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Attention: Lisa Strobridge, P.G.
Pennsylvania Department of Environmental Protection
2 East Main Street
Norristown, Pennsylvania 19401

Dear Ms. Strobridge,

Reference: Response to Public Comments
Sitewide Fate and Transport Remedial Investigation Report
Sitewide PADEP Facility ID No. 780190
Former Philadelphia Refinery
3144 Passyunk Avenue
City of Philadelphia
Philadelphia County

1.0 INTRODUCTION

On June 30, 2022, Evergreen submitted a Sitewide Fate and Transport (F&T) Remedial Investigation Report (RIR) for the Former Philadelphia Refinery (facility). As outlined in Evergreen's 2019 Public Involvement Plan for the Act 2 Remediation Process at the Former Sunoco Philadelphia Refinery, Evergreen accepted public comments for a 30-day period following the submission of the Sitewide F&T RIR. The purpose of this letter is to provide the comments received from the public and Evergreen's responses to these comments for Pennsylvania Department of Environmental Protection (PADEP) and US Environmental Protection Agency (EPA) consideration of the RIR. This response letter amends the previously submitted Sitewide F&T RIR and completes the submission. This response letter and attachments will be posted to Evergreen's website upon submission to PADEP in the same location as the Sitewide F&T RIR.

2.0 RESPONSE TO PUBLIC COMMENTS

This section presents the comments received from the public via email (phillyrefinerycleanup@ghd.com) and the website (https://phillyrefinerycleanup.info/). Evergreen received four unique sets of comments for the Sitewide Fate and Transport RIR (**Attachment A**). Three sets of comments were technical in nature and sent directly via email, one set from the Clean Air Council (CAC), one set from Brickhouse Environmental (Brickhouse), and one set received separately from 15 individuals. A copy of each of the 15 repeat comments is included in **Attachment A**. One comment was submitted via the website submission form which is not related to the content of the Sitewide Fate and Transport RIR nor Evergreen's remediation program, but rather the future use of the property. A copy is included in **Attachment A** for completeness. As comments received relevant to the Sitewide Fate and Transport RIR were technical in nature when

considered in full, the responses provided herein are also technical and not "plain language" so that the comments could adequately be addressed and evaluated by PADEP as part of the ERA review.

Note that previously published Evergreen documents referenced in this letter have not been included as attachments but can be found on the website (https://phillyrefinerycleanup.info/).

RESPONSES TO CAC COMMENTS

Comment 1

Evergreen has not eliminated potential pathways of exposure, as a substitute for a risk assessment.

Response to Comment 1

A requirement of an Act 2 Remedial Investigation Report, such as those submitted for each AOI previously, is to identify (but not eliminate) exposure pathways. The primary objective of the Sitewide F&T RIR was to use a set of numerical models to aid in the Act 2 process of documenting delineation of the extent of groundwater contamination attributable to Sunoco and characterization of both current and future contaminant transport pathways. As such, the RIR is intended to inform, but not substitute for, the assessment of site-specific human health and/or ecological risks posed by the contamination.

Comment 2a

Evergreen fails to support parameterization of the Horizontal Flow Barrier (HFB) package adjacent to the Schuylkill River. The CAC makes specific reference to AOI 8.

Response to Comment 2a

Part 1 of the Sitewide F&T RIR includes a summary of the Horizontal Flow Barrier (HFB) package used in Evergreen's groundwater flow model. The HFB package is used to numerically simulate barriers to flow such as slurry walls by reducing the conductance between individual pairs of cells. The HFB package was used in the groundwater flow model to support the Sitewide F&T RIR to simulate partial groundwater flow barriers where bulkheads are present along the Schuylkill River across all AOIs. In addition to making visual observations as to the presence or absence of bulkheads, Evergreen reviewed historic aerial photography and drawing archives for bulkhead as-builts and met with engineers from Philadelphia Energy Solutions (PES) to understand recent shoreline conditions. Appendix C of the F&T RIR Part 1 includes a report obtained from PES that discusses results of a 2017 waterfront inspection. A combination of visual observations, aerial photographs, historic plan review, and the inspection report formed the basis of Evergreen's bulkhead knowledge and was used to digitize the features in a geographic information system (GIS). The GIS dataset was used to select the model cell along the Schuylkill River boundary for inclusion as partial flow barriers.

Bulkheads were constructed of a variety of materials and for different purposes over a span of many years. Bulkhead construction drawings reviewed by Evergreen frequently did not include total depths of bulkhead installation. Further, measured hydraulic characteristic values for the different bulkhead types and ages present are not readily available. For example, there is a historic timber bulkhead present along portions of the former refinery shoreline that dates to the early 1900s. In Girard Point, steel sheeting was driven behind the timber bulkhead and concrete was poured in between. In AOI 8, the timber bulkhead connects the

Upriver Low Deck Wharf to the North Yard Terminal and can be observed exposed at low tide (note that an inspection of the terminal is included in F&T RIR Part 1, Appendix C). There is a portion of AOI 8 shoreline where the bulkhead is interpreted to extend to bedrock because bedrock is shallow in the area close to the "fall line" where Piedmont bedrock is present near land surface (wells N-148D and N-149D are located to the south and east nearer an area where the bulkheads are not present in Layer 7; note that the observed tidal response in the wells is expected to be a combination of water exchange and water pressure exerted on the deeper aquifer). The HFB properties are important flow model calibration terms and were evaluated in model sensitivity runs so that they could be represented in the flow model to the extent possible based on available information.

There appears to be some confusion about observed groundwater features and the flow system conditions, particularly along the Schuylkill River and former tributary creeks. Prior to industrialization the natural system included lowlands and tributary creeks along the Schuylkill River in AOI 8, AOIs 5/6/7, AOI 9, and AOI 10 where marshes were present. Persistent groundwater mounding would not be expected in these floodplain areas as they are natural groundwater to surface water discharge areas where base level is set by the river. Groundwater in the Coastal Plain deposits exits to surface water along tributary creek valleys to constitute base flow. Evergreen's groundwater data shows convergence along the axis of Rambo Creek (supporting seepage to the buried creek valley), but near its former mouth there is a persistent mound present. The mound in this location is inferred to be present because groundwater flow to the Schuylkill is limited by low permeability fill deposits, Holocene-age muds, bulkheads, and areas of active shoaling in the river. Comparatively, groundwater conditions in the former Case Wharf area are different in that there is no bulkhead, the river is scouring its bed, and the Pleistocene-age terrace (mostly sand and gravel deposits) are present above the Schuylkill River elevation, resulting in steeper hydraulic gradient, particularly at low tide. Groundwater converges there because the area is inferred to be an area of higher groundwater seepage.

In summary, Evergreen's flow model was calibrated and verified using annual observations of water levels across the facility to establish a model that reasonably represents average conditions of groundwater flow. CAC's primary concern regarding use of the HFB package appears to be that the condition prevents or limits interaction between surface water and groundwater, and pathways of groundwater flow between aquifers. The HFBs in the model are not impervious barriers, do not extend through all model layers across the domain, and represent the conceptual understanding of groundwater flow at the facility.

Comment 2b

Evergreen fails to support parameterization of the aquifer in the southeast portion of AOI-8.

Response to Comment 2b

Evergreen is interpreting this comment to be in reference to the southwestern portion of AOI 8. Both the southeastern and southwestern areas are mentioned, but the comments seem to be focused on elements in the southwest.

CAC states that the hydraulic parameters used in the flow model to represent the characterized depositional sequence do not adequately represent AOI 8 site-specific data presented in the RIR reports. There is significant heterogeneity in the facility Coastal Plain deposits, and the in-situ aquifer testing from AOI 8 characterization combined with other regional aquifer data was compiled to develop a range of

possible hydraulic properties to consider for the flow model. This data was to supplement and refine the original properties assigned by the United States Geological Survey (USGS) (see F&T RIR Part 1 Section 2). A surficial geologic map was developed by Evergreen from site data to inform the basis of the conceptual site model (CSM) to represent the nature and extent of observed deposits, giving particular attention to hydrostratigraphy. Stratigraphic profiles in this area of AOI 8 support that Holocene-age deposits prevail and are predominantly muddy, extending to bedrock in places where past incision of the Schuylkill River completely removed the Potomac-Raritan-Magothy (PRM) deposits. Pleistocene-age, glaciofluvial deposits (Trenton gravel) have been identified in pockets below the muds in minimal thickness and with limited connectivity to the PRM sequence to the east (e.g., N-38D and N-149D). Regarding permeabilities in the Holocene-age deposits, it was recognized that former Rambo Creek alluvial deposits could form a preferential pathway for contaminant transport to the Schuylkill River near its mouth. To test the completeness of this pathway, collocated wells N-149D, N-150, and N-156 were installed at this location. To date, the groundwater data collected does not support that a significant contaminant transport pathway exists there.

In conclusion, hydraulic conductivity was a primary model calibration term that was varied over several orders of magnitude to achieve calibration to site groundwater observations. Figures presented in the F&T RIR cited by CAC show the range of values assigned to the model zones and how they vary across and vertically through the flow model domain while being representative of the range of characterized aquifer properties.

Comment 3

Evergreen has failed to substantiate its predictions regarding the migration of contaminated groundwater past the sheet pile wall and bulkheads.

Response to Comment 3

CAC comments suggest that the model's HFB cells do not accurately reflect conditions of the sheet pile walls and bulkheads along the Schuylkill River and are therefore not adequately simulating migration of contaminated groundwater into Schuylkill River surface water in these areas. As discussed in response to CAC Comment 2a, there are varying materials, types, and ages of sheet pile walls/bulkheads along the Schuylkill River that are expected to have different conductance properties. HFBs use a conductance value or the wall's ability to transmit flow. In the absence of additional bulkhead conductance data, Evergreen applied a uniform input value for all HFBs and evaluated the magnitude of conductance through the calibration process. In general, it was observed that the HFB properties simulated conjunction with other hydraulic parameters and boundary conditions to simulate groundwater flow through the system to closely represent observed water levels and flow patterns.

Sensitivity analysis indicated that varying the conductance of the HFBs, had a localized effect on the simulated groundwater flow patterns. A lower conductance resulted in steeper gradients across the HFB, while increased conductance resulted in a lower gradient. Because flux across the HFBs is calculated within the model from a combination of both gradient and conductance, the gradient and conductance terms tended to balance the flux within the model. Sensitivity analysis and calibration supported that the presence or lack of an HFB was of greater importance than the parameterization when evaluating the presence and flux of constituents of concern (COCs) from the site to the Schuylkill River.

Comment 4

Evergreen presents inconsistent results regarding sewer discharge and contaminant flux into the Schuylkill River.

Response to Comment 4

This comment references two different sets of groundwater contaminant mass flux estimates for benzene. F&T RIR Part 2 Figure 4-12 was developed to show the estimated total flux of dissolved benzene into the City of Philadelphia (City) combined sewer system and represented by the Drain (DRN) package in MODFLOW. Under typical operating conditions represented by Evergreen's models, the City's sewers are designed to route flow to the Lower Schuylkill River East Side Intercepting Sewer where it is transported to a regional wastewater plant. As such, this pathway of contaminant transport is not interpreted to represent a steady-state flux to the Schuylkill River but was provided to inform the contaminant transport pathway to the City sewer system.

Alternately, F&T RIR Part 2 Appendix L includes a figure (Appendix A) that shows the location and magnitude of model predicted groundwater sources (seeps) to surface water in consideration of river modeling. This figure is a representation of the COC flux to the Schuylkill River as a result of direct discharge of groundwater to surface water.

Comment 5a

Evergreen's approach for selection of biodegradation rates is flawed.

Response to Comment 5a

The MT3D model employed by Evergreen models fate and transport of the selected indicator parameters through setting initial contaminant loadings and predicts their transport in the saturated zone in accordance with the groundwater flows modeled in Part 1, taking into account reductions in concentration through discharge to flow boundaries, biodegradation, dispersion, and complexation. Due to the nature of the overprinted and commingled plumes, calibration methods and analytical techniques for estimating biodegradation are not typically applicable at the facility. Evergreen has implemented a conservative approach that uses degradation rates assigned in the groundwater transport model for organic compounds (benzene, naphthalene, and methyl tertiary butyl ether [MTBE]) consistent with those reported in literature (Howard et al 1991) and biodegradation rates reported in 25 Pa. Code, Chapter 250, Appendix A, Table 5.

CAC comments reference the approach Evergreen has taken in selecting biodegradation rates for the indicator parameters. CAC specifically focuses on the estimated biodegradation rates calculated using available data and included in Appendix J. The degradation rate constants were estimated by plotting the natural log of the concentration vs. distance along the centerline of a stable plume while accounting for the seepage velocity, retardation, and longitudinal dispersion (Buschek and Alcantar 1995). Multiple evaluations were conducted for each organic indicator parameter. Degradation rates calculated via Buschek and Alcantar methodology were biased high in comparison with published values from in-situ and laboratory studies. The calculated rates also do not agree with multiple lines of evidence that indicate that biodegradation is actively occurring at the facility. Some examples include the observation of conductive biofilms in the subsurface near Belmont Terminal and AOI 1, the observation of biogenic gas pockets in the subsurface near biofilms, elevated methane dissolved in groundwater samples, compound specific isotope

analysis (CSIA) of petroleum hydrocarbons in groundwater samples showing heavy isotopic enrichment, and natural source zone depletion (NSZD) estimates obtained from the passive efflux of carbon dioxide at the facility.

Ultimately, the complex nature of the releases at the site hampers the ability to use model calibration or plume centerline data to estimate degradation rates. A comprehensive approach, citing literature values, site specific data, and plume centerlines was used to evaluate the potential range of degradation rates and degradation rates were further evaluated via sensitivity analysis.

CAC also comments on the use of first order degradation as an approximation for lead attenuation within the aquifer. While Evergreen agrees that first order attenuation of inorganics includes some simplification of the complex geochemical processes that control attenuation of inorganic compounds such as lead, evaluation of lead distribution in the subsurface indicates that dissolved concentrations rapidly decrease with distance from inferred source materials. The use of a degradation rate to approximate the observed distribution is considered appropriate to meet the objective of the model; most notably, to evaluate distribution and identify potential transport pathways.

Comment 5b

Evergreen's approach for the selection of porosity values is flawed.

Response to Comment 5b

Evergreen has selected to use 0.225 for effective porosity as it is representative of the range of sediments defined as unconsolidated including gravel, sand, silt, and clay. Site specific values of effective porosity are commonly estimated from literature values in modeling studies due to the difficulty in measurement in the field. This simplifying assumption is justified given that the flow and transport parameters such as hydraulic conductivity and hydraulic gradient have a greater influence on fate and transport of COCs. It is noted that porosity is not used for mass flux/mass discharge calculations. Mass flux is determined by multiplying the specific discharge (or Darcy velocity) by the area of the discharge and the concentration. Effective porosity is used for calculating seepage velocity (or average linear velocity), which represents the average rate at which the water moves between two points and is not applicable to mass flux or mass discharge calculations.

Comment 5c

Evergreen's approach for the selection of dispersion values is flawed.

Response to Comment 5c

The comment asserts that dispersion should be based upon site-specific plume lengths. The estimation of plume lengths at the site is complicated by multiple co-located releases and commingled plumes. In lieu of site-specific data, Evergreen has chosen to use literature values for the benzene and MTBE plume length. The literature values provide a conservative approach based on hundreds of documented benzene and MTBE plumes.

Similarly, a definitive plume with a singular transect is not applicable for the remaining COCs (naphthalene, lead, and benzo(a)pyrene [BaP]) at the facility. As a result, an approach to conservatively represent the

dispersivity of each of the aforementioned indicator parameters was completed by using an estimate of the possible lengths of the largest plumes observed at the facility to estimate dispersivity. Similar to other parameters, the uncertainty of dispersivity was further evaluated through sensitivity analysis.

Comment 5d

Evergreen's approach for the selection of f_{OC} values is flawed.

Response to Comment 5d

As documented in the F&T RIR, Evergreen has submitted "[p]revious RIRs for the facility AOIs [which] included foc estimates, where available, from geotechnical laboratory testing, and the range of values used in the model generally fits those data" (Section 4.2.2.3, pages 4.32-4.33). As discussed in the F&T report, two values were used for foc and the distribution was changed across the model layers. Evergreen did not deviate from the two zones of foc to retain simplicity within the model and to maintain a conservative approach.

As mentioned above, site-specific foc values support a high foc value in the Holocene-age marsh deposits and the distribution of Holocene chemical properties and dispersivity (zone 1 and zone 2 presented in Figure 4-2) was estimated based on surface soil distribution and boring lithology that has been documented through cross sections in previous reports.

Figure 4-2 is titled *Model Chemical Parameter and Dispersivity Distribution Maps*, in which foc is included as a chemical parameter. The report documents two foc values used, one for the alluvial deposits and fill, and the other for the Holocene-age marsh deposits presented in Figure 4-2.

As with other sensitive parameters, uncertainty in the parameter foc was evaluated through the sensitivity analysis.

Comment 5e

Evergreen does not sufficiently account for source terms.

Response to Comment 5e

The CAC asserts that Evergreen should evaluate releases not historically attributable to Sunoco operations. Releases not attributable to Sunoco are not required, nor are they relevant, to the completion of the RIR.

The CAC provides a description of the outlier analysis and seems to suggest that additional analysis be completed. The outlier analysis completed identified a total of sixteen outliers: eight BaP concentrations out of a total of 692; five benzene concentrations out of a total of 747; two lead concentrations out of a total of 727; and one naphthalene concentration out of a total of 719. Evergreen maintains that the screening methodology was an appropriate and efficient way to screen the data set and does not bias the results.

The CAC further requests that the presence of light non aqueous phase liquid (LNAPL) be used to identify source material. The presence of LNAPL, particularly apparent LNAPL within a monitoring well, is not a reliable indicator of a source of COCs to dissolved groundwater. Sources of COC mass to dissolved phase include LNAPL, COCs present in the unsaturated zone, COCs sorbed to aquifer material, and COCs

available for diffusion from fine-grained sediment. In addition, specific LNAPLs may be present but depleted of COCs. The approach within the model identifies sources based on empirical evidence of persistent dissolved phase COC "hot spots". This approach conservatively identifies areas of continuing source material.

No continuing source for lead was used in the model. Once the lead is attached to aquifer solids or used in the formation of insoluble iron sulfides, it is not mobile, and the risk is greatly reduced. The lack of dissolved phase lead plumes extending from areas of LNAPL indicate that LNAPL is not a good indicator of source of dissolved lead in groundwater.

Comment 6

Evergreen does not sufficiently account for climate resiliency in its modeling.

Response to Comment 6

Evergreen's F&T RIR was completed to document a facility-wide assessment of the fate and transport of petroleum hydrocarbons in groundwater from historic Sunoco releases to the environment in accordance with Act 2 guidance. It is recognized through model predictions that some hydrocarbons have the potential to remain in facility groundwater for years to come, making climate change an important consideration to the efficacy of the model in making accurate predictions. There is general consensus within the scientific community that changing climate will likely include more frequent and extreme weather events, but these are not events that are included in a numerical groundwater model. To meet the primary objectives of the study (future extent of groundwater contamination, identify completed pathways of transport and potential receptors) as they relate to informing facility cleanup under Act 2, sea-level rise scenarios across a range of river conditions were considered to have the most certainty and possibly greatest effect on groundwater contaminant transport, as the Schuylkill River surface water is a primary pathway identified. An emergent water-table condition is also plausible and was presented for consideration. Evergreen considers the included climate resiliency assessment to be sufficient for an Act 2 fate and transport analysis.

