - 1$$ **(Equation 5-12)**

$$\bar{S}_w^{\min} = \frac{S_w^{\min} - S_m}{1 - S_m}$$ **(Equation 5-13)**

S_{or} = maximum residual oil saturation

S_{wmin} = historical minimum water saturation that has occurred at a given elevation since the appearance of oil

S_m = minimum "irreducible" water (wetting phase) saturation under field conditions (field capacity)

S_w = the apparent water saturation

The apparent water saturation (*Sw*) (van Genuchten 1980) can be expressed by the following expressions:

(Equation 5-15)

$$\tilde{S}_w = \left(1 + (\alpha\beta_{ow}h_{ow})^n\right)^{-m} \quad \text{when} \quad h_{ow} > 0$$

(Equation 5-16)

$$\tilde{S}_w = 1 \quad \text{when} \quad h_{ow} \le 0;$$

Where: α = van Genuchten parameter for mean pore size (ES&T 1994b)

β_{ow} = Ratio of water surface tension to oil-water interfacial tension (ES&T 1994b)

n = van Genuchten pore size distribution exponent (ES&T 1994b)

m = usually defined to be $1 - 1/n$ (ES&T 1994b)

h_{ow} = oil-water capillary pressure head.

As the water-table elevation decreases the initial water saturation decreases resulting in increased oil saturation. This oil becomes trapped as the water-table elevation rises increasing the final water saturation. ARMOS computes air-oil and oil-water capillary heads at each time step and stores these values in a look-up table. As the fluid elevation varies, the water, free-oil, and trapped-oil saturations are calculated from these values at specific elevations and, therefore, the trapped oil specific volume along the path are determined. If the oil-water table later decreases in elevation, the trapped oil becomes free oil.

During periods of falling fluid elevations, oil is redistributed by gravity resulting in unsaturated zone residual saturation. ARMOS computes this redistribution of oil for each time step by determining the unsaturated zone residual oil specific volume (*Vog*) using the following equation:

(Equation 5-17)

$$\Delta V_{og} = \phi S'_{og} \Delta Z_{ao}$$

Where: ΔZao = The change in the air-oil table elevation for the time step

$S'_{og} = \min\left(S_{og}, S_o^{\max}\right)$

Where: S_{og} = The unsaturated zone residual saturation after drainage from a high oil content