RESPONSE TO BRICKHOUSE COMMENTS

Brickhouse Comment 1

The Fate & Transport Report is inadequate because it does not address all site contaminants. The Fate & Transport Report does not evaluate the fate and transport of PFAS even though Evergreen has reported the presence of PFAS in both the shallow aquifer and lower aquifer. Evergreen has reported PFOA at 2,800 ppt, PFNA at 3,100 ppt, and PFOS at 3,300 ppt in well B-173 in the shallow aquifer, and PFOA at 580 ppt in S-110DSRTF, PFNA at 370 ppt in A-19D, and PFOS at 280 ppt in S-389D in the lower aquifer. These levels are several orders of magnitude above current and proposed cleanup standards and EPA's Health Advisory Levels. PFAS will behave very differently in the environment than the five "Indicator Parameters" associated with petroleum hydrocarbon contamination that were evaluated by the Evergreen fate and transport model (benzene, MTBE, Benzo(a)pyrene, naphthalene, and lead). The stated primary objective of the Fate & Transport Report is to complete the remedial investigation process under Act 2 for remediation liability of historic groundwater contamination at the facility. This objective has not been achieved since a significant source of historic groundwater contamination, PFAS contamination, has not been evaluated. Evergreen should be required to update the Fate & Transport Report to evaluate the fate and transport of PFAS, in particular, to evaluate if PFAS contamination in the lower aquifer has migrated to

New Jersey and may be impacting public water supply wells in New Jersey, and to evaluate if PFAS in the shallow aquifer may be impacting surface waters and ecological receptors.

Response to Brickhouse Comment 1

The F&T RIR was completed to make predications as to the fate of petroleum-related hydrocarbon compounds regulated in groundwater that Evergreen is seeking release of liability for under Act 2. The COCs are listed in Part 2, Table 1-1 of the F&T RIR and do not include per- and polyfluoroalkyl substances (PFAS). Evergreen is aware of potential regulatory changes regarding PFAS in Pennsylvania groundwater and has conducted preliminary sampling at the facility.

Brickhouse Comment 2

The Fate & Transport Report is inadequate because it does not address the documented flow of groundwater in the lower aquifer from the PES Site under the Delaware River to New Jersey. It is well documented that the lower aquifer beneath the PES Site, the Potomac- Raritan-Magothy aquifer system ("PRM"), flows from PES beneath the Delaware River into Gloucester and Camden Counties in New Jersey as described in a report prepared by the U.S. Geologic Survey ("USGS") in cooperation with U.S. EPA. At the time of the USGS report, the PRM was an important sole-source ground-water supply in Camden and Gloucester Counties of New Jersey and was designated as a sole-source aquifer by the U.S. EPA because there were few or no alternative drinking water sources in the area. Evergreen should be required to update the Fate & Transport Report to evaluate the current and previous fate and transport of PFAS in the lower aquifer to New Jersey.

Response to Brickhouse Comment 2

Evergreen interprets this comment to be specifically about potential PFAS contamination from facility sources to the lower aquifer and pathways of groundwater flow that connect PRM recharge areas in Pennsylvania to drinking water sources in New Jersey. Evergreen recognizes this potential pathway exists, and it is one of the reasons that a regional USGS groundwater flow model was used as the basis of the assessment. As documented in the RIR, none of the petroleum hydrocarbon-related COCs are predicted to migrate a significant distance away from the degrading historic releases of petroleum in either of the recognized water-bearing units. If Evergreen adds PFAS compounds to the COC list seeking liability relief for those compounds in the future, then those compounds would have to be fully characterized, modeled, and the F&T RIR updated to present the results under Act 2 and One Cleanup for the facility.

Brickhouse Comment 3

The Fate & Transport Report is inadequate because it does not address all relevant time periods and conditions for the release of Site contaminants. The Groundwater Flow Model and Fate & Transport Model prepared by Evergreen provides predictive estimates of the future transport direction based on select contaminant concentration data from 2014 –2022, and groundwater withdrawal data provided in 2012 and 2013 to generate predictive flow simulations and contaminant migration for the next 30 years. The models and the conclusions from the models focus primarily on conditions from the past 10 years and are not representative of fate and transport conditions for contaminants present during the 1970s, 1980s, and early 1990s, when groundwater pumping influences near and around the PES Site were significantly greater and pumping from New Jersey was at its peak. In addition, during the period studied by Evergreen, the Site was operating groundwater extraction and treatment systems that provided some level of hydraulic control. During the 1970s, 1980s and early 1990s, there was no hydraulic control at the site to mitigate the flow of

contaminated groundwater towards New Jersey. Evergreen should be required to update the Fate & Transport Report to evaluate the fate and transport of contaminants released in the 1970s, 1980s and 1990s, particularly PFAS, when the level of pumping in New Jersey was much higher.

Response to Brickhouse Comment 3

Evergreen recognizes that the former refinery has a long operational history and has documented an understanding of the nature and extent of contamination related to past releases. Multiple lines of evidence are presented to support this, and an extensive effort to characterize the sources in complex, offsite areas was included. Most petroleum hydrocarbon contamination in the lower aquifer is postulated to have migrated to that zone under past conditions of regional pumping that were enhancing downward vertical gradients. However, Evergreen's opinion is that the fate and transport of characterized, historic groundwater plumes that were once influenced by past pumping can be adequately predicted by current, steady-state conditions.

RESPONSE TO REPEATED COMMENTS

Comments

I am writing as a nearby resident of the subject site to ask you to PLEASE disapprove Evergreen Resources Group, LLC's latest Act 2 submission to the Pennsylvania Department of Environmental Protection (DEP), the sitewide fate and transport remedial investigation report (RIR).

Pennsylvania's Act 2 of 1995 defines the "fate and transport" as describing the "the degradation of a chemical over time and where chemicals are likely to move given their physical and other properties and the environmental medium they are moving through." The most obvious concern regarding Evergreen's current RIR submission is the absence of a discussion of the effects of increased precipitation events caused by climate change and the related increased flooding caused by the combination of increased sea level rise with more frequent and severe storms that result in increased precipitation and flooding. Evergreen's report accounted for the effects of sea level rise on the tidal Schuylkill River, but did not mention the contribution of increased precipitation and more frequent storms resulting from climate change.

To compound this problem, the site's current owners, Hilco Redevelopment Partners are proposing to pave the vast majority of the 1,400 acre site, which would significantly increase the risk of flooding at this site which already contains large portions of heavily contaminated areas in the 100 and 500-year floodplains. Hilco is also proposing to raise the site out of these floodplains, which will increase flooding in the tidal Schuylkill River and the surrounding community, potentially dispersing dangerous pollutants like the known carcinogen benzene and lead, which is known to reduce brain function and damage other organs like kidneys. In its consideration of climate change, Evergreen mistakenly concludes that, "because the groundwater gradient is not anticipated to change substantively, groundwater fluxes of contaminants are similarly assumed to remain consistent over time in the absence of substantial anthropogenic changes to the system." The entire intention of incorporating climate change-related projections into this RIR is to anticipate changes in groundwater movement, particularly in the context of planned development. Evergreen should not assume "the absence of substantial anthropogenic changes to the system" given the current and future impacts of human-made climate change to the City and the network of public sewer lines under the site, which are already damaged.

While the combination of sea level rise, increased precipitation events and large increases in impervious surface could itself contribute to changes in the groundwater gradient, this change could be further

exacerbated by the several leaking sewers at the site, known to be pathways of groundwater contamination. Evergreen repeatedly mentions the several public sewer lines under the site that are known to leak and Evergreen projects that the leaking sewers will affect groundwater movement at the site. Evergreen also states several times that the sewers act as pathways to transport pollutants at the site, specifically benzene. These sewers connect the surrounding community to the Schuylkill River and could potentially flood during a storm event, dispersing pollutants to the surrounding community. Evergreen also describes that groundwater movement converges around the Shunk, Maiden Lane, 26th Street and Pollock Street/Packer Avenue Sewers, all of which are known to leak and transport groundwater pollution around the site. The combination of converging groundwater around leaking sewers at heavily contaminated areas of the site could result in a pollution incident if the sewer system overflows. The 26th Street and Pollock Street/Packer Avenue Sewers are known to transmit pollutants offsite and the Shunk Street sewer system exists at a convergence of groundwater and elevated benzene levels. In Evergreen's own words, "the most significant groundwater benzene impacts in the water table are in the northeast corner of Belmont Terminal generally on the north side of the Shunk Street sewer."

DEP should require Evergreen to model sewer overflows during large and frequent precipitation events with consideration of sea level rise and increased impervious surface at and around the site. These precipitation events could affect the groundwater gradient at the site and should be modeled as a part of this RIR. It is also premature to make assumptions about the condition of the several public sewers that run under the site before it is redeveloped by Hilco. The proposed redevelopment, cleanup, and any proposed stormwater management efforts may further damage the sewer system at the site.

An additional concern is the public water infrastructure on the West side of the Schuylkill River that is intended to prevent Area of Interest (AOI) 9 from flooding - the Mingo Basin. Another concern is Evergreen's complete disregard of the impacts that future development at the site will have on the migration of contaminated groundwater. Evergreen both assumes that the Philadelphia Water Department (PWD) will continue to operate the Mingo Basin water pump for the next 30 years while assuming that there will be no use changes at AOI 9, the Schuylkill River Tank Farm (SRTF). Hilco, the current owner of the SRTF has not stated a future use of the property. However, the Schuylkill River Development Corporation (SRDC) just announced a $2.5 million grant from Pennsylvania's Redevelopment Assistance Capital Program for a river trail that would eventually cross the riverside border of AOI 9. This new waterline construction project within the footprint of AOI 9 could affect pollution exposures and groundwater movement at the site.

Evergreen has not assessed the sturdiness of the shoreline and mistakenly claims that "along the facility, much of the Schuylkill River shoreline has been hardened with sheet pilings and bulkheads to stabilize the channel, provide shipping access, and mitigate the potential for erosion and flooding." Evergreen has clearly not confirmed the integrity of these materials along the shoreline.

Evergreen also continues to provide vague estimates of the water pumping done at the Mingo Basin. Evergreen's current assessment of water pumping at this facility, "approximately 1 to 3 MGD", is simply too broad. This figure in conjunction with Evergreen's lack of assessment of the impact of impervious surface and precipitation events in its climate change projections could lead to a misestimation of the movement of groundwater at the site.

In the RIR for AOI 9, in reference to "perched" groundwater at the site caused by fill material, Evergreen stated: "Although localized perching is common to AOI 9 due to the environmental setting, most of these areas are not extensive and are not considered mappable." DEP should require Evergreen to map these

sites in order to fulfill the objective of the current RIR: “to make predictions regarding the future of contaminants from historic Sunoco operations.”

Given the lack of lead testing along the shoreline and the vague estimations of groundwater pumping at the site, Evergreen’s “Simulated Lead Distribution Over 30 Years” for the water table at AOI 9 (Figure 4.23e) is unacceptable and should be disapproved by DEP. Evergreen claims that the lead plume at the site will be completely pumped into the Schuylkill River within 10 years. This argument is misplaced because discharging lead into the river will add lead to the sediments along the river, which has already been shown to have elevated concentrations of lead.

Response to Repeated Comments

Evergreen appreciates the level of public concern regarding climate resiliency and how future predicted climate conditions may affect the fate and transport of groundwater contaminants released to the environment from Sunoco’s historic operations at the facility. Of the anticipated changes predicted from circulation models in the context of groundwater flow, perhaps the most reliable and consistent are the projections for sea-level rise. As discussed in the F&T RIR, groundwater levels are expected to rise and keep pace with rising sea level so that the groundwater gradient and flux of groundwater remains consistent over time, particularly near the tidal Schuylkill River. The most plausible outcome of this gradual change is an emergent water table at the facility.

Evergreen’s groundwater model is calibrated to reproduce observed, current conditions at and near the facility. A sensitivity analysis is documented in the RIR that indicates the groundwater flow system is most sensitive to changes in the hydraulic properties of the subsurface deposits and recharge. It is noted that the issue of compound flooding mentioned in this and other comments is generally outside the scope of an Act 2 groundwater modeling assessment. Evergreen plans to continue monitoring the facility conditions into the future, and the groundwater flow and transport models may be used as tools to evaluate the possible outcomes of any observed changes.

Regarding the fate of lead and perched water in AOI 9, Evergreen offers the following response. Through the course of the facility characterization, hydrostratigraphic units were defined in regional context to meet the objectives of assessing contaminant fate and transport in a saturated flow model. The referenced areas are present above the water table and the pathway for contaminant transport is through percolation and eventual introduction to the water table. In Evergreen’s opinion it would be unreasonable to attempt to characterize every small area of perching at the facility, particularly in areas of urban fill, where contaminant fate and transport is more reasonably characterized by migration through underlying, mapped hydrostratigraphic units. Although lead concentrations dissolved in groundwater are predicted to decrease over time to a level below the current regulatory standard used in the RIR, the implication is not that the lead is pumped into the Schuylkill River. Most of the lead is predicted to attenuate through the formation of insoluble lead sulfides in soil while the historic sources are depleted further until there is no lead remaining.

Reference: **Response to Public Comments Sitewide Remedial Investigation Report Addendum, Former Philadelphia Refinery**

Regards,

Stantec Constulting Services Inc

Joel RK Thompson, P.G.
Senior Hydrogeologist

Andrew Klingbeil, P.G.
Associate Geologist

Enclosures: Attachment A – Public Comments

c. Tiffani Doerr (Evergreen)
Scott Cullinan (Evergreen)
Kevin Bilash (USEPA)
India McGhee (City of Philadelphia)
Jennifer Menges (Stantec)

ATTACHMENT A

Public Comments

CLEAN AIR COUNCIL

Pennsylvania Department of Environmental Protection

Evergreen Resources Management Operations
a series of Evergreen Resources Group, LLC
On behalf of Sunoco, Inc. (R&M), now known as Sunoco (R&M), LLC

Former Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, Pennsylvania
Sitewide PADEP Facility ID No. 780190

Sitewide Fate and Transport Remedial Investigation Report
Report Date: June 30, 2022

Prepared by:
Stantec Consulting Services Inc.

Written Comments by Clean Air Council

July 30, 2022

Via email: phillyrefinerycleanup@ghd.com

Clean Air Council ("the Council") appreciates the opportunity to provide comments on Evergreen Resources Management Operations' ("Evergreen's") Sitewide Fate and Transport Remedial Investigation Report at the former Philadelphia refinery. The report was prepared by Stantec Consulting Services Inc. for Evergreen on behalf of Sunoco, Inc. (R&M), now known as Sunoco (R&M), LLC ("Sunoco"). Sunoco is the party legally responsible for contamination prior to its sale of the property in 2012.

While the report was prepared by Stantec Consulting Services Inc. as a contractor or agent for Evergreen, for the sake of clarity the Council will simply refer to Evergreen rather than to Stantec throughout these comments, consistent with previous submissions.

The Council is a non-profit environmental organization headquartered at 135 South 19th Street, Suite 300, Philadelphia, Pennsylvania, 19103. For 50 years, the Council has worked to improve air quality across Pennsylvania. The Council has members throughout the Commonwealth who support its mission of protecting and defending everyone's right to a healthy environment.

Evergreen submitted the report to the Pennsylvania Department of Environmental Protection ("the Department") under Act 2 of 1995. *See* Evergreen, Act 2 Documents. The report was submitted pursuant to the Consent Order and Agreement (2003) and the Consent

Order and Agreement (2012). The report is being submitted pursuant to a revised Consent Order. *See* First Amendment to Consent Order and Agreement (June 26, 2020), page 5 of 77 (setting deadline of report by December 31, 2021).

Evergreen states that it will address comments submitted by July 30, 2022:

> June 22, 2022
> Page 2 of 2
>
> https://phillyrefinerycleanup.info/comment-submission-form, via email at phillyrefinerycleanup@ghd.com, or via US Postal Service to PO Box 7275, Wilmington, DE 19803. Evergreen will address all comments and questions related the Fate and Transport RIR and the ERA submitted between June 30, 2022 and July 30, 2022 in correspondence to PADEP/EPA that will be incorporated into the agencies' review as they will not consider the reports final until any comments/questions have been addressed.

See Letter dated June 22, 2022, page 2, Ecological Risk Assessment_Public Notices_June2022.

All documents cited in these comments are hyperlinked or attached. The yellow or orange highlighting in the quoted and snipped passages was added to direct attention to relevant text.

Index to Comments

1. Evergreen has not eliminated potential pathways of exposure, as a substitute for a risk assessment.

2. Evergreen has failed to characterize potential contaminant transport pathways from AOI-8 to the Schuylkill River and the lower aquifer.

    a. Evergreen fails to support parameterization of the Horizontal Flow Barrier (HFB) package adjacent to the Schuylkill River.

    b. Evergreen fails to support parameterization of the aquifer in the southeast portion of AOI-8.

3. Evergreen has failed to substantiate its predictions regarding the migration of contaminated groundwater past the sheet pile wall and bulkheads.

4. Evergreen presents inconsistent results regarding sewer discharge and contaminant flux into the Schuylkill River.

5. Evergreen makes a number of flawed or unsubstantiated assumptions in the operation of the model.

    a. Evergreen's approach for selection of biodegradation rates is flawed.

    b. Evergreen's approach for the selection of porosity values is flawed.

    c. Evergreen's approach for the selection of dispersion values is flawed.

    d. Evergreen's approach for the selection of f_{OC} values is flawed.

    e. Evergreen does not sufficiently account for source terms.

6. Evergreen does not sufficiently account for climate resiliency in its modeling.

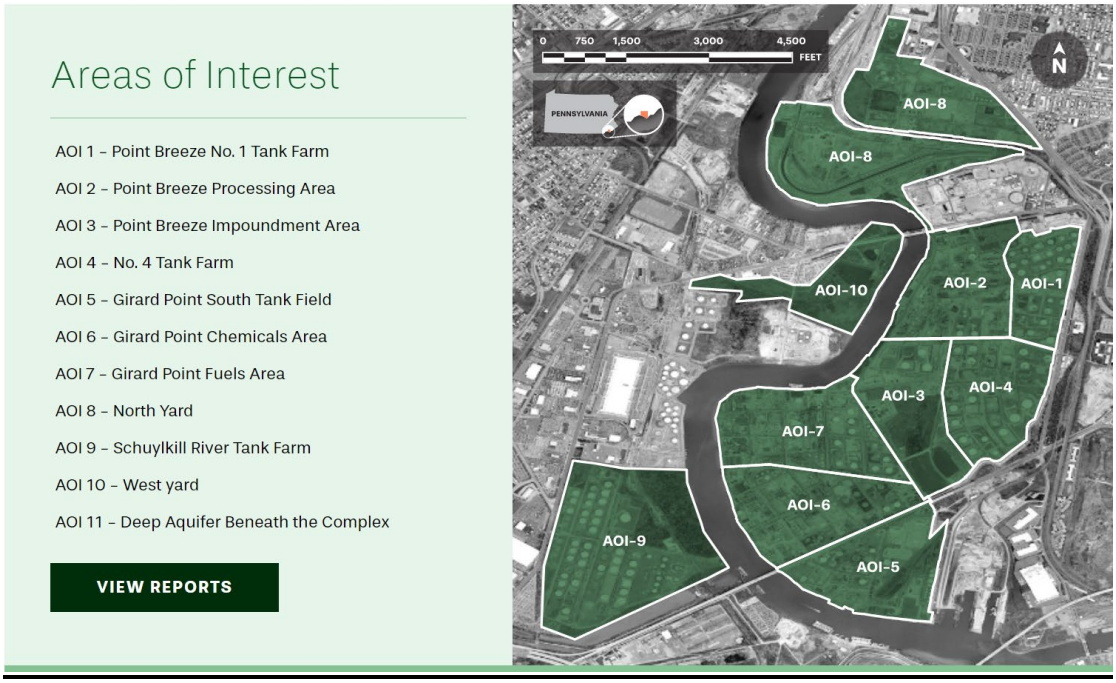
Table of Attachments

Attachment 1	Clean Air Council Comments dated January 14, 2021

Table of Relevant Reports

Area of Interest	Title	Date
AOI-8 North Yard	2012 Report (part 1) 2012 Report (part 2) 2017 Report (part 1) 2017 Report (part 2)	January 31, 2012 December 21, 2017
Sitewide	2022 Fate and Transport Remedial Investigation Report Part 1 (groundwater flow model) Part 2, Section I (Contaminant Fate and Transport Assessment) Part 2, Section II (Contaminant Fate and Transport Assessment) Part 2, Section III (Contaminant Fate and Transport Assessment)	June 30, 2022
AOI-1 through AOI-9	Ecological Risk Assessment (AOI-1 through AOI-9)	June 30, 2022

Areas of Interest



Source: Evergreen, [Home - PRLR]

Summary of Comments

The Council is providing comments on the Sitewide Fate and Transport Remedial Investigation Report at the former Philadelphia refinery. Because the report is flawed in a number of ways, the Department should disapprove it.

If one of the purposes of this report is to establish that neither present nor future exposure pathways exist, this has not been established. The current report is not sufficient for avoiding a risk assessment in the future.

Evergreen has failed to characterize potential contaminant transport pathways from AOI-8 to the Schuylkill River and the lower aquifer. This involves a failure to support parameterization of the Horizontal Flow Barrier (HFB) package adjacent to the Schuylkill River and the aquifer in the southeast portion of AOI-8.

Evergreen has failed to substantiate its predictions regarding the migration of contaminated groundwater past the sheet pile wall and bulkheads. In its comments in January 2021, the Council called attention to Evergreen's failure to offer meaningful information relating to the integrity of these engineering structures. Evergreen still has not done so. Because those structures are the last line of defense against the migration of contaminated groundwater to the river, this goes to the heart of the fate and transport analysis that Evergreen is supposed to be preparing.

Evergreen presents inconsistent results regarding sewer discharge and contaminant flux into the Schuylkill River.

Evergreen makes a number of flawed or unsubstantiated assumptions in the operation of the model. It has adopted a flawed approach in its selection of biodegradation rates, porosity values, dispersion values, and f_{OC} values. In addition Evergreen does not sufficiently account for source terms, attempting to overlook contamination that it asserts is not the responsibility of Sunoco. This is not appropriate. Sunoco may negotiate its liability in the future, but it may not weaken the model by not providing a complete picture of the contamination on site.

Finally, Evergreen does not sufficiently account for climate resiliency in its modeling. Increased and more intense storm events are things that can be modeled, but there is no indication that Evergreen has done this in its report.

Comments

1. **Evergreen has not eliminated potential pathways of exposure, as a substitute for a risk assessment.**

One of the purposes of this report is to aid in demonstrating attainment of a site-specific standard, based on a showing that unacceptable risks are not posed to human and ecological receptors, if any complete pathways are identified:

> **1.2 GROUNDWATER FLOW MODEL OBJECTIVES**
>
> The primary objective of the modeling activities is to aid in demonstration of attainment of the Act 2 site-specific standard for remediation liability of historic groundwater contamination at the facility on behalf of Evergreen. Attainment of this standard is predicated on the ability to demonstrate that the extent of contamination attributable to Sunoco has been delineated, contaminant transport pathways unique to the facility have been reasonably characterized, and that unacceptable risks are not posed to human and ecological receptors, if any completed pathways are identified. In accordance with Act 2 guidance, a fate and transport analysis is a required component of an RIR for this purpose. As such, Part 1 of the assessment documented herein describes development of a GWF model that utilizes over 30 years of facility data and, where available, offsite characterization data to meet the initial objective of simulating groundwater flow beneath the facility area. In Part 2 of the RIR, the GWF Model will be coupled with a transport model to complete the fate and transport assessment through predictive simulations.

See Fate and Transport report, Part 1 (groundwater flow model), page 1.3 (emphasis added). Hypothetically, the elimination of pathways could obviate the need for a risk assessment for a responsible party under Act 2. *See* 25 Pa. Code 250.405(b) ("The risk assessment report is not required if a fate and transport analysis which takes into account the effects of engineering and institutional controls demonstrates that neither present nor future exposure pathways exist."). If Evergreen intends this report as proof that it has eliminated pathways, it is incorrect.

To be fair, it does not appear that Evergreen is explicitly arguing that it has eliminated potential pathways of exposure. Nominally, it merely asserts it has delineated existing contamination:

> In addition, specific to the goals of the fate and transport assessment in completing the remedial investigation process under the Act 2 SSS for for pre-existing contamination, the following objectives have been met:
>
> - The extent of contamination (the sources) attributable to Sunoco has been delineated
> - Contaminant transport pathways unique to the facility have been sufficiently characterized
> - Sufficient data has been generated to assess risks to human and ecological receptors

See Fate and Transport report, Part 2, Section I (Contaminant Fate and Transport Assessment), page 8.47 (emphasis added). However, it gives the impression that it has established an incomplete pathway with respect to AOI- 4, when it asserts it has not identified direct pathways from the water table to the lower aquifer:

> - The three lower aquifer wells encountered the PRM middle clay unit aquitard based on lithologic character, depositional sequence, and relative elevation. The middle clay generally thickened to the east. Consistent with previous findings, no direct pathways from the petroleum sources in the water table to the lower aquifer were identified.

See page 3.24 (emphasis added). The implication is not supported by the facts.

In fact, Evergreen admits that some of the contamination in the lower aquifer is attributable to Evergreen (that is, the responsible party Sunoco):

> Based on the data, 113 water-table DSCP wells were not included in the initial concentration source for Evergreen's groundwater transport model. These wells are located generally east of the Conrail property on the former DSCP and Passyunk Homes properties. Nine offsite DSCP and Passyunk Homes wells interpreted to be screened in the lower zone of the water table in the PRM upper sand unit were also removed. None of the lower aquifer wells were removed as there is stable isotope evidence supporting that both Evergreen and DSCP sources mix in this deeper zone. Initial concentrations in the transport modeling for benzene, MTBE, naphthalene, BaP, and lead are presented in **Figures 4-3** through **4-7**, respectively.

See Fate and Transport report, Part 2, Section I (Contaminant Fate and Transport Assessment), page 4.34 (emphasis added).

Moreover, there is other evidence to demonstrate the existence of pathways of contamination from the water table to the deep aquifer:

1. Vertical pressure gradients have been identified throughout the property (*See* Attachment 1 – Clean Air Council Comments dated January 14, 2021, Comment 7(D), pages 61-66):

Area of Interest	**Title**	**Evergreen's References to Downward Gradients**
AOI-2 Point Breeze Processing Area	2017 Report	Section 2.2.3, page 15 ("The observed head differences correspond to downward vertical hydraulic gradients ranging between 0.015 ft/ft to 0.051 ft/ft."
AOI 3 Point Breeze Impoundment Area	2017 Report	Appendix I, page I-5 ("The observed head differences correspond to downward vertical hydraulic gradients ranging between 0.005 to 0.05 feet/feet (ft/ft).")

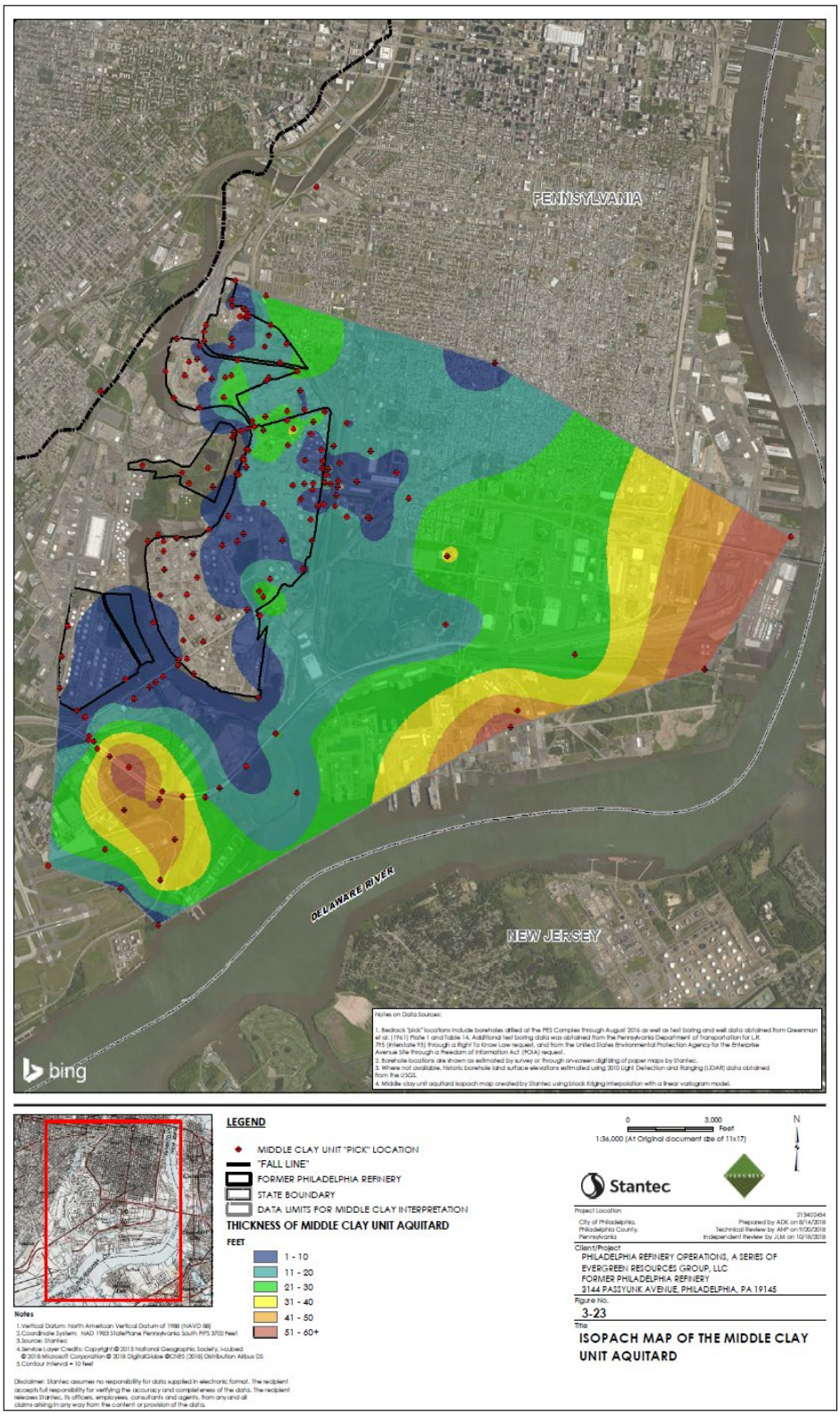
AOI-4 No. 4 Tank Farm	2017 Report	Section 10.2, page 10.59 ("Across most of the study area (including all well pairs in AOI 4), the hydraulic head potential between observed aquifers was positive (downward) in May 2016 (Figure 5-8)."
AOI-5 Girard Point South Tank Field	2011 Report/Cleanup Plan 2017 Report	Section 2.3.2, page 11 ("Groundwater elevations in A-13D, A-19D, and A-21D were lower than elevations observed in nearby shallow wells indicating a downward vertical gradient exists between the shallow and the deep monitoring wells.") Section 2.2.3, page 15 ("The observed head differences correspond to downward vertical hydraulic gradients of 0.082 and 0.16 ft/ft at the A-13 and A-21 monitoring well pairs, respectively.")
AOI-6 Girard Point Chemicals Area	2017 Report	Section 5.2.3, page 28 ("There is a downward gradient between the unconfined and lower aquifers. These gradients are consistent with previous data collected in AOI 6 (2013 RIR).")

AOI-7 Girard Point Fuels Area	2012 Report 2013 Addendum to Report 2017 Report	Section 2.3.2, page 13 ("Groundwater elevations in the deep zone are lower than the shallow/intermediate zone, exhibiting a downward vertical hydraulic gradient.") Section 9.2.3, page 37 ("There is a downward gradient between the unconfined and lower aquifers. These gradients are consistent with previous data collected in AOI 7 (2010 RIR and 2012 RIR).") Section 5.2, page 30 ("It is also noted that hydraulic head potentials between the unconfined and lower aquifers are downward across AOI 7.")
AOI-8 North Yard	2012 Report 2017 Report	Section 8.0 Site Conceptual Model, page 46 ("A downward vertical flow gradient exists between the shallow and deep zone as indicated by the groundwater elevations in the following monitoring well pairs: N-3/N-4, N-12/N-13, N-8/N-9, N-18/N-19, N-20/N-21, N-29/N-30, N-38/N-38D, N-43/N-44D, N-47/N-46D and N-51/N-50D. This is consistent with vertical gradients elsewhere in the refinery." Section 5.4.1, page 5.44 ("The positive potentials in AOI 8 ranged from approximately 3 feet to 11 feet. Near-equal hydraulic heads are assumed to be present in the lower aquifer subcrop area, as exemplified by wells N-137 and N-4; however, separation of geologic units in the area is difficult using existing lithologic logs.")

AOI-9 Schuylkill River Tank Farm	2015 Report 2017 Report Addendum	Section 2.2.3, page 14 ("As defined above, the deep aquifer is the Lower Sand which is a semi-confined to confined aquifer except where the clay aquitard is absent. Groundwater flow in the deep aquifer in the area where the Lower/Middle clay is absent is divergent due to gradual downward vertical groundwater migration through this area from the shallow aquifer. Following recharge from the shallow aquifer groundwater generally flows towards the southwest in the direction of regional flow patterns.") Appendix I, page I-5 ("The head differences measured in October 2016 between paired monitoring wells in the unconfined and lower aquifer (S-74D2SRTF/S-7D1SRTF, S-118SRTF/S-118DSRTF S-137SRTF/S- 138SRTF, and S-142SRTF/S-143SRTF) ranged between zero (S-118SRTF/S-118DSRTF) to 4.28 (S-74D2SRTF/S-74D1SRTF). The observed head differences correspond to a downward vertical hydraulic gradient of 0.067 feet per feet (ft/ft) near the potentiometric high point of the unconfined aquifer (S-74D2SRTF/S-74D1SRTF) and transition to an upward vertical hydraulic gradient of 0.016 ft/ft (S-142SRTF/S-143SRTF) near Mingo Creek basin. The upward vertical hydraulic gradients observed are most likely attributable to the artificial lowering of the unconfined aquifer potentiometric surface due to the pumping in Mingo Creek basin.")
AOI-10 West Yard	2011 Report	Section 7.2, page 25 ("The vertical hydraulic gradient between the shallow and intermediate (Trenton Gravel) zones is downward at an average of 0.325 ft/ft"), but not addressing the gradient with respect to the deep aquifer)

AOI-11 Deep Aquifer Beneath Complex	2011 Report	Section 7.2, page 28 ("Downward vertical gradients exist between the shallow/intermediate and deep monitoring wells throughout the refinery with the exception of AOI 9 where deep groundwater flows vertically upward at the edges of the semi-confining clay.")
	2013 Report	Section 8.2, page 25 ("Downward vertical gradients exist between the shallow/intermediate and deep monitoring wells throughout the facility with the exception of AOI 9 where deep groundwater flows vertically upward at the edges of the semi-confining clay.")

2. Large areas have been identified where the middle clay (identified by Evergreen to be the significant confining unit separating the water table aquifer and the lower aquifer at the site) is absent:



See Fate and Transport report, Part 1 (groundwater flow model), Figure 3-23 – Isopach Map of the Middle Clay Unit Aquitard (PDF 88 of 1431). From the Figure, it appears that the thickness

of the middle clay unit aquitard is less than 1 foot (if not absent) in wide areas to the north (AOI-8), west of the Schuylkill River (AOI-10), and to the south (AOI-5, AOI-6, and AOI-7).

3. Evergreen states that where the middle clay is absent, there is greater potential for direct pathways between the water table aquifer and deep aquifer:

Evergreen recognizes that vertical pressure gradients are important for identifying and quantifying pathways from the water table aquifer to the deep aquifer:

> The middle clay unit, in places resting directly on and combining with the lower clay unit, acts as a mappable and significant aquitard at the facility. In a regional context, it creates hydraulic separation between the water-table aquifer and deeper, semi-confined aquifer of the middle and/or lower sand units (**Section 3.2.3**). However, where it appears to be thin and sandy, notably in the southeastern area of AOI 1, there may be more potential for vertical exchange between groundwater of the deeper aquifer and water-table aquifer, the direction and magnitude of which would depend upon the vertical hydraulic gradients at the time. The middle clay unit is discussed in more detail in **Section 3.2.3**.

See Fate and Transport report, Part 1 (groundwater flow model), page 3.17 (PDF 24 of 1431) (emphasis added). However, Evergreen presents no analysis of empirical vertical hydraulic gradients in the context of the model.

Evergreen should present an analysis of vertical pressure gradients in areas where the middle clay is suspected to be thin or absent in comparison to areas where the middle clay is expected to be thick. In addition, Evergreen should attempt to quantify the flux of contaminants into the lower aquifer, with the model.

2. **Evergreen has failed to characterize potential contaminant transport pathways from AOI-8 to the Schuylkill River and the lower aquifer.**

A. Evergreen fails to support parameterization of the Horizontal Flow Barrier (HFB) package adjacent to the Schuylkill River.

In the area of AOI-8, a Horizontal Flow Barrier (HFB) was modeled along almost the entire boundary with the Schuylkill River, with the exception of two small areas to the far south of AOI-8, just north of the Passyunk Avenue Bridge. Evergreen mentions that a document review and site walk was performed to map the bulkheads along the Schuylkill River. *See* Fate and Transport report, Part 1 (groundwater flow model), page 3.26 (PDF 33 of 1431). As mentioned by Evergreen, no information is presented regarding the depth of the bulkheads.

Additionally, Appendix C (PDF 1318-1420 of 1431) only discusses a small bulkhead within AOI-8, the Upriver Low Deck Wharf. *See id.*, PDF page 1319 of 1431 (Appendix C, page Upriver Low Deck Wharf - 1). The Upriver Low Deck Wharf is only approximately 430 ft. long, while the length of the modeled HFB is approximately 5,000 feet long in AOI-8.

The conceptual support for the HFB seems to be groundwater mounding identified in AOI-8: "*Groundwater mounding is apparent within the filled Rambo Creek valley and former floodplain of the Schuylkill River, suggesting that the river bulkhead is limiting groundwater to surface water discharges from this aquifer near the mouth of the former creek.*" *See* 2017 Report (AOI-8) (2017) (part 1), page 5.41.

However, earlier in the 2017 AOI-8 report, Evergreen states that the cause of the mounding is unknown: "*Groundwater mounding may in places be the result of leaking infrastructure (such as fire suppression lines or sewers) that creates localized anomalies, defined by only one well in areas of less complete data coverage.*" *See id.,* page 5.40.