$S_o^{\max}$ = The current maximum oil saturation (ES&T 1994a)

```
CONTROL VARIABLES
Professional
    3    0    1    0    1    0    0
 0.0000000 46355.000 0.0010000 0.0010000 25.000000 1.1000000 1825.0000
    5   12 0.0500000 0.0500000
MESH FILE , NODAL VALUE FILE, AND MESURED ELEVATION
F:\EST\SUNPHI\SUNPHIL4.msh
F:\EST\SUNDPS\SUNDP600.val
    3   SWITCH 0 = BLOCK EDIT 1 = MEASUREMENT POINT  2= CONST ELEV. 3=CONST
THICKNESS
  30.000
SOIL PROPERTIES
 10 NUMBER OF SOILS
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1.0000    0.0000    0.0000
    2.8000    0.3900    1.8900    0.4100 3.4809999466    0.1830    0.0710
1.0000    0.0000    0.0000
    0.6760    0.9370    1.1100    0.3200 0.2029999942    0.0190    0.0180
1.0000    0.0000    0.0000
    0.6710    0.4300    1.7000    0.4500 0.3610999882    0.1710    0.0730
1.0000    0.0000    0.0000
    0.2560    0.8400    2.8000    0.3600 0.0156999994    0.0480    0.0403
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
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1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
FLUID PROPERTIES
    0.7800    0.8290    2.7857    1.5600  1.000000000
INITIAL CONDITIONS
    0 SWITCH, 0=BLOCK_EDIT,  1=MEASUREMENT POINTS  2=FROM DATABASE
3=RESTART_FILE
BOUNDARY SCHEDULE NUMBERS
   26 specified Zaw nodes
   50   17
  100   17
  150   17
  200   17
   49   17
   48   17
   47   17
   46   17
   45   17
 2451   18
 2452   18
 2453   18
 2454   18
 2401   18
 2351   18
 2301   18
 2251   18
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   2201   18
   2151   18
   2101   18
   2051   18
   2001   18
   1951   18
   1901   18
     44   17
     43   17
     19 boundary zaw fluctuation
      0 specified Zao nodes
      0 specified water flux nodes
      0 specified oil flux nodes
      0 water recharge nodes
     25 Well nodes
    465    1    2  -10.0000    0.0000   -5.0000          26th
    581    3    4  -10.0000   12.5000    0.0000          #25-26
    642    3    4  -10.0000   12.5000    0.0000          #21-22
    526    5    6  -10.0000    0.0000    0.0000          #28
    472    5    6  -10.0000    0.0000    0.0000          #28
    578    5    6  -10.0000    0.0000    0.0000          #28
    468    5    6  -10.0000    0.0000    0.0000          #28
    412    5    6  -10.0000    0.0000    0.0000          #28
    309    5    6  -10.0000    0.0000    0.0000          #28
    145    7    8    0.0000    0.0000    0.0000          1870
    112    9   10    0.0000    0.0000    0.0000          1875
    141    9   10    0.0000    0.0000    0.0000          1900
    137    9   10    0.0000    0.0000    0.0000          1900
    443   11   12    0.0000    0.0000    0.0000          1925
    338   11   12    0.0000    0.0000    0.0000          1925
    375   11   12    0.0000    0.0000    0.0000          1925
    321   11   12    0.0000    0.0000    0.0000          1925
    164   11   12    0.0000    0.0000    0.0000          1925
    222   11   12    0.0000    0.0000    0.0000          1925
    367   11   12    0.0000    0.0000    0.0000          1925
    446   13   14    0.0000    0.0000    0.0000          1925
    591   11   12    0.0000    0.0000    0.0000          1925
    311   15   16  -10.0000    0.0000   -5.0000          #6
    645   15   16  -10.0000    0.0000   -5.0000          #10
    491   15   16  -10.0000    0.0000   -5.0000          #8
SCHEDULES
     29
      4 0.00000E+00 0.00000E+00    1
        3.46750E+04 0.00000E+00
        3.48000E+04 9.62500E+03
        4.63550E+04 9.62500E+03
      1 0.00000E+00 0.00000E+00    2
     10 0.00000E+00 0.00000E+00    3
        3.50400E+04 0.00000E+00
        3.50450E+04 1.81000E+01
        3.51650E+04 1.80950E+03
        3.73300E+04 1.80950E+03
        3.73350E+04 0.00000E+00
        4.52600E+04 0.00000E+00
        4.52800E+04 1.80950E+01
        4.53650E+04 1.80950E+03
        4.63550E+04 1.80950E+03
```

```
9 0.00000E+00 0.00000E+00     4
  1.63800E+04 0.00000E+00
  1.64000E+04 1.15000E+00
  1.64250E+04 1.15000E+01
  1.86150E+04 1.15000E+01
  1.86300E+04 0.00000E+00
  2.66400E+04 0.00000E+00
  2.66450E+04 1.15000E+01
  2.77400E+04 1.15000E+01
7 0.00000E+00 0.00000E+00     5
  3.57700E+04 0.00000E+00
  3.57850E+04 1.92500E+01
  3.58800E+04 1.92500E+03
  3.72300E+04 1.92500E+03
  3.72350E+04 0.00000E+00
  4.63550E+04 0.00000E+00
7 0.00000E+00 0.00000E+00     6
  3.57700E+04 0.00000E+00
  3.57750E+04 1.60000E+01
  3.58200E+04 1.60000E+02
  3.72300E+04 1.60000E+02
  3.72350E+04 0.00000E+00
  4.63550E+04 0.00000E+00
1 0.00000E+00 0.00000E+00     7
6 0.00000E+00 0.00000E+00     8
  3.65000E+02 0.00000E+00
  3.75000E+02 -1.92500E+01
  1.86150E+04 -1.92500E+01
  1.86200E+04 0.00000E+00
  4.63550E+04 0.00000E+00
1 0.00000E+00 0.00000E+00     9
8 0.00000E+00 0.00000E+00    10
  1.82500E+03 0.00000E+00
  1.83000E+03 -1.00000E+01
  1.84000E+03 -1.00000E+02
  1.86000E+03 -1.00000E+03
  1.90600E+03 -1.00000E+03
  1.90700E+03 0.00000E+00
  4.63550E+04 0.00000E+00
1 0.00000E+00 0.00000E+00    11
7 0.00000E+00 0.00000E+00    12
  2.00750E+04 0.00000E+00
  2.00760E+04 -4.20000E+00
  2.00900E+04 -4.27000E+01
  4.52600E+04 -4.27000E+01