Evergreen provides no support for modeled depth of the HFB in AOI-8. Based on Figures 6-2A through 6-2D (PDF 125-128 of 1431), the HFB appears to extend into Layer 7 for a portion of AOI-8. This suggests that the lower aquifer is separated from the river for much of AOI-8. In 2017, Evergreen provided data which contradicts this, indicating that the wells in the lower aquifer in AOI-8 have a strong tidal response:

> To evaluate the presence or absence of a river tide signal in the lower aquifer beneath AOI 8, Stantec collected water-level data from wells N-148D and N-149D. The well data has been plotted with synoptic data from additional lower aquifer wells at the PES Complex and the USGS river gauge data to compare the timing and amplitude of the signals (**Figure 5-10**). The data plot demonstrates that a semidiurnal tide signal is present and that the lower aquifer near both AOI 8 wells N-148D and N-149D fluctuated by up to approximately 1 foot in response to river tides. Comparatively AOI 1 wells (S-42I and S-264D) and AOI 4 well S-218D near 26th Street exhibited an approximately 0.1 to 0.2-foot tidal response. The timing of tidal cycles during the monitoring period was nearly synchronous at well N-149D (located approximately 50 feet from the river), whereas there was a lag of approximately 15 to 45 minutes between the arrival of high tide at the gauge and at the location of well N-148D (approximately 1,500 feet from the river). The close timing of the tides in the AOI 8 wells supports that the signal is in response to water-level changes in the Schuylkill River and not the tidal Delaware River to the south (or earth tides).

See 2017 Report (AOI-8) (2017) (part 1), page 5.45 (emphasis added).

Additionally, water table elevation maps generated by empirical observations (Figures 3-25 through 3-29 in Part 1 of the Groundwater Flow Model report, PDF pages 90-94 of 1431) indicate that the water table configuration reflects the historic Rambo Creek, suggesting a potential pathway from AOI-8 to the Schuylkill River. Evergreen identifies that groundwater convergence occurs in this area:

> - Groundwater flow directions follow a pattern that generally mirrors the historical topography shown on **Figure 3-1**. This pattern includes an east-west trending groundwater divide beneath the PGW Passyunk Facility, additional groundwater divides in northcentral AOI 8 and in AOIs 2 and 3 along the Schuylkill River cut bank, and groundwater convergence along buried stream valleys, such as former Rambo Creek, where parts of the features are indicated to have been gaining streams based on the recent hydraulic data presented.

See Fate and Transport report, Part 1 (groundwater flow model), page 3.22 (emphasis added).

It is highly likely that this configuration of the water table indicates the existence of groundwater pathways along the historic stream valley into the Schuylkill River. In fact, Evergreen uses groundwater convergence as an indication of pathways to surface water in reference to the Case Wharf Area high-resolution site characterization (HRSC):

> A former facility wharf located on the Schuylkill River, called Case Wharf, encompasses a cut bank section of AOI 2 where petroleum hydrocarbon sheens have been periodically observed. It is also an area along the river bank where groundwater convergence persists in the water table, supporting that seepage to surface water occurs. Recent site activities have been conducted in the Case Wharf project area with the primary objectives of characterizing petroleum hydrocarbon source(s) to river sheens, refining understanding of groundwater flow patterns, and enhancing knowledge of petroleum hydrocarbons dissolved in groundwater to support fate and transport pathways to the river and the development of future remedial strategies.

See Fate and Transport report, Part 2, Section I (Contaminant Fate and Transport Assessment), page 3.22 (emphasis added).

B. Evergreen fails to support parameterization of the aquifer in the southeast portion of AOI-8.

Evergreen identifies an area in the southeastern portion of AOI-8 which has no significant confining layer between the unconfined and lower aquifers.

> and white clay with very little sand (Greenman et al., 1961). Near the facility, others have found the middle clay to be nearly continuous in the subsurface (IST, 1998). Based on boring log review and stratigraphic correlation, Stantec would generally agree with these previous findings and has mapped the middle clay unit of the PRM to be the prevailing clay unit at the facility. However as previously discussed in Stantec (2016), Stantec (2017a,b), and Stantec (2021a,b), the interpreted middle clay unit is absent in areas along the perimeter of the Schuylkill River, including portions of AOIs 5, 6, 7, 8, and 9 where recent alluvial deposits are prevalent. Where present, thickness of the middle clay unit generally ranges from less than one foot to more than 20 feet (**Figure 3-23**). The middle clay's characteristically muddy texture

See Fate and Transport report, Part 1 (groundwater flow model), page 3.17 (emphasis added).

Evergreen identifies the portion of AOI-8 without a middle clay unit as subcropping the unconfined aquifer, meaning the lower aquifer is directly underlying the unconfined aquifer in this area without an intervening confining bed:

- Lower aquifer groundwater flows in a radial pattern away from its subcrop area in AOI 8 near the "Fall Line." Southerly flow is prevalent beneath the PGW Passyunk Facility and AOIs 1, 2, 3, and 4. A

See id., page 3.23 (emphasis added).

For a portion of the subcrop area, Evergreen identifies a thick deposit of Holocene alluvium (See Figure 3-17, Stratigraphic Profile L-L'). Evergreen mentions that the Holocene alluvium has lower hydraulic conductivity:

> Because of its relatively young geologic age and stratigraphic position along the Schuylkill River and tributary creeks, recent alluvium at the facility is often poorly consolidated and saturated with groundwater. However, it generally has limited water-transmitting capabilities due to its predominantly fine-grained texture. The regional water-table surface occurs within or just above the Holocene alluvium

See id., page 3.13 (emphasis added).

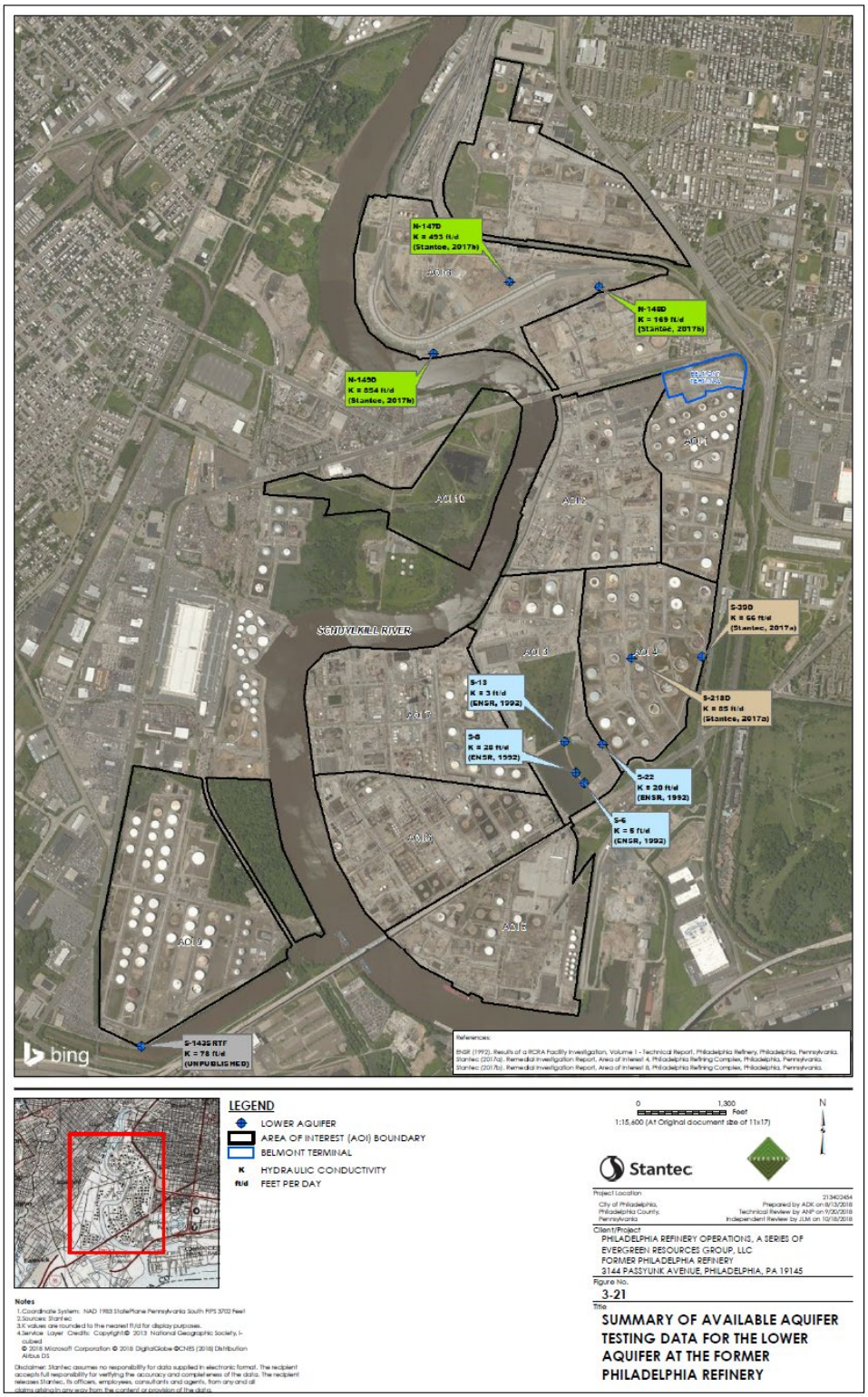
Based on Figures 5-5A through 5-5G (PDF 115-121 of 1431), Evergreen appears to have assigned this area a horizontal conductivity of 1.2 ft/day and a vertical hydraulic conductivity of 0.12 ft/day across all layers. This value seems to contradict tested values of nearby wells (see the 2017 AOI-8 Conceptual Site Model report, Table 6 and Figures 3-21 and 3-22 of the Groundwater Flow Model report), which suggest a horizontal conductivity two orders of magnitude higher:

Table 6
Summary of Aquifer Properties
Philadelphia Refining Complex, AOI 8

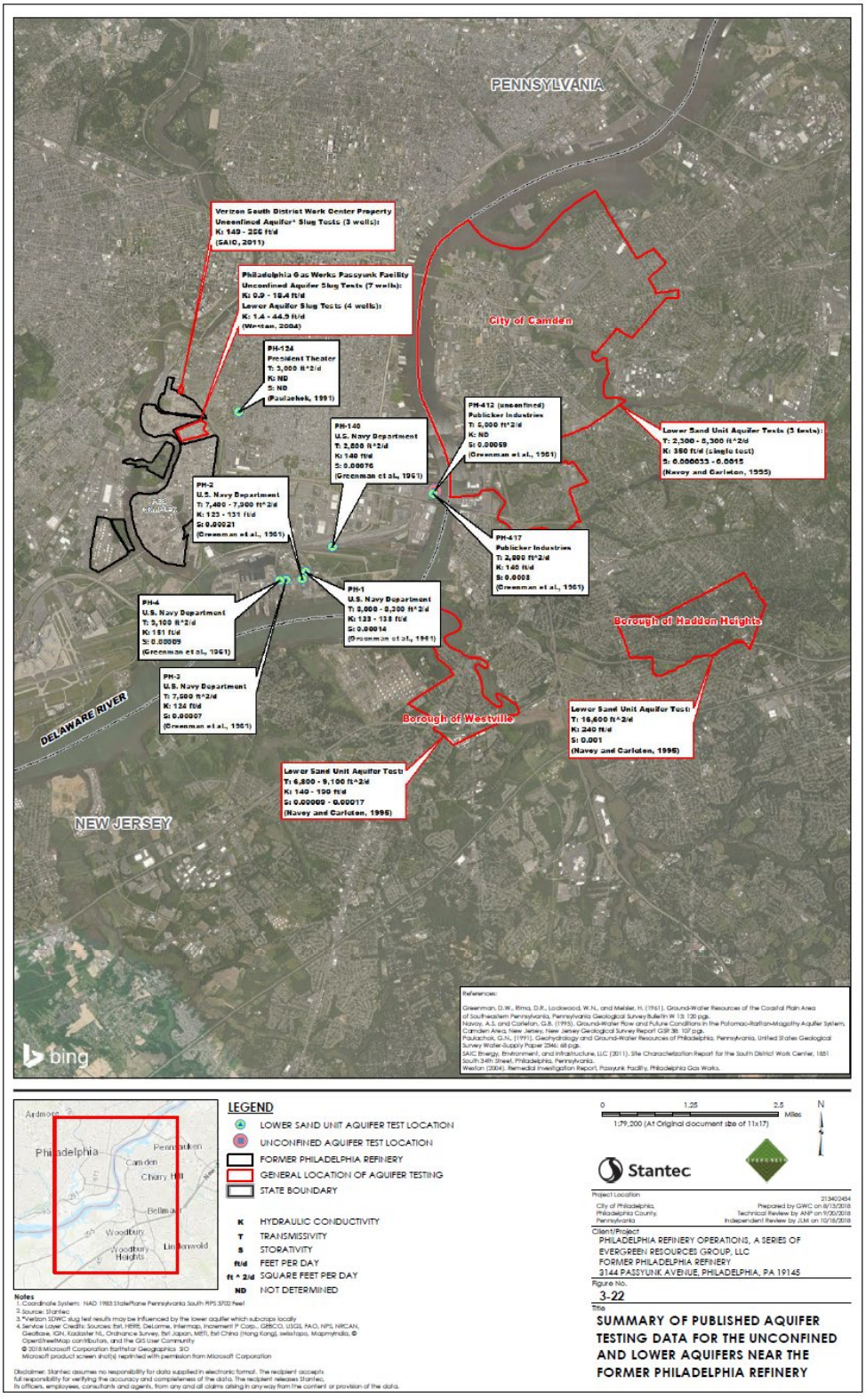
Hydrogeologic Zone	Location	Aquifer Description[1]	Saturated Thickness (ft)	Estimated Hydraulic Gradient[1] (May 2017)	Hydraulic Conductivity (ft/d)	Source[2]
1	Southern portion of AOI 8, to the north and west of the crude rail expansion	Fill (comprised of sand and gravel with some fines) underlain by alluvium.	10	0.001	200	Conservative estimate based on observed geology
2	Southern portion of AOI 8, to the south and east of the crude rail expansion (PGW Border System area)	Fill (comprised of sand and gravel with some fines) underlain by Trenton Gravel	15	0.011	430	RW-2 pumping test (IST, 1998)
3	Area surrounding N-14 and N-102	Upper PRM (Trenton Gravel is unsaturated in this area)	15	0.006	270	(Low et al, 2002)
4	Verizon Property border area	Fill comprised of brick and other debris with gravel and sand	10	0.009	194	Slug test geomean (SAIC, 2011)

Notes:
ft feet
ft/d feet per day
PRM Potomac-Raritan Magothy Aquifer System
1 Refer to Remedial Investigation Report (Stantec, 2017) for comprehensive hydrostratigraphic discussion.
2 Full references provided in text (Section 5.0).

See 2017 Report (AOI-8) (2017) (part 1), Light Non-Aqueous Phase Liquid Conceptual Site Model, Table 6 (PDF page 776 of 1545) (emphasis added).



See Fate and Transport report, Part 1 (groundwater flow model), Figure 3-21 – Summary of Available Aquifer Testing Data for the Lower Aquifer at the Former Philadelphia Refinery (PDF 86 of 1431).



See Fate and Transport report, Part 1 (groundwater flow model), Figure 3-22 – Summary of Published Aquifer Testing Data for the Unconfined and Lower Aquifers Near the Former Philadelphia Refinery (PDF 87 of 1431).

Evergreen provides no data to support the selected values of hydraulic conductivity in this area. Drilling logs show sand beds within the Holocene alluvium and the vertical hydraulic conductivity could be significantly higher. Due to the absence of a confining layer in this area and it being downgradient of a groundwater convergence, there could be contaminant pathways from the unconfined aquifer into the deeper aquifer.

Evergreen should perform a high-resolution site characterization (HRSC) study in the southwestern portion of AOI-8 to better characterize pathways from AOI-8 into the river and from the unconfined aquifer into the lower aquifer. This study should include an empirical analysis of vertical hydraulic conductivity.

3. **Evergreen has failed to substantiate its predictions regarding the migration of contaminated groundwater past the sheet pile wall and bulkheads.**

In its comments in January 2021, the Council noted that Evergreen had offered no information or investigation of the integrity of the sheet pile wall – the last line of defense against the migration of contaminated groundwater to the Schuylkill River. *See* Attachment 1 – Comments of Clean Air Council dated January 14, 2021, Comment 9, pages 93-101.

Evergreen asserted that the sheet pile "limits" the flow of groundwater to the Schuylkill River -- and thereby acknowledged the possibility of flow into the river. *See id.,* page 93. Begging the question, it asserted that the movement of groundwater toward the river is limited because the groundwater can discharge no faster than the sheet pile wall permits. *See id.,* pages 93-94.

In addition, Evergreen asserted that the effective hydraulic conductivity used for simulating Zones 1 through 5 was 0.283 ft/d (10^{-5} cm/sec) which represents unsealed sheet piling (Waterloo Barrier, Inc.). This was not reliable because this coefficient was developed for a product in 1989 – decades after the construction of this sheet pile wall in the 1950s. *See id.,* pages 96-97. The Council pointed out that Evergreen had not substantiated the use of this coefficient for this sheet pile wall.

Now, Evergreen has offered a modeling analysis that does not provide specifications relating to hydraulic "conductance" (which is assumed to be the hydraulic conductivity of the barrier divided by the thickness (*see* USGS, Online Guide to MODFLOW-2005, HFB6 - Horizontal Flow Barrier Package (usgs.gov)) or depth of the Horizontal Flow Barrier (HFB) package. Instead, Evergreen offers a brief and somewhat vague description of the efforts to parameterize this important model feature:

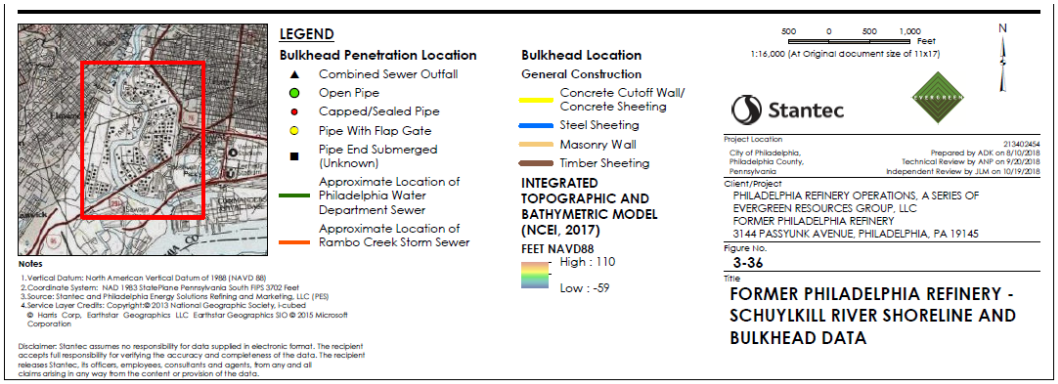
> Along the facility, much of the Schuylkill River shoreline has been hardened with sheet pilings and bulkheads to stabilize the channel, provide shipping access, and mitigate the potential for erosion and flooding. As discussed in **Section 3.1.1** and **Section 3.1.2**, shoreline hardening had already commenced by the turn of the 20th Century near the facility. Where present and not deteriorated, sheet pilings act as hydraulic barriers that limit the horizontal exchange of groundwater with surface water and vice-versa, depending on the depth to which the pilings are anchored. Stantec and Evergreen met with PESRM engineers during January 2018 with the goal of obtaining any available as-built information related to bulkheads and other shoreline structures (**Appendix C**). A site walk was also performed to visually review the structures. Based on the information received from PESRM, Stantec compiled and digitized the locations of bulkheads, bulkhead types, and walls along the Schuylkill River, also noting where the shoreline appears to be open (**Figure 3-36**). Most drawings reviewed did not indicate the installation depth for sheet pilings, only noting that the sheeting is generally driven to refusal based on geotechnical standards. As such, the vertical extent of hydraulic flow barriers in the GWF model was estimated during model calibration to observed hydraulic heads (**Section 6**).

See Fate and Transport report, Part 1, page 3.26 (emphasis added).

Absent additional data, Evergreen appears to make the following assumptions about the sheet pile walls (also referred to interchangeably as "bulkheads" by Evergreen) represented by HFB cells in the model (see Figure 3-36, Figure 5-4, and Figures 6-2A through 6-2D of part 1):

- Sheet pile walls are sufficiently anchored into confining units, limiting flow beneath sheet pile walls
- In the areas around AOI-8, sheet pile walls are installed down to bedrock
- Sheet pile walls are not deteriorated
- Initial estimates for conductance are the same for all HFB cells

Contrary to these assumptions, Evergreen presents data suggesting the hydraulic conductance could vary widely among sheet pile walls. In Figure 3-36, Evergreen identifies bulkheads constructed of concrete (in yellow), timber (in brown), steel (in blue), and masonry (in peach):



See Fate and Transport report, Part 1, Figure 3-36 – Former Philadelphia Refinery - Schuylkill River Shoreline and Bulkhead Data (PDF 101 of 1014).

In Appendix C, the variety of ages of the sheet pile walls is evident, with some identified as being over 80 years old:

1. PDF 1323 ("Circa 1979, a steel sheet pile (SSP) bulkhead comprised of Hoesch 175 SSP sections was constructed to encapsulate the original timber low deck structure and the space between the timber low deck and mudline filled with un-compacted soil fill through holes cut in the timber low deck."),

2. PDF 1334 ("The original construction of this wharf [Case Wharf] may have occurred prior to year 1910. Most of this wharf has collapsed over the years and has been replaced by stone rip-rap revetments and sheet pile bulkhead."),

3. PDF 1339 ("Circa 1980, a SSP bulkhead was installed along the O/S edge of low deck structures and the space between the mudline and finished low deck filled with un-compacted fill. These wharves were rehabilitated again in year 2014 when additional W18x97 soldier piles spaced at 10'-4", a new fender system and stone rip-rap for scour protection were installed along the outshore face of the wharves.").

4. PDF 1340 ("Short Pier was constructed as an approximately 74 ft. long and 40 ft. wide (I/S-O/S direction) timber low deck structure with steel sheet pile cut off walls circa 1939."),

5. PDF 1344 ("GP Wharf #1 was constructed circa 1919."),

6. PDF 1349 ("GP Wharf #2 was constructed circa 1930."),

7. PDF 1352 ("GP Wharf #3 was constructed circa 1947."),

8. PDF 1354 (“The original bulkhead was constructed in the early 1900’s as a timber bulkhead comprised of 6x12 timber sheeting with 12x12 low-water and high-water wales.”),

9. PDF 1355 (“Circa mid-1950s, the timber bulkhead was trimmed down to the low-water wale at approximate elevation of +2’-6” to +3’-0” mean-low water (MLW), including timber sheeting and the plumb and batter piles supporting the high water wale.”),

10. PDF 1366 (“The higher high water wale is the original wale of PZ27 steel sheet piles installed circa mid-1950 and is located 2’-6” below the top of SSP.”),

11. PDF 1366 (“Only one high water wale (original wale circa 1950) exists in this region of the bulkhead.”), and

12. PDF 1368 (“The following, approximately 140 linear feet of circa mid-1950 bulkhead has been repaired by installing a relatively new PZ27 steel sheet pile bulkhead, approximately 4 ft. inshore of the circa mid-1950 steel sheet piles. The mid-1950 sheet piles were notched to install twenty-five (25) HP12 batter piles, labeled H1 thru H25, upriver to downriver, to laterally support the new bulkhead.”).

See id., PDF 1318-1420.

There is no discussion of how the material or expected age of the sheet pile walls affects initial estimates of the conductivity or thickness of the HFB cells. For example, large sections of AOI-8 and AOI-9 are identified as having timber sheeting, which appears to be given the same initial parameters as steel sheeting. *See id.*, Part 1, Figure 3-36.

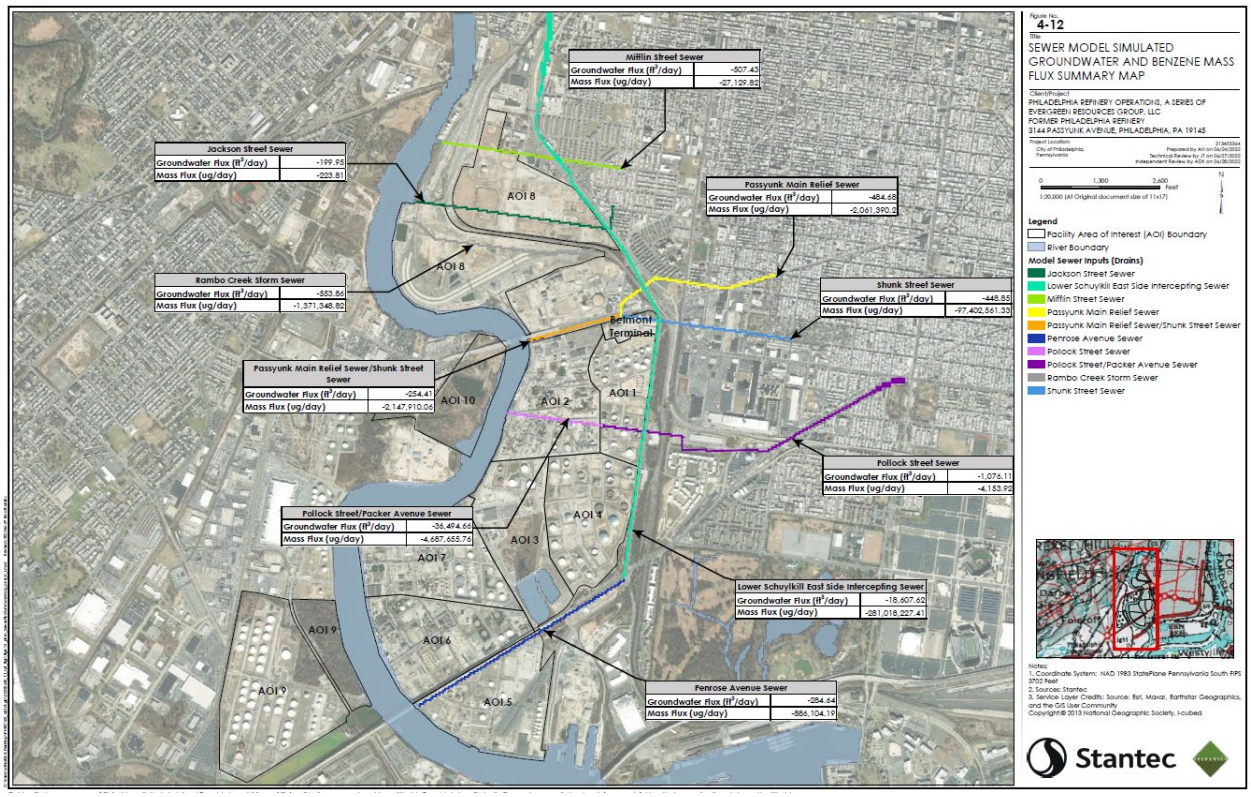
In Figure 5-4 (PDF page 114 of 1431) Evergreen shows the extent of the HFB. Areas where the bulkhead material transitions from one type to another appear to be modeled as a continuous horizontal barrier. But it seems unlikely that bulkhead sections made of different material and installed at different times would be tied together well enough to prevent groundwater flow to the river. There are inconsistencies between the mapped bulkheads and the HFB that are not explained. For example, sheet pile walls are mapped in AOI-8 and AOI-2 on Figure 3-36, but it is not modeled according to Figure 5-4.

The data and narratives presented in Appendix C are only constrained to subsections of the areas modeled as HFB, and it is silent on how observed conditions would influence groundwater flow and pathways into the river.

Evergreen should provide more data on the parameters of the HFB package and a narrative supporting the selection of these where supporting data are lacking.

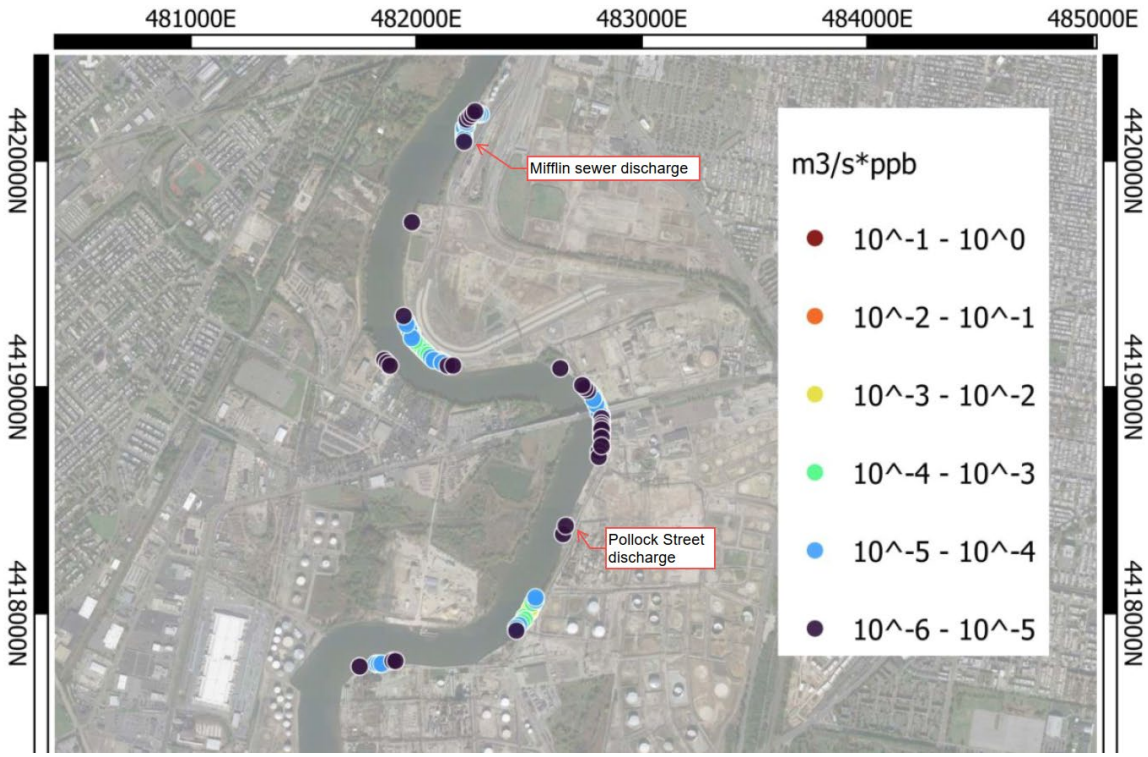
4. **<u>Evergreen presents inconsistent results regarding sewer discharge and contaminant flux into the Schuylkill River.</u>**

Evergreen presents Benzene mass flux from sewer systems on Figure 4-12:



See Fate and Transport report, Part 2, Section I, PDF page 121 of 174). To illustrate with respect to two sewer systems, the Pollock Street/Packer Avenue Sewer (drawn in lavender in the Figure) has a negative benzene flux (benzene leaving the site via the sewer and entering the Schuylkill River) two orders of magnitude greater than the Mifflin Street Sewer (drawn in lime green in the Figure).

However, in the report describing the river modeling, a contradictory Figure is presented showing Benzene flux into the river:



…

Location and Magnitude of Benzene Sources

Schuylkill River
Numerical Modeling of Pollutant Dispersion

Baird.

13524.101.R1.Rev1

Appendix A

See Fate and Transport report, Part 2, Section III, Appendix L (PDF 1010 of 1014). Given the difference in the coloring of the circles in this Figure, the location where the Pollock Street/Packer Avenue Sewer discharges to the Schuylkill river has a much lower flux than the location where the Mifflin Street Sewer discharges. The Pollock street source is shown as a 10^{-6} to 10^{-5} m^3-ppb/sec (the lowest possible range), whereas the Mifflin Street discharge (it is not clear which dot represents the sewer) is this low range or higher. This relationship is opposite that represented by the data in Figure 4-12 above. This discrepancy is not explained by the data presented.

5. <u>Evergreen makes a number of flawed or unsubstantiated assumptions in the operation of the model</u>.

Sections 1 through 3 above address the Council's concerns regarding the groundwater flow numerical model (Part 1). Evergreen uses the numerical model to predict contaminant migration in Part 2 of the Fate and Transport remedial investigation report. Included in Part 2 are several appendices that provide data generated in site investigations conducted after submission of previous remedial investigation reports, and various levels of interpretation of these data.

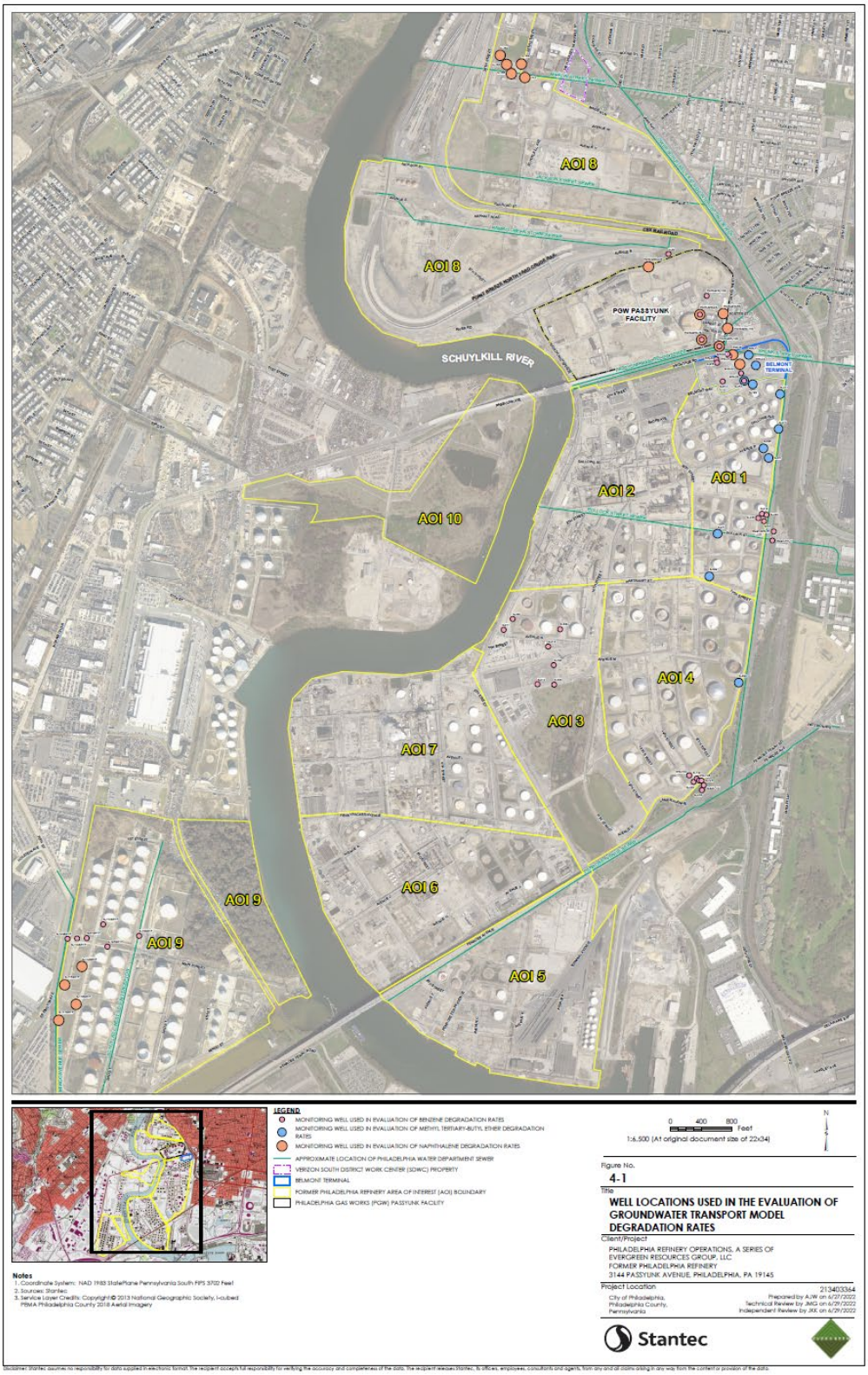
The MT3D model employed by Evergreen models fate and transport of the selected indicator parameters through setting initial contaminant loadings and predicts their transport in the saturated zone in accordance with the groundwater flows modeled in Part 1, taking into account reductions in concentration through biodegradation, dispersion, complexation, and dilution.

A. Evergreen's approach for selection of biodegradation rates is flawed.

For all the indicator parameters except for lead, the primary mode of attenuation is biodegradation. The model employs first order degradation constants to predict rates of destruction. Evergreen's approach to biodegradation is poorly substantiated.

The report states that degradation rate constants were calculated in Appendix J. *See* Fate and Transport report, Part 2, Section I, Section 4.2.1.2 (Degradation Rates), page 4.30 (PDF 31 of 174). That appendix requires significantly more documentation in order for anyone to meaningfully evaluate it. *See* Fate and Transport report, Part 2, Section III, Appendix L (PDF 912-922 of 1014). Appendix J simply contains a series of printouts of the Department-supplied spreadsheet for using the Buscheck and Alcantar technique for calculating rates.

While the report asserts that this appendix uses well data from those shown on Figure 4-1, in actuality Figure 4-1 only shows well locations, and none of the actual sequences of wells are used for each calculation:



See Fate and Transport report, Part 2, Section I, Figure 4-1 – Well Locations Used in the Evaluation of Groundwater Transport Model Degradation Rates, PDF 102 of 174).

There are no indications on Figure 4-1 showing what wells are along what lines (where distance is measured) and how those concentrations are entered into the Appendix J spreadsheet. For each spreadsheet printout presented in Appendix J, Evergreen should identify what wells are used, both in a list and how the wells are lined up on the Figure.

In the end, Evergreen does not use these data anyway, and it does not explain why. It merely asserts that "[t]he calculated rates also do not agree with multiple lines of evidence that indicate that biodegradation is actively occurring at the facility." This lack of agreement should be documented and substantiated with specific examples.

Evergreen stated that "[u]ltimately, degradation rates assigned in the groundwater transport model for benzene, naphthalene, and MTBE were consistent with those reported in literature (Howard et al 1991) and biodegradation rates reported in 25 Pa. Code, Chapter 250, Appendix A, Table 5." *See id.,* Section 4.2.1.2 (Degradation Rates), page 4.30. However, the Act 2 guidance says "[p]ublished values such those in Appendix A, Table 5A of Chapter 250 should not be relied on as default values for site-specific modeling":

> • Lambda – this measure of biodegradation (as first order decay) varies from site to site for each compound and is usually determined by model calibration, or sometimes calculated from plume centerline data. Published values such those in Appendix A, Table 5A of Chapter 250 should not be relied on as default values for site-specific modeling.

See Pennsylvania Department of Environmental Protection, Technical Guidance Manual, Section III, page III-10 (March 27, 2021) (emphasis added). Although this quote is from the section of the guidance on unsaturated zone transport modeling (and Evergreen did not do any unsaturated zone modeling) it should apply to the saturated zone as well.