  4.52650E+04 0.00000E+00
  4.63550E+04 0.00000E+00
1 0.00000E+00 0.00000E+00    13
1 0.00000E+00 0.00000E+00    14
9 0.00000E+00 0.00000E+00    15
  2.77400E+04 0.00000E+00
  2.77410E+04 -2.20000E+01
  2.77500E+04 -2.18000E+02
  2.78600E+04 -2.17500E+03
  2.89000E+04 -8.50000E+03
  3.72300E+04 -8.50000E+03
  3.72350E+04 0.00000E+00
```

```
        4.63550E+04 0.00000E+00
      8 0.00000E+00 0.00000E+00    16
        2.77400E+04 0.00000E+00
        2.77410E+04 -1.00000E+00
        2.77450E+04 -1.00000E+01
        2.78600E+04 -1.03000E+02
        3.72300E+04 -1.03000E+02
        3.72310E+04 0.00000E+00
        4.63550E+04 0.00000E+00
      2 0.00000E+00 7.00000E+00    17
        4.63550E+04 7.00000E+00
      2 0.00000E+00 7.00000E-01    18
        4.63550E+04 7.00000E-01
      7 0.00000E+00 0.00000E+00    19
        2.59150E+04 0.00000E+00
        2.66000E+04 -3.00000E+00
        2.73750E+04 -8.00000E+00
        3.43100E+04 -8.00000E+00
        3.45100E+04 0.00000E+00
        4.63550E+04 0.00000E+00
      1 0.00000E+00 0.00000E+00    20
      1 0.00000E+00 0.00000E+00    21
      1 0.00000E+00 0.00000E+00    22
      1 0.00000E+00 0.00000E+00    23
      1 0.00000E+00 0.00000E+00    24
      1 0.00000E+00 0.00000E+00    25
      1 0.00000E+00 0.00000E+00    26
      1 0.00000E+00 0.00000E+00    27
      1 0.00000E+00 0.00000E+00    28
      1 0.00000E+00 0.00000E+00    29
PRINTOUT LOCATIONS
    1
   20241.80    7220.26     mw-1
BOUNDARY NODES INPUT OPTION
    0   SWITCH 0= USE FLUCTUATION SCHEDULE, 1=USE THE FOLLOWING FILE NAME
CHECK BOX
1 1 0 0 0 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1
ELEV OPT
15  7.5420e+03
-9.9999e+04 3.4000e+08 -9.9999e+04 3.4000e+08
0 15 0.0000e+00
0
```

```
CONTROL VARIABLES
Professional
    3    0    1    0    1    0    0
  35046.000 46355.000 0.0100000 0.0100000 25.000000 1.1000000 1825.0000
    5   12 0.0500000 0.5000000
MESH FILE , NODAL VALUE FILE, AND MESURED ELEVATION
F:\EST\SUNPHI\SUNPHIL4.msh
F:\EST\SUNDPS\SUNDP602.val
    3   SWITCH 0 = BLOCK EDIT 1 = MEASUREMENT POINT  2= CONST ELEV. 3=CONST
THICKNESS
  30.000
SOIL PROPERTIES
 10 NUMBER OF SOILS
    4.2980     0.4500     2.7000     0.4000 8.2110004425     0.1650     0.0742
1.0000     0.0000     0.0000
    2.8000     0.3900     1.8900     0.4100 3.4809999466     0.1830     0.0710
1.0000     0.0000     0.0000
    0.6760     0.9370     1.1100     0.3200 0.2029999942     0.0190     0.0180
1.0000     0.0000     0.0000
    0.6710     0.4300     1.7000     0.4500 0.3610999882     0.1710     0.0730
1.0000     0.0000     0.0000
    0.2560     0.8400     2.8000     0.3600 0.0156999994     0.0480     0.0403
1.0000     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000 0.0000000000     0.0000     0.0000
1.0000     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000 0.0000000000     0.0000     0.0000
1.0000     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000 0.0000000000     0.0000     0.0000
1.0000     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000 0.0000000000     0.0000     0.0000
1.0000     0.0000     0.0000
    0.0000     0.0000     0.0000     0.0000 0.0000000000     0.0000     0.0000
1.0000     0.0000     0.0000
FLUID PROPERTIES
    0.7800     0.8290     2.7857     1.5600   1.000000000
INITIAL CONDITIONS
    3 SWITCH, 0=BLOCK_EDIT,  1=MEASUREMENT POINTS  2=FROM DATABASE
3=RESTART_FILE
F:\EST\SUNDPS\SUNDP600.oxf
BOUNDARY SCHEDULE NUMBERS
   26 specified Zaw nodes
   50    17
  100    17
  150    17
  200    17
   49    17
   48    17
   47    17
   46    17
   45    17
 2451    18
 2452    18
 2453    18
 2454    18
 2401    18
 2351    18
 2301    18
```

```
 2251   18
 2201   18
 2151   18
 2101   18
 2051   18
 2001   18
 1951   18
 1901   18
   44   17
   43   17
   19 boundary zaw fluctuation
    0 specified Zao nodes
    0 specified water flux nodes
    0 specified oil flux nodes
    0 water recharge nodes
   25 Well nodes
  465    1    2  -10.0000    0.0000   -5.0000          26th
  581    3    4  -10.0000   12.5000    0.0000          #25-26
  642    3    4  -10.0000   12.5000    0.0000          #21-22
  526    5    6  -10.0000    0.0000    0.0000          #28
  472    5    6  -10.0000    0.0000    0.0000          #28
  578    5    6  -10.0000    0.0000    0.0000          #28
  468    5    6  -10.0000    0.0000    0.0000          #28
  412    5    6  -10.0000    0.0000    0.0000          #28
  309    5    6  -10.0000    0.0000    0.0000          #28
  145    7    8    0.0000    0.0000    0.0000          1870
  112    9   10    0.0000    0.0000    0.0000          1875
  141    9   10    0.0000    0.0000    0.0000          1900
  137    9   10    0.0000    0.0000    0.0000          1900
  443   11   12    0.0000    0.0000    0.0000          1925
  338   11   12    0.0000    0.0000    0.0000          1925
  375   11   12    0.0000    0.0000    0.0000          1925
  321   11   12    0.0000    0.0000    0.0000          1925
  164   11   12    0.0000    0.0000    0.0000          1925
  222   11   12    0.0000    0.0000    0.0000          1925
  367   11   12    0.0000    0.0000    0.0000          1925