Evergreen summarizes its selected degradation rates in Table 4-1:

Table 4-1: Summary of Degradation Half Lives
Former Philadelphia Refinery, Sitewide Fate and Transport Model
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Indicator Parameter	Site-Specific Calculations (days)	Literature [1] (days)	25 Pa. Code Capter 250 [2] (days)	Model Input (days)
Benzene	198 - 7427	10 - 730	722.70	829
MTBE	913	56 - 365	366.59	913
Naphthalene	4164 - 6956	1 - 258	258.11	861
BaP	-	114 - 1058.5	1053.94	1059
Lead	562.10	-	-	562

Notes:
MTBE = methyl tertiary-butyl ether
BaP = benzo(a)pyrene
1 - Howard, P. H., Boethling, R. S., Jarvis, W.F., Meylan, W.M., and Michalenko, E.M., 1991. Environmental Degradation Rates. Lewis Publishers, Chelsea, Michigan, 725 p.
2 - 25 Pa. Code, Chapter 250, Appendix A, Table 5 and Physical Database Summary

See Fate and Transport report, Part 2, Section I, Table 4-1 (PDF 67 of 174). However, the process for selection of the degradation rates is arbitrary. The text of the report states "*degradation rates assigned in the groundwater transport model for benzene, naphthalene, and MTBE were consistent with those reported in literature (Howard et al 1991) and biodegradation*

rates reported in 25 Pa. Code, Chapter 250, Appendix A, Table 5. The degradation rate assigned for BaP in the groundwater transport model was based solely upon literature values due to the low mobility and wide distribution at relatively low concentrations." *See id.,* Section 4.2.1.2 (Degradation Rates), page 4.30. However, the value used for benzene is not tied to any of these values, while MTBE is actually based on the measured rate (though as mentioned above, this is not clearly explained). Naphthalene is well above the literature and well below the site-specific evaluation numbers, BaP is from the upper end of literature. Evergreen needs to better define the rationale for selection of these key model parameters.

Evergreen presents the lead degradation rate based on the site-measured values. Aside from the issues described above for the site-specific evaluations, it is not a certainty that lead would follow a first order attenuation in the same way that biodegradation does. It does attenuate, but this depends on the presence of the anions with which it complexes. Unlike biodegradation – which is a rate-limited process to a certain extent (diffusion into the bacterial cells, enzymatic reactions, etc.) – lead would either precipitate or not depending on what complexing agents it encounters as it migrates. While there is a kinetic component of the reaction, this is not driving the attenuation process. Removal of lead should be modeled by presenting the locations where precipitating ions such as sulfide are found to be enriched within the aquifer.

B. Evergreen's approach for the selection of porosity values is flawed.

Evergreen does not provide an explanation on how it selected the value within the wide range it says is typical. Evergreen makes the following statement:

> While effective porosity is an important variable in estimating advective flow velocities it generally varies within a small range in comparison to hydraulic conductivity and is therefore not considered to be a sensitive parameter in the transport model.

See id., Section 4.2.2.1 (Porosity), page 4.31. It might be the case that it does not vary over the site, but that does not mean that the parameter value it selects does not have an impact on the results of the modeling.

This parameter should be set based on site specific measurements.

C. Evergreen's approach for the selection of dispersion values is flawed.

Evergreen estimates dispersion based on a fraction of plume lengths. Dispersion is a function of the specific aquifer, but Evergreen uses literature values for lengths of plumes for benzene and MTBE dispersion. But this should be site-specific, not literature based.

For the other compounds, Evergreen makes this statement:

> Plume length for the constituents naphthalene, BaP, and lead were estimated based upon areas within the facility where longitudinal axes may be drawn and plume length estimated. Based upon the graphical measurement of current plume lengths (inferred to be stable or decreasing plumes) the longitudinal dispersivity is 28 feet, 5 feet, and 25 feet for naphthalene, BaP, and lead, respectively.

See id., Section 4.2.2.2 (Dispersivity), page 4.31 (emphasis added). But it does not say where it is doing these measurements. This should be shown.

D. Evergreen's approach for the selection of f_{OC} values is flawed.

A key parameter in estimating retardation is the fraction of organic carbon in the aquifer material (f_{OC}). Evergreen selects a single value for the entire model. *See id.,* Section 4.2.2.3 (Retardation), pages 4.31-4.33. However, f_{OC} is likely to vary with layer. The Act 2 guidance identifies f_{OC} as one of a number of "Site-Specific Requirements" (Technical Guidance Manual, page III-4), indicating that literature values should not be used. The guidance provides "default values" but only in regards to explaining how it calculated MSCs. The purpose of the F&T transport model is not to use MSCs. Ideally f_{OC} values would be measured in samples collected from uncontaminated portions of the aquifer and those values used in the model.

The text of the report says that Figure 4-2 indicates where a much higher f_{OC} was applied due to Holocene-era marsh deposits but (1) Figure 4-2 is labeled as a dispersivity figure, not a f_{OC} nor retardation figure and (2) no explanation was provided on how these areas are designated.

This much higher f_{OC} right near the water will result in the model slowing the rate of migration right before it hits the water. This might be the case, but it has to be documented that such an increase in f_{OC} is present in these areas.

E. Evergreen does not sufficiently account for source terms.

Evergreen excludes some source terms because it asserts that Sunoco is not responsible for the contamination. *See id.,* Section 4.2.3.2 (Data Sources Removed from the Assessment), pages 4.34-4.35. Even if it believes it is not responsible for the contamination, it should show whether or not it will contribute to contamination migrating to a receptor. If it turns out that that contamination does migrate to a receptor, then it could negotiate liability at some point in the future. But it should not model a situation that is factually inaccurate. Evergreen should include all contamination terms in its model runs, and then evaluate them.

In establishing the source terms, Evergreen rejects outliers based on outlier identification using EPA software ProUCL. *See id.,* pages 4.35. It is noted that the main purpose of ProUCL is not to identify outliers, but is a general statistical package. From the user manual, "*Methods incorporated in ProUCL cover many common environmental situations and allow environmental practitioners with limited knowledge of statistics to perform calculations to estimate DQO based sample size, establish background levels, compare background and site sample data sets for site evaluation and risk assessment, and perform basic trend analysis.*" *See* ProUCL Version 5.2.0 User Guide (2016), Executive Summary, page x.

That said, there is a module for determining when certain data points are outliers. However, the user guide states that "*When an outlier is identified using statistical test, the best practice is to first scientifically investigate extreme values in the context of site processes, geology and historical use, and based on this information decide whether there is a reason to*

discard the data. One may also conduct the planned analysis with and without the datapoint in question, as this can lead to better understanding of sub-populations that may be present within a site, such as hot spots." *See id.,* Section 4.1 (Outlier Tests), page 4-46. Evergreen simply ran the software and threw out the samples the software indicated were outliers, without performing an evaluation as to whether there may be good reasons why these values were detected in the first place.

The report defines continuing sources as follows:

> Constant continuing source, representing residual LNAPL and/or back diffusion from low permeability sediments, was simulated in areas of elevated concentration ("hot spots") inferred to exhibit maximum concentrations greater than 1,000 ug/L for benzene, greater than 200 ug/L for MTBE, greater than 1,000 ug/L for naphthalene, and greater than 1 ug/L for BaP. Constant concentration sources were not implemented in the groundwater transport model during the simulation of lead. The fate of lead is largely controlled by aquifer and sediment geochemistry in the facility environment. A discussion of lead fate is included in **Appendix H**.

See Fate and Transport report, Part 2, Section I, Section 4.2.4 (Source Terms), page 4.37 (emphasis added). This may or may not correspond to all areas where LNAPL has been observed. Places where LNAPL has been observed should also be considered as continuing sources because LNAPL will continue to dissolve into the groundwater producing additional groundwater contamination, even if there exist no monitoring wells near the NAPL that currently show concentrations about these arbitrary thresholds.

Evergreen erroneously assigns no continuing source for lead. This is important because lead may be present in NAPL solutions as a tetraethyl lead component depending on when the release occurred. Wherever a continuing organic source is present at a location where elevated lead source terms are also present, lead should be assigned a continuing source at those locations. By assigning a degradation rate to lead (commented above as not the best way to define how lead may become immobilized) and then assigning a no-recurring source term to it (commented herein as unreasonable) inexorably leads to the model predicting lead disappearing by the first snapshot in time presented in the report. The fact that lead has not disappeared over the long time contamination at this site has existed demonstrates how these assumptions are not correct.

6. <u>Evergreen does not sufficiently account for climate resiliency in its modeling</u>.

Evergreen's report asserts that it accounted for the effects of sea level rise on the tidal Schuylkill River, but it did not mention the contribution of increased precipitation and more frequent storms resulting from climate change:

6.0 CLIMATE RESILIENCY

An evaluation of potential effects of climate change was performed to evaluate potential future groundwater conditions over an approximately 80-year time horizon using estimates of projected sea level rise. Sea level rise driven groundwater rise was assessed by evaluating near-term, mid-century, and end-of-century sea level rise predictions outlined in the Climate-Resilient Planning and Design Guidance for the Philadelphia Water Department's primary planning scenario from National Oceanic and Atmospheric Administration (NOAA) data (Philadelphia Water Department 2022). The projection of future conditions was completed by assuming a linear response of groundwater to rising sea levels. Sea level rise of 1.18, 2.89, and 6.4 feet for the near term (2030s), mid-century (2060s), and end-of century (2100s) scenarios were considered, respectively.

In flux-controlled groundwater systems where recharge remains consistent over time, a linear response of groundwater rise to sea level rise is assumed. This assumption is consistent with the approach used by other researchers in this area (Hummel et al. 2018). Because groundwater gradient is not anticipated to change substantively, groundwater fluxes of contaminants are similarly assumed to remain consistent over time in the absence of substantial anthropogenic changes to the system. Therefore, this groundwater evaluation of climate change focused on projected groundwater elevations with respect to recent land surface elevations and considered contaminant distribution, remediation systems, and infrastructure.

The assessment was completed by comparing a series of groundwater table elevations to the City of Philadelphia 2015 Light Detection and Ranging (LiDAR) model obtained from the Pennsylvania Spatial Data Access (PASDA) website. The 2021 groundwater surface presented in GWF Model verification was raised by the projected amount of sea level rise (1.18 feet, 2.89 feet, and 6.4 feet). The LiDAR model was then subtracted from each water table for the planning scenarios. **Figure 6-1** shows the areas where it is predicted that groundwater could emerge due to future sea level rise. The areas shown to be possibly impacted by emerging groundwater generally correlate to historic marsh areas reclaimed during industrialization. The exception is facility AOI 9 because of Mingo Basin pumping and maintaining a depressed water table in that area.

An additional climate change scenario was simulated in the Schuylkill River using similar predicted future conditions for sea level rise and results from Stantec's groundwater transport model. Simulation of a very dry future condition, when mixing would be reduced, was completed as a potential climate change scenario that might cause adverse impacts at the facility. The COC levels in the river were higher during these low flow conditions; however, they were still well below the thresholds for all but the BaP fish consumption criteria. This is discussed further in Baird's hydrodynamic model assessment in **Appendix**

See Fate and Transport report, Part 2, Section I, Section 6.0, page 6.4 (emphasis added). These phenomena would be expected to affect groundwater modeling. There is literature on the subject of modeling such events. *See e.g.,* Bermúdez, M., Farfán, J. F., Willems, P., & Cea, L. (2021). Assessing the effects of climate change on compound flooding in coastal river areas. Water Resources Research, 57, e2020WR029321. https://doi.org/10.1029/2020WR029321. In 2022, there is no reason for Evergreen to ignore this in its modeling.

Nor does Evergreen appear to consider the potential future uses of the 1,400 acre site, which could involve paving, which could affect the risk of flooding at this site.

In the section of the report quoted above, Evergreen states that "because the groundwater gradient is not anticipated to change substantively, groundwater fluxes of contaminants are similarly assumed to remain consistent over time in the absence of substantial anthropogenic changes to the system." Apparently, Evergreen is assuming that groundwater fluxes will not respond to more frequent and more intense precipitation events in the future or future paving of the site. This disregards available evidence.

The problems caused by these events could be exacerbated by the leaking sewers at the site, known to affect pathways of groundwater contamination. The combination of converging groundwater around leaking sewers at heavily contaminated areas of the site could result in a pollution incident if the sewer system overflows.

The Department should require Evergreen to model sewer overflows during large and frequent precipitation events with consideration of sea level rise and increased impervious surface at and around the site.

Thank you for your consideration of the comments of the Council.

_____

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CLEAN AIR COUNCIL

Evergreen Resources Management Operations
a series of Evergreen Resources Group, LLC
On behalf of Sunoco, Inc. (R&M), now known as Sunoco (R&M), LLC

Pennsylvania Department of Environmental Protection

Site Characterization/Remedial Investigation Reports/Risk Assessments
Philadelphia Refinery Complex
3144 Passyunk Avenue, Philadelphia, Pennsylvania

Written Comments by Clean Air Council

Clean Air Council ("the Council") appreciates the opportunity to provide comments on Evergreen Resources Management Operations' ("Evergreen's") Site Characterization Reports and Remedial Investigation Reports regarding contamination at the former Philadelphia refinery. The reports were prepared by Evergreen on behalf of Sunoco, Inc. (R&M), now known as Sunoco (R&M), LLC ("Sunoco"). Sunoco is the party legally responsible for contamination prior to its sale of the property in 2012.

The Council is a non-profit environmental organization headquartered at 135 South 19th Street, Suite 300, Philadelphia, Pennsylvania, 19103. For 50 years, the Council has worked to improve air quality across Pennsylvania. The Council has members throughout the Commonwealth who support its mission to protect everyone's right to breathe clean air, including members in Allegheny County. The Council has approximately 35,000 activist members.

Evergreen submitted the reports to the Pennsylvania Department of Environmental Protection ("the Department") under Act 2 of 1995. *See* Evergreen, Act 2 Documents. The reports were submitted pursuant to the Consent Order and Agreement (2003) and the Consent Order and Agreement (2012). There are 19 remedial investigation reports and 2 risk assessments, listed in the Table of Reports on page 4. The comments also address work under the corrective action provisions of the Resource Conservation and Recovery Act ("RCRA"). Evergreen submitted reports relating to this work to EPA pursuant to the Settlement Agreement (2012). The work under Act 2 and RCRA are under the One Cleanup Program. Evergreen, Site History.

All documents cited in these comments are hyperlinked or attached.

Index to Comments

Procedure and Process

Content of Reports

Table of Attachments

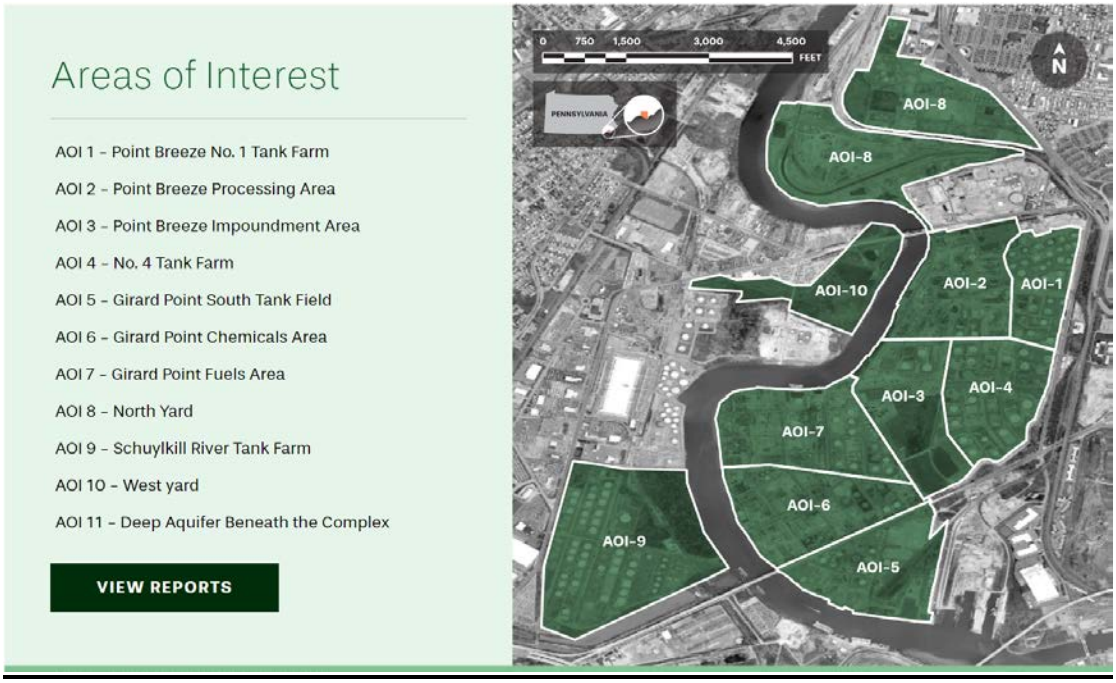
Table of Reports

(Remedial Investigation Reports and Risk Assessments)

Area of Interest	Title	Date
AOI-1 Point Breeze No. 1 Tank Farm	2016 Report (part 1) 2016 Report (part 2) (approved)	August 5, 2016
AOI-2 Point Breeze Processing Area	2017 Report (part 1) 2017 Report (part 2) (approved)	July 20, 2017
AOI 3 Point Breeze Impoundment Area	2017 Report (part 1) 2017 Report (part 2) (approved)	March 20, 2017
AOI-4 No. 4 Tank Farm	2013 Report (disapproved) 2017 Report (part 1) 2017 Report (part 2) (disapproved)	November 16, 2013 March 24, 2017
AOI-5 Girard Point South Tank Field	2011 Report/Cleanup Plan (disapproved) 2017 Report (part 1) 2017 Report (part 2) (approved)	December 13, 2011 January 16, 2017
AOI-6 Girard Point Chemicals Area	2013 Report (part 1) 2013 Report (part 2) (disapproved) 2017 Report (part 1) 2017 Report (part 2) (approved)	September 3, 2013 November 21, 2017

AOI-7 Girard Point Fuels Area	2012 Report (disapproved) 2013 Addendum to Report (disapproved) 2017 Report (part 1) 2017 Report (part 2) (approved)	February 29, 2012 September 19, 2013 June 9, 2017
AOI-8 North Yard	2012 Report (part 1) 2012 Report (part 2) (approved) 2017 Report (part 1) 2017 Report (part 2) (approved)	January 31, 2012 December 21, 2017
AOI-9 Schuylkill River Tank Farm	2015 Report (part 1) 2015 Report (part 2) (disapproved) 2017 Report Addendum (part 1) 2017 Report Addendum (part 2) (disapproved)	December 31, 2015 February 8, 2017
AOI-10 West Yard	2011 Report (approved) 2016 Ecological Risk Assessment (approved)	June 29, 2011 September 16, 2016
AOI-11 Deep Aquifer Beneath Complex	2011 Report (part 1) 2011 Report (part 2) 2013 Report (part 1) 2013 Report (part 2) (disapproved)	September 12, 2011 June 21, 2013
Site-Wide Reports (Lead in Surface Soils)	2015 Human Health Risk Assessment Report (approved)	February 25, 2015

Areas of Interest



Source: Evergreen, Home - PRLR

Summary of Comments

The Council is providing comments on Evergreen's remedial investigation reports on the nature and extent of contamination in the soil and groundwater at the former Philadelphia refinery.