  446   13   14    0.0000    0.0000    0.0000          1925
  591   11   12    0.0000    0.0000    0.0000          1925
  311   15   16  -10.0000    0.0000   -5.0000          #6
  645   15   16  -10.0000    0.0000   -5.0000          #10
  491   15   16  -10.0000    0.0000   -5.0000          #8
SCHEDULES
   29
    4 0.00000E+00 0.00000E+00    1
      3.46750E+04 0.00000E+00
      3.48000E+04 9.62500E+03
      4.63550E+04 9.62500E+03
    1 0.00000E+00 0.00000E+00    2
   10 0.00000E+00 0.00000E+00    3
      3.50400E+04 0.00000E+00
      3.50450E+04 1.81000E+01
      3.51650E+04 1.80950E+03
      3.73300E+04 1.80950E+03
      3.73350E+04 0.00000E+00
      4.52600E+04 0.00000E+00
      4.52800E+04 1.80950E+01
      4.53650E+04 1.80950E+03
```

```
    4.63550E+04 1.80950E+03
  9 0.00000E+00 0.00000E+00     4
    1.63800E+04 0.00000E+00
    1.64000E+04 1.15000E+00
    1.64250E+04 1.15000E+01
    1.86150E+04 1.15000E+01
    1.86300E+04 0.00000E+00
    2.66400E+04 0.00000E+00
    2.66450E+04 1.15000E+01
    2.77400E+04 1.15000E+01
  7 0.00000E+00 0.00000E+00     5
    3.57700E+04 0.00000E+00
    3.57850E+04 1.92500E+01
    3.58800E+04 1.92500E+03
    3.72300E+04 1.92500E+03
    3.72350E+04 0.00000E+00
    4.63550E+04 0.00000E+00
  7 0.00000E+00 0.00000E+00     6
    3.57700E+04 0.00000E+00
    3.57750E+04 1.60000E+01
    3.58200E+04 1.60000E+02
    3.72300E+04 1.60000E+02
    3.72350E+04 0.00000E+00
    4.63550E+04 0.00000E+00
  1 0.00000E+00 0.00000E+00     7
  6 0.00000E+00 0.00000E+00     8
    3.65000E+02 0.00000E+00
    3.75000E+02 -1.92500E+01
    1.86150E+04 -1.92500E+01
    1.86200E+04 0.00000E+00
    4.63550E+04 0.00000E+00
  1 0.00000E+00 0.00000E+00     9
  8 0.00000E+00 0.00000E+00    10
    1.82500E+03 0.00000E+00
    1.83000E+03 -1.00000E+01
    1.84000E+03 -1.00000E+02
    1.86000E+03 -1.00000E+03
    1.90600E+03 -1.00000E+03
    1.90700E+03 0.00000E+00
    4.63550E+04 0.00000E+00
  1 0.00000E+00 0.00000E+00    11
  7 0.00000E+00 0.00000E+00    12
    2.00750E+04 0.00000E+00
    2.00760E+04 -4.20000E+00
    2.00900E+04 -4.27000E+01
    4.52600E+04 -4.27000E+01
    4.52650E+04 0.00000E+00
    4.63550E+04 0.00000E+00
  1 0.00000E+00 0.00000E+00    13
  1 0.00000E+00 0.00000E+00    14
  9 0.00000E+00 0.00000E+00    15
    2.77400E+04 0.00000E+00
    2.77410E+04 -2.20000E+01
    2.77500E+04 -2.18000E+02
    2.78600E+04 -2.17500E+03
    2.89000E+04 -8.50000E+03
    3.72300E+04 -8.50000E+03
```

```
        3.72350E+04 0.00000E+00
        4.63550E+04 0.00000E+00
      8 0.00000E+00 0.00000E+00   16
        2.77400E+04 0.00000E+00
        2.77410E+04 -1.00000E+00
        2.77450E+04 -1.00000E+01
        2.78600E+04 -1.03000E+02
        3.72300E+04 -1.03000E+02
        3.72310E+04 0.00000E+00
        4.63550E+04 0.00000E+00
      2 0.00000E+00 7.00000E+00   17
        4.63550E+04 7.00000E+00
      2 0.00000E+00 7.00000E-01   18
        4.63550E+04 7.00000E-01
      7 0.00000E+00 0.00000E+00   19
        2.59150E+04 0.00000E+00
        2.66000E+04 -3.00000E+00
        2.73750E+04 -8.00000E+00
        3.43100E+04 -8.00000E+00
        3.45100E+04 0.00000E+00
        4.63550E+04 0.00000E+00
      1 0.00000E+00 0.00000E+00   20
      1 0.00000E+00 0.00000E+00   21
      1 0.00000E+00 0.00000E+00   22
      1 0.00000E+00 0.00000E+00   23
      1 0.00000E+00 0.00000E+00   24
      1 0.00000E+00 0.00000E+00   25
      1 0.00000E+00 0.00000E+00   26
      1 0.00000E+00 0.00000E+00   27
      1 0.00000E+00 0.00000E+00   28
      1 0.00000E+00 0.00000E+00   29
PRINTOUT LOCATIONS
    1
   20241.80    7220.26     mw-1
BOUNDARY NODES INPUT OPTION
    0   SWITCH 0= USE FLUCTUATION SCHEDULE, 1=USE THE FOLLOWING FILE NAME
CHECK BOX
1 1 0 0 0 1 1 1 1 0 0 0 0 0 1 1 1 1 1 1
ELEV OPT
15  7.5420e+03
-9.9999e+04 3.4000e+08 -9.9999e+04 3.4000e+08
0 15 0.0000e+00
0
```

```
CONTROL VARIABLES
Professional
    3    0    1    0    1    0    0
 0.0000000 17155.000 0.0100000 0.0500000 25.000000 1.1000000 365.00000
    5   12 0.0500000 0.0500000
MESH FILE , NODAL VALUE FILE, AND MESURED ELEVATION
F:\EST\SUNPHI\SUNPHIL4.msh
F:\EST\SUNDPS\SUNDP200.val
    3   SWITCH 0 = BLOCK EDIT 1 = MEASUREMENT POINT  2= CONST ELEV. 3=CONST
THICKNESS
  30.000
SOIL PROPERTIES
 10 NUMBER OF SOILS
    4.2980    0.4500    2.7000    0.4000 8.2100000381    0.1650    0.0742
1.0000    0.0000    0.0000
    2.8000    0.3900    1.8900    0.4100 3.4809999466    0.1830    0.0710
1.0000    0.0000    0.0000
    0.6760    0.9370    1.1100    0.3200 0.2029999942    0.0190    0.0180
1.0000    0.0000    0.0000
    0.6710    0.4300    1.7000    0.4500 0.3610999882    0.1710    0.0730
1.0000    0.0000    0.0000
    0.2560    0.8400    2.8000    0.3600 0.0156999994    0.0480    0.0403
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
FLUID PROPERTIES
    0.7800    0.8290    2.7857    1.5600  1.000000000
INITIAL CONDITIONS
    0 SWITCH, 0=BLOCK_EDIT,  1=MEASUREMENT POINTS  2=FROM DATABASE
3=RESTART_FILE
BOUNDARY SCHEDULE NUMBERS
  100 specified Zaw nodes
 2500    1
 1950    1
 1250    1
  700    1
   50    1
 1300    1
 1350    1
 1400    1
 1450    1
 1500    1
 1550    1
 1600    1
 1650    1
 1700    1
 1750    1
 1800    1
 1850    1
```