Throughout these comments, the Council will be referring to Evergreen as the author of the reports, but it should be made clear that it is Sunoco, Inc. (R&M), now known as Sunoco (R&M), LLC ("Sunoco") that is the party legally responsible for the contamination prior to its sale of the property in 2012. Evergreen has prepared these reports as an agent, consultant, and corporate affiliate of Sunoco. Evergreen was formed in 2013 to manage Sunoco's environmental liabilities. *See* Attachment 1 -- Letter from Evergreen dated February 11, 2014. Under applicable environmental laws, a private agreement does not nullify statutory obligations.

In the interest of avoiding confusion, the Council may at times generally refer to the reports as Evergreen reports, despite the fact that some of them were prepared by Sunoco before Evergreen was formed. This is consistent with the spirit of that relationship structured by Sunoco, the responsible party. With respect to individual reports, the Council will refer to Evergreen or Sunoco, as appropriate based on the context.

In terms of procedure and process, these comments provide a history of the lack of public involvement in the preparation of the reports, with an eye toward making sure that the public is involved in the future.

The Council wishes to clarify that this remediation project is not a "voluntary cleanup," because it is being done pursuant to a series of consent orders dating back to at least 2003. The fact that an order is a labelled a "consent order" does not make it voluntary.

The Council asks that Evergreen make available all relevant historical reports on its website, and make changes to the website to make it more accessible.

The Council is also commenting collectively on Evergreen's answers to questions on the Q&A section of its website, which presumably reflects Evergreen's most recent thoughts on the remedial investigation.

As for the content of the remedial investigation reports, Evergreen's Conceptual Site model is fundamentally flawed due to insufficient analysis and synthesis of information relating to the soil and groundwater investigation. To properly revise the reports, Evergreen would have to dramatically change its approach, with the result that it would change the nature of the reports and the characterization of contamination. Accordingly, the public should be given another opportunity for public comment before the submission of revised reports to the Department.

Because the public is commenting on reports that are all at least three years old, Evergreen should revise them and synthesize them with other information, data and analysis

from other sources, including groundwater remediation status reports. The public should not be put into the position of commenting on reports that may be stale.

Evergreen has not delineated the nature and extent of contamination in the deep aquifer and the unconfined aquifer (water table). It has not completely delineated contamination of the aquifer that provides a source of water supply in New Jersey.

Evergreen has failed to delineate contamination for metals in groundwater, paring down its list of Constituents of Concern over time and discontinuing sampling for chemicals such as arsenic and manganese, without sufficient explanation.

Although Evergreen cites the existence of an 8400-foot sheet pile wall as a buffer against the migration of contamination toward the adjacent Schuylkill River, Evergreen provides no meaningful discussion of the protectiveness of this wall, making circular assertion that "groundwater behind the sheet pile wall can discharge no faster to the Schuylkill River than the sheet pile wall permits."

Evergreen fails to consider the impacts of climate change (including sea level rise and storm surges) on the soil and groundwater contamination. This is material and significant because the Schuylkill River is expected to experience a sea level rise of 2 feet by 2050, and there is widespread lead contamination in surface soil (0-2 feet) on the site.

It would be inappropriate and unfair for Evergreen to fragment these remedial investigation reports by diverting a discussion of the deficiencies in these reports into yet another remedial investigation report to be made available later in 2021. The public cannot submit complete comments now in the absence of a promised Fate and Transport Analysis. Moreover, if the current reports are approved Evergreen will argue that material in the current reports may not be reopened in a public comment period on that carved-out report later this year. The material is interrelated.

Throughout the reports, Evergreen marginalizes the soil-to-groundwater numeric value (typically, the more stringent of numeric values under Act 2) in favor of a less stringent direct contact numeric value and an even less stringent proposed site-specific standard for lead. The problem is most notable in the case of lead, but it is common to other contaminants as well.

Evergreen should abandon its proposed site-specific standard of 2240 mg/kg for lead in surface soils (0-2 feet). This was based on a target blood lead level of 10 ug/dL in a human fetus, which is two times the level that the Centers for Disease Prevention and Control was using for case management for children exposed to lead even at the time when Evergreen made this proposal. On its website, Evergreen has committed to changing this proposal if the Department changes its target blood lead level. Because the Department has done this in a pending Act 2 rulemaking, Evergreen should abandon its proposal.

Because the reports define exceedances (that is, concentrations above an applicable standard) in terms of that flawed proposed standard, the reports do not provide a complete and

accurate picture of the lead contamination and its significance in the context of appropriate standards.

Finally, Evergreen should prepare a work plan and revise the reports to include Per- and Polyfluoroalkyl Substances (PFAS) as a constituent of concern. Other states have required this in remedial investigations, and the Department recently proposed to add Medium-Specific Concentrations for three PFAS chemicals in the Act 2 regulations.

Data overload is not a substitute for analysis and synthesis. This comment period concerns a large number of documents -- 19 remedial investigation reports and two risk assessments. Evergreen has collected a large amount of data from soil samples and groundwater samples. Similar efforts to gather data were made by other consultants before Evergreen was formed. The number of pages and the amount of data do not cure the analytical flaws in the reports.

Sometimes, deficiencies in reports may be easily cured. That is not the case here. The flaws in these reports are so widespread that substantial revisions are necessary. Evergreen should revise its reports to address these comments, and it should schedule another public comment period before any revised reports are submitted to the Department.

Comments

1. **The Council Appreciates the Proactive Revision of the Public Involvement Plan and the Reopening of the Public Comment Period For 19 Remedial Investigation Reports and 2 Risk Assessments.**

The Council appreciates the opportunity to provide these comments on remedial investigation reports and risk assessments prepared by Evergreen on behalf of Sunoco. Evergreen provided this comment period in response to concerns that the public involvement requirements and objectives of Act 2 had not been met. In this comment, the Council sets forth its best understanding of what happened and why. The Council hopes that this will help decision makers avoid a similar situation in the future.

This is not meant to be a meaningless exercise in checking boxes--but instead should reflect a serious obligation of the local government, the public and especially impacted neighbors.

A. Consistent with Act 2, the Public Involvement Plan should include measures to involve the public in the development and review of reports, include a proactive community information and consultation program.

There are two important public involvement provisions in Act 2 that apply to this remedial investigation and cleanup. First, a responsible party utilizing a site-specific standard:

> (n) Notice and review provisions.--***Persons utilizing the site-specific standard shall comply with the following requirements for notifying the public and the department of planned remediation activities***:
>
> (1)(i) A notice of intent to remediate a site shall be submitted to the department which provides, to the extent known, a brief description of the location of the site, a listing of the contaminant or contaminants involved and the proposed remediation measures. The department shall publish an acknowledgment noting receipt of the notice of intent in the Pennsylvania Bulletin. At the same time a notice of intent to remediate a site is submitted to the department, a copy of the notice shall be provided to the municipality in which the site is located, and a summary of the notice of intent shall be published in a newspaper of general circulation serving the area in which the site is located.
>
> (ii) The notices required by this paragraph shall include a 30-day public and municipal comment period during which the municipality can request to be involved in the development of the remediation and reuse plans for the site. ***If requested by the***

municipality, the person undertaking the remediation shall develop and implement a public involvement program plan which meets the requirements of subsection (o). Persons undertaking the remediation are encouraged to develop a proactive approach to working with the municipality in developing and implementing remediation and reuse plans.

(2) ***The following notice and review provisions apply each time a remedial investigation report, risk assessment report, cleanup plan and final report demonstrating compliance with the site-specific standard is submitted to the department***:

(i) When the report or plan is submitted to the department, a notice of its submission shall be provided to the municipality in which the site is located, and a notice summarizing the findings and recommendations of the report or plan shall be published in a newspaper of general circulation serving the area in which the site is located. ***If the municipality requested to be involved in the development of the remediation and reuse plans, the reports and plans shall also include the comments submitted by the municipality, the public and the responses from the persons preparing the reports and plans***.

(ii) The department shall review the report or plan within no more than 90 days of its receipt or notify the person submitting the report of deficiencies. If the department does not respond with deficiencies within 90 days, the report shall be deemed approved.

(3) If the remedial investigation report, risk assessment report and cleanup plan are submitted at the same time to the department, the department shall notify persons of any deficiencies in 90 days. If the department does not respond with deficiencies within 90 days, the reports are deemed approved.

See Act 2, §304(n) (emphasis added), 35 P.S. §6026.304(n) (same, unofficial statute).

Because Sunoco intended to use a site-specific standard, the law required Sunoco to provide notice in the first instance. *See* Act 2, §304(n)(2)(i) (requiring "a notice summarizing the findings and recommendations of the report or plan shall be published in a newspaper of general circulation serving the area in which the site is located"), 35 P.S. §6026.304(n)(2)(i) (same, in unofficial statute), 25 Pa. Code 250.6. In addition, because the City of Philadelphia requested to be involved in the development of the remediation and reuse plans, Sunoco was required to prepare a Public Involvement Plan and include in its reports to the Department comments received from the public.

Second, if the municipality requests to be involved in the remediation and reuse plans for the site, the responsible party must develop a public involvement plan that involves the public in the cleanup and use of the property:

> (o) Community involvement.***--Persons using site-specific standards are required to develop a public involvement plan which involves the public in the cleanup and use of the property*** if the municipality requests to be involved in the remediation and reuse plans for the site.

See Act 2, §304(o) (emphasis added), 35 P.S. §6026.304(o) (same, in unofficial statute). The statute requires the plan to include measures to involve the public in the development and review of a remedial investigation report as well as a risk assessment report:

> The plan ***shall propose measures*** to ***involve the public*** in the ***development and review*** of the ***remedial investigation report, risk assessment report***, cleanup plan and final report.

Id. (bold italics added for emphasis). Therefore, these requirements extend not only to the 20 remedial investigation reports, but also to the Human Health Risk Assessment for lead (a risk assessment report).

Finally, the state provides a list of techniques that may be included in these measures, including a "proactive community information and consultation program":

> Depending on the site involved, ***measures may include techniques such as*** developing a ***proactive community information and consultation program*** that includes door step notice of activities related to remediation, public meetings and roundtable discussions, convenient locations where documents related to a remediation can be made available to the public and designating a single contact person to whom community residents can ask questions; the formation of a community-based group which is used to solicit suggestions and comments on the various reports required by this section; and, if needed, the retention of trained, independent third parties to facilitate meetings and discussions and perform mediation services.

Id. The word "proactive" is important for unraveling what happened with public participation in the case of the former refinery. Although not strictly required by the language of the statute, a proactive program would be one calculated to make sure that the community is actively participating in a project and submitting comments on reports where there is evidence that it is not.

B. While the 2007 plan contemplated only the sharing of information about the project, the 2019 plan now contemplates a nested public comment period for reports.

After a Notice of Intent to Remediate was submitted in 2006, the City of Philadelphia requested that Sunoco develop a Public Involvement Plan. *See* Evergreen, Public Involvement. In response, Sunoco prepared a plan in 2007, several years before the 2012 transaction. *See* Sunoco, Public Involvement Plan (2007). The notice provisions are set forth as follows:

> The Act 2 Report submittals will include the appropriate municipal and public notice requirements in accordance with the provisions of Act 2. Notices will be published in the Pennsylvania Bulletin and a summary of the notice will appear in at least one local newspaper. As part of the Public Involvement Plan, ***Sunoco intends to hold an initial public meeting and subsequent meetings on an as-needed basis upon request of the City of Philadelphia to give status updates of the project***. EPA will complete additional public involvement through activities, such as notices under Corrective Action Program and by updating its online Fact Sheet for the refinery.

Id. (bold italics added for emphasis). The plan also contemplated making documents available and scheduling an initial public information session. *Id.* But it does not speak in terms of receiving comments on proposed reports, or even in terms of public comment periods. It does not even use the term "comment" at all. Rather, it only contemplates sharing information about the project.

Evergreen has attempted to address this deficiency in a second Public Involvement Plan prepared in 2019, several years after the 2012 transaction. This second plan uses the word "comment" repeatedly, and it explains how future reports will be made available for a nested public comment period between Evergreen and the public, before the reports are submitted to the Department:

> All future Act 2 report submittals will have public notices as per above including the newspaper notices and correspondence. ***The notices will be sent/published prior to submittal of the reports, and will include a 30-day public comment period per Act 2 guidelines***. Reports will be posted to the website and library branches prior to initiation of the 30-day comment period. Upon conclusion of the 30-day public comment period, the ability to comment on the reports via the website will be closed, and no further comments accepted. ***Evergreen will summarize and respond to comments received during the 30-day comment period and will submit them in document form to PADEP, USEPA, and the City of Philadelphia***.

See Evergreen, Public Involvement Plan (June 19, 2019). This is a "proactive" way of addressing the requirements of Act 2. *See* Act 2, §304(n) ("[i]f the municipality requested to be involved in the development of the remediation and reuse plans, the reports and plans shall also include the comments submitted by the municipality, the public and the responses from the persons preparing the reports and plans"), 35 P.S. §6026.304(n) (same, in unofficial statute).

C. The 2011 Work Plan incorporated only "aspects of public involvement."

Prior to the 2012 transaction, Sunoco prepared a work plan to address contamination under the 2003 consent order. Attaching the Public Involvement Plan discussed above, it spoke in terms of holding meetings and giving updates on the project:

> 4 Public Involvement
>
> The Public Involvement Plan is provided in Appendix E. ***This plan incorporates aspects of public involvement under both PADEP's Act 2 program and EPA's RCRA Corrective Action program***. The Act 2 report submittals will include the appropriate municipal and public notice requirements in accordance with the provisions of Act 2. Notices will be published in the Pennsylvania Bulletin and a summary of the notice will appear in four local newspapers, including the Philadelphia Daily News, South Philly Review, Philadelphia Inquirer and, Philadelphia Globe Times. As part of the public involvement plan, ***Sunoco intends to hold an initial public meeting in the city of Philadelphia to present the strategy and give status updates of the project at the CAP meeting on an annual basis***.
>
> EPA will complete its own public involvement through notices under the Corrective Action Program and by updating its online Fact Sheet for the refinery.

See Sunoco, Interim Activities Workplan (2011), Section 4.4, page 13. But Sunoco should have done more. While the work plan stated that the plan "incorporates aspects of public involvement" under the law, it does not specifically offer comment periods on individual reports.

D. Newspaper notices did not provide meaningful notice of an opportunity for public comment.

Based on a sampling of Sunoco's newspaper notices for AOI-5, it is clear that they do not provide sufficient information to inform people of the availability of a public comment period. The following three notices did not acknowledge the opportunity for public comment, they did not invite public comment, and they did not provide any contact information for people

who might have been inclined to submit comments if they had been aware that they had such an opportunity. The notices did not even use the word "comment."

In 2011, Sunoco apparently published the following notice in the newspaper:

> Notification of Receipt of Site Characterization/Remedial Investigation Report/Cleanup Plan
>
> ***Notice is hereby given that Sunoco Inc. (R&M) (Sunoco) is in the process of submitting a Site Characterization/ Remedial Investigation Report/Cleanup Plan to the Pennsylvania Department of Environmental Protection (PADEP),*** Southeast Regional Office for Area of Interest 5 (AOI 5) located at the Sunoco Philadelphia Refinery, Philadelphia, Pennsylvania. ***Sunoco has indicated in the report that site characterization activities have been completed at AOI 5*** in accordance with the Land Recycling and Environmental Remediation Standards Act and the 2004 Memorandum of Agreement between the PADEP and U.S. Environmental Protection Agency (EPA) (a.k.a., the PA One Cleanup Program). ***This notice is made under the provision of the Land Recycling and Environmental Remediation Standards Act, the Act of May 19, 1995, P.L. #4, No. 2.***

See Sunoco, Copy of Notice of Publication (November 14, 2011). The notice merely stated that Sunoco is in the process of submitting a report, that it believes site characterization activities have been completed, and that the notice is being made under Act 2.

In 2015, Evergreen apparently published the following notice in the newspaper:

> Notification of Submittal of a Remedial Investigation Report
>
> ***Notice is hereby given that Evergreen Resources Group LLC (Remediator), is in the process of submitting a Remedial Investigation Report to the Pennsylvania Department of Environmental Protection***, Southeast Regional Office for Area of Interest 5 located at the Philadelphia Energy Solutions Refining and Marketing LLC Facility, Philadelphia County, Philadelphia, PA. The report is being submitted in accordance with the site-specific remediation standards established under the Land Recycling and Environmental Remediation Standards Act. ***This notice is made under the provision of the Land Recycling and Environmental Remediation Standards Act, the Act of May 19, 1995, P.L. #4, No. 2.***

See Evergreen, Copy of Notice of Publication (March 19, 2015). This is like the first notice.

In 2017, Evergreen apparently published the following notice in the newspaper:

> Notification of Submittal of a Remedial Investigation Report
>
> ***Notice is hereby given that Evergreen Resources Group LLC (Remediator), is in the process of submitting a Remedial Investigation Report to the Pennsylvania Department of Environmental Protection,*** Southeast Regional Office for Area of Interest 5 located at the Philadelphia Energy Solutions Refining and Marketing LLC Refining Complex, Philadelphia County, Philadelphia, PA. The report is being submitted in accordance with the site-specific remediation standards established under the Land Recycling and Environmental Remediation Standards Act. ***This notice is made under the provision of the Land Recycling and Environmental Remediation Standards Act, the Act of May 19, 1995, P.L. #4, No. 2***.

See Evergreen, Copy of Notice of Publication (February 3, 2017). This notice is like the first and second notices.

The notices were not proactive. They merely asserted that Sunoco and Evergreen were in the process of submitting a report to the Department. Based on that limited information, a reasonable person would not understand that there was an opportunity for public comment.

E. Sunoco narrowly construed public participation requirements as only requiring it to "inform" the public about the project.

Sunoco submitted two reports relating to these three notices (the second report relates to the second and third notices). In these reports Sunoco did not refer to the public comment process and it did not attach any public comments -- implying that it received none in response to the vague newspaper notices above.

In a 2011 report, Sunoco indicated it would be giving status updates to the community on an annual basis. Apparently, this meant only that it would inform the community about what it would be doing:

> 12.0 COMMUNITY RELATION ACTIVITIES
>
> A Community Relation Plan (CRP) that includes ***public involvement with local residents to inform them of the anticipated investigations and remediation activities*** was completed as part of the NIR submittal in 2006. The purpose of this CRP is to provide a mechanism for the community, government officials, and other interested or affected citizens ***to be***

> ***informed of on-site activities related to the investigation activities at the Site***. This plan ***incorporates aspects of public involvement under both PADEP's Act 2 program and EPA's RCRA Corrective Action program.*** This report and future Act 2 reports will include the ***appropriate municipal and public notices*** in accordance with the provisions of Act 2. Notices will be published in the Pennsylvania Bulletin and a summary of the notice will appear in a local newspaper. As part of the CRP, Sunoco intends to hold an initial public meeting in the city of Philadelphia ***to present the strategy and give status updates of the project at the CAP meeting on an annual basis***.
>
> A copy of the NIR and the Act 2 report notifications for this SCR/RIR are included in Appendix A.

See 2011 Report (AOI-5), Section 12.0, page 47. In two places in the paragraph above, Sunoco makes it clear that the purpose of the plan is to "inform" the public. It states that the plan incorporates "aspects of public involvement" under the law (see the discussion on that in the Council's comment above), and it does not mention the ability to submit comments on reports. The attachments to the report do not include any public comments, implying that none were received in response to the vague newspaper notices. *See also* 2011 Report (AOI-5), part 2, including Appendix A.

In the 2017 report, Evergreen made very similar statements, again framing the process in terms of informing the public of what it would be doing, and ignoring the role of public comment.