1900	1
1200	1
1150	1
1100	1
1050	1
1000	1
950	1
900	1
850	1
800	1
750	1
650	1
600	1
550	1
500	1
450	1
400	1
350	1
300	1
100	1
150	1
200	1
250	1
2050	1
2100	1
2150	1
2200	1
2250	1
2300	1
2350	1
2400	1
2450	1
2000	1
2451	2
2401	2
2351	2
2301	2
2251	2
2201	2
2151	2
2101	2
2051	2
2001	2
1951	2
1901	2
1851	2
1801	2
1751	2
1701	2
1651	2
1601	2
1551	2
1501	2
1401	2
1451	2
1301	2
1251	2

```
  1201     2
  1151     2
  1101     2
  1051     2
  1001     2
   951     2
   851     2
   801     2
   751     2
   701     2
   651     2
   551     2
   501     2
   451     2
   401     2
   351     2
   251     2
   301     2
   201     2
   151     2
   101     2
    51     2
     1     2
  1351     2
   901     2
   601     2
    11 boundary zaw fluctuation
     0 specified Zao nodes
     0 specified water flux nodes
     0 specified oil flux nodes
     0 water recharge nodes
    10 Well nodes
   591     3    4     0.0000     0.0000     0.0000          Tank
   465     5    6   -10.0000     0.0000    -5.0000          26th
   581     7    8   -10.0000    12.5000     0.0000          #25-26
   642     7    8   -10.0000    12.5000     0.0000          #21-22
   526     9   10   -10.0000     0.0000     0.0000          #28
   472     9   10   -10.0000     0.0000     0.0000          #28
   578     9   10   -10.0000     0.0000     0.0000          #28
   468     9   10   -10.0000     0.0000     0.0000          #28
   412     9   10   -10.0000     0.0000     0.0000          #28
   309     9   10   -10.0000     0.0000     0.0000          #28
SCHEDULES
    21
     2 0.00000E+00 6.00000E+00     1
       1.71550E+04 6.00000E+00
     2 0.00000E+00 6.00000E-01     2
       1.71550E+04 6.00000E-01
     1 0.00000E+00 0.00000E+00     3
     5 0.00000E+00 0.00000E+00     4
       1.00000E+01 -3.81000E+00
       2.00000E+01 -3.81000E+01
       3.00000E+01 -3.81000E+02
       1.71550E+04 -3.81000E+02
     4 0.00000E+00 0.00000E+00     5
       5.47400E+03 0.00000E+00
       5.47500E+03 9.62500E+03
```

```
     1.71550E+04 9.62500E+03
   1 0.00000E+00 0.00000E+00    6
   7 0.00000E+00 0.00000E+00    7
     5.80000E+03 1.81000E+01
     5.84000E+03 1.80950E+03
     8.03000E+03 1.80950E+03
     8.03200E+03 0.00000E+00
     1.60500E+04 1.80950E+03
     1.71550E+04 1.80950E+03
   7 0.00000E+00 0.00000E+00    8
     5.80000E+03 1.15000E+00
     5.84000E+03 1.15000E+01
     8.03000E+03 1.15000E+01
     8.04000E+03 0.00000E+00
     1.60600E+04 1.15000E+01
     1.71550E+04 1.15000E+01
   6 0.00000E+00 0.00000E+00    9
     6.56000E+03 1.92500E+01
     6.57000E+03 1.92500E+03
     8.03000E+03 1.92500E+03
     8.04000E+03 0.00000E+00
     1.71550E+04 0.00000E+00
   6 0.00000E+00 0.00000E+00   10
     6.56000E+03 1.60000E+01
     6.57000E+03 1.60000E+02
     8.03000E+03 1.60000E+02
     8.04000E+03 0.00000E+00
     1.71550E+04 0.00000E+00
   7 0.00000E+00 0.00000E+00   11
     1.00000E+00 -2.00000E+00
     1.00000E+01 -5.00000E+00
     1.50000E+01 -8.00000E+00
     5.11000E+03 -8.00000E+00
     5.13000E+03 0.00000E+00
     1.71550E+04 0.00000E+00
   1 0.00000E+00 0.00000E+00   12
   1 0.00000E+00 0.00000E+00   13
   1 0.00000E+00 0.00000E+00   14
   1 0.00000E+00 0.00000E+00   15
   1 0.00000E+00 0.00000E+00   16
   1 0.00000E+00 0.00000E+00   17
   1 0.00000E+00 0.00000E+00   18
   1 0.00000E+00 0.00000E+00   19
   1 0.00000E+00 0.00000E+00   20
   1 0.00000E+00 0.00000E+00   21
PRINTOUT LOCATIONS
    1
   20241.80    7220.26     mw-1
BOUNDARY NODES INPUT OPTION
    0   SWITCH 0= USE FLUCTUATION SCHEDULE, 1=USE THE FOLLOWING FILE NAME
CHECK BOX
1 1 0 0 0 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1
ELEV OPT
15  7.5420e+03
-9.9999e+04 3.4000e+08 -9.9999e+04 3.4000e+08
0 15 0.0000e+00
0
```

```
CONTROL VARIABLES
Professional
    3     0     1     0     1     0     0
 0.0000000 17155.000 0.0100000 0.0500000 25.000000 1.1000000 365.00000
    5    12 0.0500000 0.0500000
MESH FILE , NODAL VALUE FILE, AND MESURED ELEVATION
F:\EST\SUNPHI\SUNPHIL4.msh
F:\EST\SUNDPS\SUNDP202.val
    3   SWITCH 0 = BLOCK EDIT 1 = MEASUREMENT POINT  2= CONST ELEV. 3=CONST
THICKNESS
  30.000
SOIL PROPERTIES
 10 NUMBER OF SOILS
    4.2980    0.4500    2.7000    0.4000 8.2100000381    0.1650    0.0742
1.0000    0.0000    0.0000
    2.8000    0.3900    1.8900    0.4100 3.4809999466    0.1830    0.0710
1.0000    0.0000    0.0000
    0.6760    0.9370    1.1100    0.3200 0.2029999942    0.0190    0.0180
1.0000    0.0000    0.0000
    0.6710    0.4300    1.7000    0.4500 0.3610999882    0.1710    0.0730
1.0000    0.0000    0.0000
    0.2560    0.8400    2.8000    0.3600 0.0156999994    0.0480    0.0403
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
FLUID PROPERTIES
    0.7800    0.8290    2.7857    1.5600  1.000000000
INITIAL CONDITIONS
    0 SWITCH, 0=BLOCK_EDIT,  1=MEASUREMENT POINTS  2=FROM DATABASE
3=RESTART_FILE
BOUNDARY SCHEDULE NUMBERS
   27 specified Zaw nodes
   50     1
   48     1
   47     1
   46     1
  100     1
  150     1
  200     1
   44     1
   45     1
 2451     2
 2401     2
 2351     2
 2301     2
 2251     2
 2201     2
 2151     2
 2101     2
```

```
 2051    2
 2001    2
 1951    2
 1901    2
 1851    2
 1801    2
 2454    2
 2452    2
 2453    2
 2455    2
   11 boundary zaw fluctuation
    0 specified Zao nodes
    0 specified water flux nodes
    0 specified oil flux nodes
    0 water recharge nodes
   10 Well nodes
  591    3    4     0.0000     0.0000     0.0000          Tank
  465    5    6   -10.0000     0.0000    -5.0000          26th
  581    7    8   -10.0000    12.5000     0.0000          #25-26
  642    7    8   -10.0000    12.5000     0.0000          #21-22
  526    9   10   -10.0000     0.0000     0.0000          #28
  472    9   10   -10.0000     0.0000     0.0000          #28
  578    9   10   -10.0000     0.0000     0.0000          #28
  468    9   10   -10.0000     0.0000     0.0000          #28
  412    9   10   -10.0000     0.0000     0.0000          #28
  309    9   10   -10.0000     0.0000     0.0000          #28
SCHEDULES
   21
    2 0.00000E+00 7.00000E+00    1
      1.71550E+04 7.00000E+00
    2 0.00000E+00 7.00000E-01    2
      1.71550E+04 7.00000E-01
    1 0.00000E+00 0.00000E+00    3
    5 0.00000E+00 0.00000E+00    4
      1.00000E+01 -3.81000E+00
      2.00000E+01 -3.81000E+01
      3.00000E+01 -3.81000E+02
      1.71550E+04 -3.81000E+02
    4 0.00000E+00 0.00000E+00    5
      5.47400E+03 0.00000E+00
      5.47500E+03 9.62500E+03
      1.71550E+04 9.62500E+03
    1 0.00000E+00 0.00000E+00    6
    7 0.00000E+00 0.00000E+00    7
      5.80000E+03 1.81000E+01
      5.84000E+03 1.80950E+03
      8.03000E+03 1.80950E+03
      8.03200E+03 0.00000E+00
      1.60500E+04 1.80950E+03
      1.71550E+04 1.80950E+03
    7 0.00000E+00 0.00000E+00    8
      5.80000E+03 1.15000E+00
      5.84000E+03 1.15000E+01
      8.03000E+03 1.15000E+01
      8.04000E+03 0.00000E+00
      1.60600E+04 1.15000E+01
      1.71550E+04 1.15000E+01
```

```
    6 0.00000E+00 0.00000E+00    9
      6.56000E+03 1.92500E+01
      6.57000E+03 1.92500E+03
      8.03000E+03 1.92500E+03
      8.04000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    6 0.00000E+00 0.00000E+00   10
      6.56000E+03 1.60000E+01
      6.57000E+03 1.60000E+02
      8.03000E+03 1.60000E+02
      8.04000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    7 0.00000E+00 0.00000E+00   11
      1.00000E+00 -2.00000E+00
      1.00000E+01 -5.00000E+00
      1.50000E+01 -8.00000E+00
      5.11000E+03 -8.00000E+00
      5.13000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    1 0.00000E+00 0.00000E+00   12
    1 0.00000E+00 0.00000E+00   13
    1 0.00000E+00 0.00000E+00   14
    1 0.00000E+00 0.00000E+00   15
    1 0.00000E+00 0.00000E+00   16
    1 0.00000E+00 0.00000E+00   17
    1 0.00000E+00 0.00000E+00   18
    1 0.00000E+00 0.00000E+00   19
    1 0.00000E+00 0.00000E+00   20
    1 0.00000E+00 0.00000E+00   21
PRINTOUT LOCATIONS
    1
   20241.80    7220.26     mw-1
BOUNDARY NODES INPUT OPTION
    0   SWITCH 0= USE FLUCTUATION SCHEDULE, 1=USE THE FOLLOWING FILE NAME
CHECK BOX
1 1 0 0 0 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1
ELEV OPT
15  7.5420e+03
-9.9999e+04 3.4000e+08 -9.9999e+04 3.4000e+08
0 15 0.0000e+00
0
```

```
CONTROL VARIABLES
Professional
    3    0    1    0    1    0    0
 0.0000000 17155.000 0.0100000 0.0500000 25.000000 1.1000000 365.00000
    5   12 0.0500000 0.0500000
MESH FILE , NODAL VALUE FILE, AND MESURED ELEVATION
F:\EST\SUNPHI\SUNPHIL6.msh
F:\EST\SUNDPS\SUNDP203.val
    3   SWITCH 0 = BLOCK EDIT 1 = MEASUREMENT POINT  2= CONST ELEV. 3=CONST
THICKNESS
  30.000
SOIL PROPERTIES
 10 NUMBER OF SOILS
    7.9370    0.4840    2.7000    0.3100 28.000000000    0.1550    0.0750
1.0000    0.0000    0.0000
    2.8000    0.3900    1.8900    0.4100 3.4809999466    0.1830    0.0710
1.0000    0.0000    0.0000
    0.6760    0.9370    1.1100    0.3200 0.2029999942    0.0190    0.0180
1.0000    0.0000    0.0000
    0.6710    0.4300    1.7000    0.4500 0.3610999882    0.1710    0.0730
1.0000    0.0000    0.0000
   31.8198    0.1935    2.7000    0.3100 450.00000000    0.3226    0.0624
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
FLUID PROPERTIES
    0.7800    0.8290    2.7860    1.5600  1.000000000
INITIAL CONDITIONS
    0 SWITCH, 0=BLOCK_EDIT,  1=MEASUREMENT POINTS  2=FROM DATABASE
3=RESTART_FILE
BOUNDARY SCHEDULE NUMBERS
   25 specified Zaw nodes
   50    1
  100    1
   49    1
 2451    2
 2452    2
 2453    2
 2454    2
 2455    2
 2456    2
 2401    2
 2351    2
 2301    2
 2251    2
 2201    2
 2151    2
 2101    2
 2051    2
```

```
  150    1
   48    1
   47    1
   46    1
   45    1
   44    1
  200    1
   43    1
   11 boundary zaw fluctuation
    0 specified Zao nodes
    0 specified water flux nodes
    0 specified oil flux nodes
    0 water recharge nodes
    4 Well nodes
  581    3    4    0.0000    0.0000    0.0000          Tank42
  430    5    6   -5.0000   12.5000   -5.0000          #8
  681    7    8   -5.0000   12.5000   -5.0000          #21-22
  571    9   10   -5.0000   12.5000   -5.0000          #25-26
SCHEDULES
   21
    2 0.00000E+00 7.00000E+00    1
      1.71550E+04 7.00000E+00
    2 0.00000E+00 7.00000E-01    2
      1.71550E+04 7.00000E-01
    1 0.00000E+00 0.00000E+00    3
    5 0.00000E+00 0.00000E+00    4
      1.00000E+00 -3.81000E+00
      1.00000E+01 -3.81000E+01
      2.00000E+01 -3.81000E+02
      1.71550E+04 -3.81000E+02
    7 0.00000E+00 0.00000E+00    5
      1.00000E+00 3.28000E+00
      1.00000E+01 3.28000E+01
      1.50000E+01 3.28000E+02
      7.30000E+03 3.28000E+02
      7.32000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    7 0.00000E+00 0.00000E+00    6
      1.00000E+00 3.65700E+00
      1.00000E+01 3.65700E+01
      1.50000E+01 3.65700E+02
      7.30000E+03 3.65700E+03
      7.32000E+03 3.65700E+03
      1.71550E+04 3.65700E+03
   11 0.00000E+00 0.00000E+00    7
      5.84000E+03 1.80900E+00
      5.84500E+03 1.80900E+01
      5.89900E+03 1.80900E+03
      8.03000E+03 1.80900E+03
      8.03500E+03 0.00000E+00
      1.60600E+04 0.00000E+00
      1.60610E+04 1.80900E+00
      1.60650E+04 1.80900E+01
      1.60990E+04 1.80900E+03
      1.71550E+04 1.80900E+03
    7 0.00000E+00 0.00000E+00    8
      5.84000E+03 2.32000E-01
```

```
         5.85000E+03 2.32000E+00
         5.85500E+03 2.32000E+01
         6.00000E+03 2.32000E+02
         7.32000E+03 2.32000E+03
         1.71550E+04 2.32000E+03
       6 0.00000E+00 0.00000E+00    9
         5.84000E+03 0.00000E+00
         5.84100E+03 1.54000E+00
         5.88500E+03 1.54000E+02
         5.99500E+03 1.54000E+03
         1.71550E+04 1.54000E+03
       7 0.00000E+00 0.00000E+00   10
         5.84000E+03 0.00000E+00
         5.84500E+03 6.00000E+00
         5.88500E+03 6.00000E+01
         5.99500E+03 1.00000E+03
         6.10000E+03 2.50000E+03
         1.71550E+04 2.50000E+03
       6 0.00000E+00 0.00000E+00   11
         5.00000E+01 -5.00000E+00
         1.00000E+02 -8.00000E+00
         5.13000E+03 -8.00000E+00
         5.33000E+03 0.00000E+00
         1.71550E+04 0.00000E+00
       1 0.00000E+00 0.00000E+00   12
       1 0.00000E+00 0.00000E+00   13
       1 0.00000E+00 0.00000E+00   14
       1 0.00000E+00 0.00000E+00   15
       1 0.00000E+00 0.00000E+00   16
       1 0.00000E+00 0.00000E+00   17
       1 0.00000E+00 0.00000E+00   18
       1 0.00000E+00 0.00000E+00   19
       1 0.00000E+00 0.00000E+00   20
       1 0.00000E+00 0.00000E+00   21
PRINTOUT LOCATIONS
    0
BOUNDARY NODES INPUT OPTION
    0   SWITCH 0= USE FLUCTUATION SCHEDULE, 1=USE THE FOLLOWING FILE NAME
CHECK BOX
1 1 0 0 0 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1
ELEV OPT
15  7.5420e+03
-9.9999e+04 3.4000e+08 -9.9999e+04 3.4000e+08
0 15 0.0000e+00
0
```

```
CONTROL VARIABLES
Professional
    3    0    1    0    1    0    0
 0.0000000 17155.000 0.0100000 0.0500000 25.000000 1.1000000 365.00000
    5   12 0.0500000 0.0500000
MESH FILE , NODAL VALUE FILE, AND MESURED ELEVATION
F:\EST\SUNPHI\SUNPHIL4.msh
F:\EST\SUNDPS\SUNDP204.val
    3   SWITCH 0 = BLOCK EDIT 1 = MEASUREMENT POINT  2= CONST ELEV. 3=CONST
THICKNESS
  30.000
SOIL PROPERTIES
 10 NUMBER OF SOILS
    4.2980    0.4500    2.7000    0.4000 8.2100000381    0.1650    0.0742
1.0000    0.0000    0.0000
    2.8000    0.3900    1.8900    0.4100 3.4809999466    0.1830    0.0710
1.0000    0.0000    0.0000
    0.6760    0.9370    1.1100    0.3200 0.2029999942    0.0190    0.0180
1.0000    0.0000    0.0000
    0.6710    0.4300    1.7000    0.4500 0.3610999882    0.1710    0.0730
1.0000    0.0000    0.0000
    0.2560    0.8400    2.8000    0.3600 0.0156999994    0.0480    0.0403
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
FLUID PROPERTIES
    0.7800    0.8290    2.7857    1.5600  1.000000000
INITIAL CONDITIONS
    0 SWITCH, 0=BLOCK_EDIT,  1=MEASUREMENT POINTS  2=FROM DATABASE
3=RESTART_FILE
BOUNDARY SCHEDULE NUMBERS
   25 specified Zaw nodes
   50    1
   45    1
   46    1
   47    1
   48    1
  100    1
  150    1
  200    1
   49    1
 2451    2
 2401    2
 2351    2
 2301    2
 2251    2
 2201    2
 2151    2
 2101    2
```

```
 2051    2
 2001    2
 1951    2
 1901    2
 1851    2
 2452    2
 2453    2
 2454    2
    9 boundary zaw fluctuation
    0 specified Zao nodes
    0 specified water flux nodes
    0 specified oil flux nodes
    0 water recharge nodes
   10 Well nodes
  591    3    4    0.0000    0.0000    0.0000          Tank
  581    5    6  -10.0000   12.5000    0.0000          #25-26
  642    5    6  -10.0000   12.5000    0.0000          #21-22
  526    7    8  -10.0000    0.0000    0.0000          #28
  472    7    8  -10.0000    0.0000    0.0000          #28
  578    7    8  -10.0000    0.0000    0.0000          #28
  468    7    8  -10.0000    0.0000    0.0000          #28
  412    7    8  -10.0000    0.0000    0.0000          #28
  309    7    8  -10.0000    0.0000    0.0000          #28
  595    3    4    0.0000    0.0000    0.0000          Tank
SCHEDULES
   19
    2 0.00000E+00 7.00000E+00    1
      1.71550E+04 7.00000E+00
    2 0.00000E+00 7.00000E-01    2
      1.71550E+04 7.00000E-01
    1 0.00000E+00 0.00000E+00    3
    9 0.00000E+00 0.00000E+00    4
      1.00000E+01 -3.20000E+00
      2.00000E+01 -3.20000E+01
      4.00000E+01 -3.20000E+02
      6.00000E+01 -3.20000E+03
      8.00000E+01 -3.50000E+03
      1.40000E+02 -3.50000E+03
      1.50000E+02 0.00000E+00
      1.71550E+04 0.00000E+00
    7 0.00000E+00 0.00000E+00    5
      5.80000E+03 1.81000E+01
      5.84000E+03 1.80950E+03
      8.03000E+03 1.80950E+03
      8.03200E+03 0.00000E+00
      1.60500E+04 1.80950E+03
      1.71550E+04 1.80950E+03
    7 0.00000E+00 0.00000E+00    6
      5.80000E+03 1.15000E+00
      5.84000E+03 1.15000E+01
      8.03000E+03 1.15000E+01
      8.04000E+03 0.00000E+00
      1.60600E+04 1.15000E+01
      1.71550E+04 1.15000E+01
    6 0.00000E+00 0.00000E+00    7
      6.56000E+03 1.92500E+01
      6.57000E+03 1.92500E+03
```

```
      8.03000E+03 1.92500E+03
      8.04000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    6 0.00000E+00 0.00000E+00     8
      6.56000E+03 1.60000E+01
      6.57000E+03 1.60000E+02
      8.03000E+03 1.60000E+02
      8.04000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    7 0.00000E+00 0.00000E+00     9
      1.00000E+00 -2.00000E+00
      1.00000E+01 -5.00000E+00
      1.50000E+01 -8.00000E+00
      5.11000E+03 -8.00000E+00
      5.13000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    1 0.00000E+00 0.00000E+00    10
    1 0.00000E+00 0.00000E+00    11
    1 0.00000E+00 0.00000E+00    12
    1 0.00000E+00 0.00000E+00    13
    1 0.00000E+00 0.00000E+00    14
    1 0.00000E+00 0.00000E+00    15
    1 0.00000E+00 0.00000E+00    16
    1 0.00000E+00 0.00000E+00    17
    1 0.00000E+00 0.00000E+00    18
    1 0.00000E+00 0.00000E+00    19
PRINTOUT LOCATIONS
    1
   20241.80     7220.26     mw-1
BOUNDARY NODES INPUT OPTION
    0   SWITCH 0= USE FLUCTUATION SCHEDULE, 1=USE THE FOLLOWING FILE NAME
CHECK BOX
1 1 0 0 0 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1
ELEV OPT
15  7.5420e+03
-9.9999e+04 3.4000e+08 -9.9999e+04 3.4000e+08
0 15 0.0000e+00
0
```

```
CONTROL VARIABLES
Professional
    3    0    1    0    1    0    0
 0.0000000 17155.000 0.0100000 0.0500000 25.000000 1.1000000 365.00000
    5   12 0.0500000 0.0500000
MESH FILE , NODAL VALUE FILE, AND MESURED ELEVATION
F:\EST\SUNPHI\SUNPHIL4.msh
F:\EST\SUNDPS\SUNDP210.val
    3   SWITCH 0 = BLOCK EDIT 1 = MEASUREMENT POINT  2= CONST ELEV. 3=CONST
THICKNESS
  30.000
SOIL PROPERTIES
 10 NUMBER OF SOILS
    4.2980    0.4500    2.7000    0.4000 8.2100000381    0.1650    0.0742
1.0000    0.0000    0.0000
    2.8000    0.3900    1.8900    0.4100 3.4809999466    0.1830    0.0710
1.0000    0.0000    0.0000
    0.6760    0.9370    1.1100    0.3200 0.2029999942    0.0190    0.0180
1.0000    0.0000    0.0000
    0.6710    0.4300    1.7000    0.4500 0.3610999882    0.1710    0.0730
1.0000    0.0000    0.0000
    0.2560    0.8400    2.8000    0.3600 0.0156999994    0.0480    0.0403
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000 0.0000000000    0.0000    0.0000
1.0000    0.0000    0.0000
FLUID PROPERTIES
    0.7800    0.8290    2.7857    1.5600  1.000000000
INITIAL CONDITIONS
    0 SWITCH, 0=BLOCK_EDIT,  1=MEASUREMENT POINTS  2=FROM DATABASE
3=RESTART_FILE
BOUNDARY SCHEDULE NUMBERS
  100 specified Zaw nodes
 2500    1
 1950    1
 1250    1
  700    1
   50    1
 1300    1
 1350    1
 1400    1
 1450    1
 1500    1
 1550    1
 1600    1
 1650    1
 1700    1
 1750    1
 1800    1
 1850    1
```

1900	1
1200	1
1150	1
1100	1
1050	1
1000	1
950	1
900	1
850	1
800	1
750	1
650	1
600	1
550	1
500	1
450	1
400	1
350	1
300	1
100	1
150	1
200	1
250	1
2050	1
2100	1
2150	1
2200	1
2250	1
2300	1
2350	1
2400	1
2450	1
2000	1
2451	2
2401	2
2351	2
2301	2
2251	2
2201	2
2151	2
2101	2
2051	2
2001	2
1951	2
1901	2
1851	2
1801	2
1751	2
1701	2
1651	2
1601	2
1551	2
1501	2
1401	2
1451	2
1301	2
1251	2

```
 1201    2
 1151    2
 1101    2
 1051    2
 1001    2
  951    2
  851    2
  801    2
  751    2
  701    2
  651    2
  551    2
  501    2
  451    2
  401    2
  351    2
  251    2
  301    2
  201    2
  151    2
  101    2
   51    2
    1    2
 1351    2
  901    2
  601    2
   11 boundary zaw fluctuation
    0 specified Zao nodes
    0 specified water flux nodes
    0 specified oil flux nodes
    0 water recharge nodes
   13 Well nodes
  465    3    4  -10.0000    0.0000   -5.0000          26th
  581    5    6  -10.0000   12.5000    0.0000          #25-26
  642    5    6  -10.0000   12.5000    0.0000          #21-22
  526    7    8  -10.0000    0.0000    0.0000          #28
  472    7    8  -10.0000    0.0000    0.0000          #28
  578    7    8  -10.0000    0.0000    0.0000          #28
  468    7    8  -10.0000    0.0000    0.0000          #28
  412    7    8  -10.0000    0.0000    0.0000          #28
  309    7    8  -10.0000    0.0000    0.0000          #28
 2026    9   10    0.0000    0.0000    0.0000          Bldg
 1275    9   10    0.0000    0.0000    0.0000          Bldg
 1371    9   10    0.0000    0.0000    0.0000          Bldg
 1869    9   10    0.0000    0.0000    0.0000          Bldg
SCHEDULES
   21
    2 0.00000E+00 6.00000E+00    1
      1.71550E+04 6.00000E+00
    2 0.00000E+00 6.00000E-01    2
      1.71550E+04 6.00000E-01
    4 0.00000E+00 0.00000E+00    3
      5.47400E+03 0.00000E+00
      5.47500E+03 9.62500E+03
      1.71550E+04 9.62500E+03
    1 0.00000E+00 0.00000E+00    4
    7 0.00000E+00 0.00000E+00    5
```

```
      5.80000E+03 1.81000E+01
      5.84000E+03 1.80950E+03
      8.03000E+03 1.80950E+03
      8.03200E+03 0.00000E+00
      1.60500E+04 1.80950E+03
      1.71550E+04 1.80950E+03
    7 0.00000E+00 0.00000E+00    6
      5.80000E+03 1.15000E+00
      5.84000E+03 1.15000E+01
      8.03000E+03 1.15000E+01
      8.04000E+03 0.00000E+00
      1.60600E+04 1.15000E+01
      1.71550E+04 1.15000E+01
    6 0.00000E+00 0.00000E+00    7
      6.56000E+03 1.92500E+01
      6.57000E+03 1.92500E+03
      8.03000E+03 1.92500E+03
      8.04000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    6 0.00000E+00 0.00000E+00    8
      6.56000E+03 1.60000E+01
      6.57000E+03 1.60000E+02
      8.03000E+03 1.60000E+02
      8.04000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    1 0.00000E+00 0.00000E+00    9
    4 0.00000E+00 0.00000E+00   10
      1.00000E+01 -9.62500E-01
      2.00000E+01 -9.62500E+00
      1.71550E+04 -9.62500E+00
    7 0.00000E+00 0.00000E+00   11
      1.00000E+00 -2.00000E+00
      1.00000E+01 -5.00000E+00
      1.50000E+01 -8.00000E+00
      5.11000E+03 -8.00000E+00
      5.13000E+03 0.00000E+00
      1.71550E+04 0.00000E+00
    1 0.00000E+00 0.00000E+00   12
    1 0.00000E+00 0.00000E+00   13
    1 0.00000E+00 0.00000E+00   14
    1 0.00000E+00 0.00000E+00   15
    1 0.00000E+00 0.00000E+00   16
    1 0.00000E+00 0.00000E+00   17
    1 0.00000E+00 0.00000E+00   18
    1 0.00000E+00 0.00000E+00   19
    1 0.00000E+00 0.00000E+00   20
    1 0.00000E+00 0.00000E+00   21
PRINTOUT LOCATIONS
    1
   20241.80    7220.26     mw-1
BOUNDARY NODES INPUT OPTION
    0   SWITCH 0= USE FLUCTUATION SCHEDULE, 1=USE THE FOLLOWING FILE NAME
CHECK BOX
1 1 0 0 0 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1
ELEV OPT
15  7.5420e+03
-9.9999e+04 3.4000e+08 -9.9999e+04 3.4000e+08
```

```
0 15 0.0000e+00
0
```