> 10.0 COMMUNITY RELATION ACTIVITIES
>
> A Community Relation Plan (CRP) that includes public involvement with local residents ***to inform them of the anticipated investigations and remediation activities*** was completed as part of the original NIR submittal in 2006. A revised NIR was submitted in 2014. The purpose of the CRP is to provide a mechanism for the community, government officials, and other interested or affected citizens ***to be informed of on-site activities*** related to the remediation
> program at the Site. ***This plan incorporates aspects of public involvement under both PADEP's Act 2 program and EPA's RCRA Corrective Action program***. Sunoco held an initial public meeting ***to present the strategy and give a status update of the project***. As part of the CRP, ***Sunoco has presented updates*** on the remediation program to the Community Action Plan (CAP) ***on an as requested basis***. The CAP meets on a monthly basis and

> includes members of the community, local officials and PES employees.
>
> This report and future Act 2 reports will include the ***appropriate municipal and public notices*** in accordance with the provisions of Act 2. Notices will be published in the Pennsylvania Bulletin and a summary of the notice will appear in a local newspaper. A copy of the original NIR, the 2014 NIR and the Act 2 report notifications for this RIR are included in Appendix A.

See 2017 Report (AOI-5), Section 10.0, page 63. The attachments to the report do not include any public comments, implying that none were received in response to the vague newspaper notices. *See* 2017 Report (AOI-5), part 2.

F. The Department did not address public involvement requirements in its responses to the reports.

In its review of the submitted reports for AOI-5, the Department does not question whether the public involvement requirements were met. *See* 2012 Disapproval Letter (AOI-5), 2012 Comments (AOI-5); *see also* 2017 Approval Letter (AOI-5), 2017 Comments (AOI-5), 2017 Memorandum (AOI-5). Rather, it limits its comments to the technical aspects of the reports. The same is true for comments and memoranda for the other reports. *See* Evergreen, Act 2 Documents.

In conclusion, Sunoco did not draft notices sufficient to inform the community of the opportunity to provide public comments, or of the existence of a public comment period. This did not comply with the public involvement provisions of Act 2. It is not enough to simply make a large number of documents available and inform the public what one is doing. It is important to be "proactive," as allowed by the law.

In its 2019 Public Involvement Plan, Evergreen has taken a positive step by structuring public involvement around subsequent public comment periods. Still, this is something that should have been done a long time ago. Public comment is a fundamental aspect of public involvement. Without it, a Public Involvement Plan cannot be meaningful.

Of course, public comment is not sufficient to give meaning to the public involvement requirements of Act 2. Ultimately, it is important that the opportunities for public comment and public involvement are meaningful. To make them meaningful, Evergreen should by doing other things to facilitate public understanding of its work, as it has recently done its website. The Council makes additional recommendations for making public involvement more meaningful, with respect to the posting of documents on Evergreen's website. *See* Comment #3, below.

2. Evergreen Should Not Characterize This Remediation Project as a Voluntary Cleanup.

Perhaps unintentionally, Evergreen has provided the public impression that this is a voluntary cleanup, rather than an involuntary one. This is an incorrect impression because the remedial investigation and cleanup are being done pursuant to a series of consent orders dating back to 2003 -- nearly twenty years. (There was also a consent order in 1993). The fact that a cleanup is done pursuant to a consent order does not make it voluntary.

On its website, Evergreen makes two errors -- (1) equating the Voluntary Cleanup Program with Act 2, and (2) giving the impression that its work is being done under the Voluntary Cleanup Program because the work is being done under the One Cleanup Program:

> The PADEP and USEPA signed an agreement entitled "One Cleanup Program Memorandum of Agreement (MOA or One-Cleanup Program)" in 2004, ***which clarifies how sites remediated under Pennsylvania's Voluntary Cleanup Program (Act 2) may also satisfy RCRA corrective action requirements*** through characterization and attainment of remediation standards established under the Pennsylvania Land Recycling and Environmental Remediation Standards Act (statutory name for Act 2). ***In November 2011, the facility was entered into the One Cleanup Program with the USEPA Region III and PADEP***, though both agencies had substantial involvement in the progress of the environmental activity at the complex prior to that time. In November 2011, Sunoco submitted a revised Work Plan for Sitewide Approach under the One Cleanup Program (Work Plan for Sitewide Approach).

See Evergreen, Site History (visited December 26, 2020) (emphasis added).

A. Act 2 applies to all cleanups, whether voluntary or involuntary.

Evergreen has conflated the Voluntary Cleanup Program with Act 2. These two things are not synonymous. Act 2 is a state law that applies not only to voluntary cleanups, but also to those required by a number of state environmental laws:

> Section 106. Scope.
>
> (a) ***Remediation standards***.--The environmental remediation standards established under this act ***shall be used whenever site remediation is voluntarily conducted or is required under*** the act of June 22, 1937 (P.L.1987, No.394), known as The Clean Streams Law, the act of January 8, 1960 (1959 P.L.2119, No.787), known as the Air Pollution Control Act, ***the act of July***

> ***7, 1980 (P.L.380, No.97), known as the Solid Waste Management Act***, the act of July 13, 1988 (P.L.525, No.93), referred to as the Infectious and Chemotherapeutic Waste Law, ***the act of October 18, 1988 (P.L.756, No.108), known as the Hazardous Sites Cleanup Act, and the act of July 6, 1989 (P.L.169, No.32), known as the Storage Tank and Spill Prevention Act, to be eligible for cleanup liability protection under Chapter 5***. In addition, the remediation standards established under this act shall be considered as applicable, relevant and appropriate requirements for this Commonwealth under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Public Law 96-510, 42 U.S.C. § 9601 et seq.) and the Hazardous Sites Cleanup Act.

See Act 2, §106(a) (emphasis added), 35 P.S. §6026.106(a) (same, in unofficial statute).

B. This is not a voluntary cleanup under the 2003 consent order with the Department of Environmental Protection.

In reality, the remedial investigation is required by a series of consent orders dating back to at least December 17, 2003. *See* 2003 Consent Order and Agreement, pages 4-7, Sections 3-4 (setting forth corrective action requirements, including Phase One and Phase Two requirements). That consent order did not use the word "voluntary." *See generally id.* Rather, the agreement was executed so that the Department would not bring a lawsuit against Sunoco for noncompliance with the law:

> After full and complete negotiation of all matters set forth in this CO&A and upon mutual exchange of covenants contained herein, ***the parties desiring to avoid litigation and intending to be legally bound, it is hereby ORDERED by the Department and AGREED to by Sunoco as follows***:
>
> 1. ***Authority***. This CO&A is an Order of the Department authorized ***and issued pursuant to Sections 5 and 316 of the Clean Streams Law, 35 P.S. §§ 691.5, 691.316***; and Section 1917-A of the Administrative Code, supra.

Id., page 3 (bold italics added for emphasis). (As noted earlier, Act 2 applies to cleanups required under the statute highlighted above).

It is true that DEP did not assess civil penalties because the responsible party had undertaken considerable work to date:

> Civil Penalties. The Department recognizes that Sunoco began operations at a portion of the Philadelphia Refinery and Belmont

> Terminal in 1988, and began operations at another portion in 1994, ***and that Sunoco has undertaken considerable work to address contamination at these facilities***, and that contamination was present at the facilities for decades prior to Sunoco's operations. Accordingly, no Civil Penalties are assessed to Sunoco except as provided in Paragraph 13 (Stipulated Penalties).

See id. at Section 12, page 7 (bold italics added for emphasis). But that did not make the work required by the consent order "voluntary."

C. This is not a voluntary cleanup under the One Cleanup Program.

In the original notice of intent to remediate on October 12, 2006, Sunoco does not refer to a "Voluntary Cleanup Program," and it does not make a request for this to be considered a voluntary cleanup. *See* Sunoco, Initial Notice of Intent to Remediate (October 2006). Rather, it merely expressed an intent for the work to be done under the One Cleanup Program. *See id.* ("[t]his NIR is being submitted with the intent to enter the Sunoco Philadelphia Refinery into the One Cleanup Program with PaDEP and the USEPA."). It stated that the work was to be done under the 2003 consent order:

> This NIR covers remediation being done as part of the 2003 Consent Order and Agreement (CO&A) at Point Breeze, Girard Point and Schuylkill River Tank Farm.

Id. at 1. Subsequent notices of intent to remediate did not suggest this was a voluntary cleanup. *See* Evergreen, Update of Notice of Intent to Remediate (November 2014); *see also* Evergreen, Update of Notice of Intent to Remediate (December 2016).

In response to the original notice of intent to remediate, the Department and EPA never agreed that this was a voluntary cleanup. Rather, they only agreed to Sunoco's participation in the One Cleanup Program. *See* Attachment 2 -- Letter dated November 8, 2011 ("[t]he EPA agrees to your participation in the One Cleanup Program per your wish to select this option within the NIR.").

The One Cleanup Program is simply an administrative agreement between the Department and the Environmental Protection Agency to cooperate with respect to their oversight of a cleanup subject to both state law (Act 2) and federal law:

> **One Cleanup Program**
>
> In 2004, Pennsylvania DEP and the U.S. Environmental Protection Agency signed an historic Memorandum of Agreement (MOA) that ***outlines a procedure where sites remediated according to Pennsylvania's Land Recycling Program may also satisfy requirements for three key federal laws***: the Resource

> Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response Compensation Liability Act (CERCLA or Superfund) and the Toxic Substances Control Act (TSCA).
>
> By opting into this program, a remediator/facility can be provided with a "one-stop shop" for state and federal standards guiding the cleanup of brownfield sites. ***Sites owners or operators subject to RCRA Corrective Action may be able to satisfy federal RCRA obligations and[1] obtain liability relief under Pennsylvania's Act 2 program***.

See DEP, One Cleanup Program (bold italics added for emphasis); *see also* One Cleanup Program Memorandum of Agreement (April 21, 2004).

It may be the case that the Department has indiscriminately conflated the terms "Voluntary Cleanup Program" with the term "Act 2." Currently, its website does this. *See* DEP, Land Recycling Program (last visited December 26, 2020) ("Pennsylvania's Land Recycling Program (Voluntary Cleanup Program) was established by a series of legislation enacted in 1995").

But any error by the Department does not make this a voluntary cleanup.

D. This is not a voluntary cleanup under the 2012 consent order with the Department of Environmental Protection.

Nothing in the August 14, 2012 consent order with the Department makes this a voluntary cleanup. *See* 2012 Consent Order and Agreement, page 6, Section 4(a) ("Seller's Obligations. Seller shall: a. Attain and demonstrate compliance with the Site-Specific Standard for all Pre-Existing Contamination in accordance with the Department-approved Plans and Act 2, by December 2020 ….". This legal agreement setting a deadline for attainment of a remediation standard does not use the word "voluntary." Again, the Department ordered the responsible party to comply with the terms of the document:

> After full and complete negotiation of all matters set forth in this Agreement, and upon mutual exchange of the covenants contained herein, ***the Parties intending to be legally bound, it is hereby ORDERED by the Department and AGREED TO by Seller and Buyer as follows***:
>
> 1. Authority. This Agreement is an Order of the Department authorized and ***issued pursuant to*** the environmental laws of the Commonwealth listed in Paragraph A, particularly ***Sections 5, 316, 402 and 610 of the Clean Streams Law***, 35 P.S. §§ 691.5,

[1] The word "and" is in bold in the original.

> 691.316, 691.402 and 691.610; ***Sections 4 and 602 of the Solid Waste Act***, 35 P.S. §§ 6018.4 and 6018.602; ***Sections 107 and 1309 of the Storage Tank Act***, 35 P.S. §§ 6021.107 and 6021.1309; and 71 P.S. § 510-17.

See id., pages 4-5 (bold italics added for emphasis). (As noted earlier, Act 2 applies to cleanups required under the three statutes highlighted above).

As in the case of the 2003 consent order, this did not make this a voluntary cleanup.

E. <u>This is not a voluntary cleanup under the 2012 prospective purchaser agreement with the Environmental Protection Agency</u>.

Nothing in the prospective purchaser agreement with the Environmental Protection Agency makes this a voluntary cleanup. While that agreement contemplated a settlement and covenant not to sue, that arrangement was with the prospective purchasers, and not with Sunoco:

> The Parties agree to undertake all actions required of each of them by the terms and conditions of this Settlement Agreement. ***The purpose of this Settlement Agreement as it pertains to the Parties, is to settle and resolve***, subject only to reservations and limitations contained in Sections VIII (Certification), IX (Covenant Not to Sue), X (Reservation of Rights), and XI (Settling Respondents' Covenant Not to Sue), ***the potential liability of the Settling Respondents for the Existing Contamination at the Property which would otherwise result from PES R&M LLC becoming the owner and/or operator of the Property***.

See 2012 Settlement Agreement and Covenant Not to Sue, page 4, paragraph 5 (bold italics added for emphasis). The Settling Respondents were Philadelphia Energy Solutions LLC and Philadelphia Energy Solutions Refining and Marketing LLC -- not Sunoco. *See id.*, page 1.

Nevertheless, the agreement contained provisions applicable to Sunoco, to ensure that it would meet its corrective action requirements under federal law:

> ***Sunoco agrees to undertake all actions required by Section XVII (Obligations by Sunoco)*** of this Settlement Agreement. ***The purpose of this Settlement Agreement as it pertains to Sunoco is to provide assurances that Sunoco will implement its corrective action obligations under RCRA at the Property***. Furthermore, Sunoco agrees that the actions to be undertaken pursuant to the terms and conditions of this Settlement Agreement are in its benefit.

See id., page 4, paragraph 5 (bold italics added for emphasis). Under the agreement, Sunoco was *required* to do a number of things for assurances of financial responsibility for its corrective action obligations. *See id.*, paragraphs 27-33, pages 57-71. This was not voluntary.

True, the Settlement Agreement states that Sunoco had entered into the Voluntary Cleanup Program on October 12, 2006. *See id.*, paragraph 17, page 10 ("Sunoco voluntarily entered into the Act 2 Program on October 12, 2006. PADEP and EPA are addressing the Site under the One Cleanup Program Memorandum of Agreement ("MOA") signed by PADEP and EPA in 2004."). But this simply repeats the error made by the Department in characterizing Act 2 as a Voluntary Cleanup Program.

F. This is not a voluntary cleanup under the 2020 First Amendment to Consent Order and Agreement.

Finally, nothing in the 2020 consent order makes this a voluntary cleanup. *See* 2020 First Amendment to Consent Order and Agreement. Amending the 2012 consent order to acknowledge Hilco's new ownership of the owner/operator (Philadelphia Energy Solutions Refining and Marketing LLC), it sets forth a new timeline for the submission of remedial investigation reports and cleanup reports. *See id.*, pages 4-5 (requiring attainment with cleanup standards by December 31, 2030).

Accordingly, Evergreen should not characterize this as a voluntary cleanup.

3. **Evergreen Should Make Available on its Website All Historical Reports Referenced in Appendix A of the 2004 Current Conditions Report**.

Evergreen has prepared a website that is helpful for locating the available remedial investigation reports, and it is neatly organized according to Area of Interest. *See* Evergreen, Act 2 Documents. Linked from this webpage, Evergreen has created a webpage for groundwater monitoring reports for 2015-present, which is also clear and well-organized. *See* Evergreen, Semi-Annual Remediation Status Reports.

However, Evergreen's webpage for historical reports is unorganized and incomplete. *See* Evergreen, Referenced Historical Reports ("Referenced Historic Reports"). It is helpful that this webpage is also linked from the webpage for the Act 2 Reports. However, the documents are listed in alphabetical order according to the title of the saved document. Without point headings or some other outline, this webpage is difficult to navigate. Evergreen should reorganize this webpage according to some criterion that would help the public to better understand the project (by Area of Interest, chronological order, etc.).

Finally, Evergreen should post all the historical reports set forth in Appendix A of the 2004 Current Conditions Report on its webpage. *See* 2004 Current Conditions Report and Comprehensive Remedial Plan (all Areas of Interest), pdf pages 150-153. It appears that Evergreen has already posted a number of these reports on its webpage. In addition, at the request of the Council, Evergreen recently posted 15 of the remaining reports from Appendix A at the top of that webpage. The Council appreciates Evergreen doing this.

The Council made that request because it was looking for documentation relating to the sheet pile wall, which provides the last line of defense against the migration of contaminated groundwater to the Schuylkill River. (*See* Comment #9, below). The documents recently posted by Evergreen do not provide any more detail on the sheet pile wall, beyond the minimal detail provided in Evergreen's reports. Posting all the historical reports would help the public gather documents relating to this issue as well as other issues regarding the remedial investigation.

Finally, the Council requests that Evergreen make available on its website geological logs and detailed well construction information for all the monitoring well and remedial well network. This would help the public in providing a detailed review and comments to the remedial investigations. *See* Comment #7, below.

The Council requests that Evergreen make the documents word-searchable before posting them. Many of the documents posted on the website are word-searchable, but many are not. Depending on the length of the document, it may take as much as half an hour for a user to make a document word-searchable.

4. <u>Evergreen Has Not Sufficiently Answered Questions From the Public on its Q&A Webpage</u>.

Evergreen has dedicated a webpage to address comments from the public on an ongoing basis. *See* Evergreen, Q & A. In theory, this is a good practice. However, a number of Evergreen's responses did not answer the question or inappropriately deferred answers to a future report. Evergreen will be submitting the Q&A to the Department. *See id.* ("The questions and comments below have been generated from website comment forms, emails, and public meeting comments. These will be updated periodically and will be included in the Public Comment Remedial Investigation Report to be submitted to the agencies upon completion of the public comment period."). Therefore, the Council is commenting directly on the Q&A, which are separately attached and numbered to facilitate a discussion regarding them. *See* Attachment 3 -- Evergreen's Q&A (downloaded on December 30, 2020).

As a preliminary matter, it would be helpful if Evergreen were to organize the Q&A on its website according to some numbering system, to make it easier for the public to track. (This is why the Council downloaded all the Q&A on December 30, 2020 and assigned numbers to them). Also, additional Q&A were added since that time. Without some sort of tracking system, it is very difficult to even identify changes to the webpage.

A. <u>Public involvement</u>
Q&A 58

In response to a question why it took so long to engage the public in the preparation of the remedial investigation reports, Evergreen merely describes the notifications that were made. But it does not answer the question:

> [Q&A 58]
>
> Why did it take 10+ years, and an almost-catastrophic explosion, for Evergreen to come back and engage the public?
>
> Since Atlantic/Sunoco purchased the refinery, there have been 21 Act 2 reports submitted and, ***at the time of each submission (as well as at the time of each of three Notices of Intent to Remediate (NIR) submitted for the property), a letter was sent to the City of Philadelphia and notices appeared in a local newspaper informing the public of each submittal and their opportunity to comment on the submittals***. In August 2018, DEP requested that Evergreen revisit the previous public involvement plan with the City of Philadelphia. After a meeting with DEP, EPA and City officials in November 2018, Evergreen began developing the www.phillyrefinerycleanup.info website in preparation for a public meeting. The fire at PES' facility occurred after this effort was underway, in June of 2019. At that time, Evergreen suggested

> opening the website prior to announcing a date for a legacy remediation public meeting to allow the agencies to share the website in order to aid in answering questions that were being posed about Sunoco's legacy remediation program. The June 2019 fire at the PES facility does not relate to Evergreen's Act 2 submittals or public involvement plan.

See id., Q&A 58. In the present comments, the Council is setting forth its own answer to the question. *See* Comment #1, above.

B. Proposed site-specific standard for lead
Q&A 12, 36, 43, 44, 70, 72, 90, 91, 94, 95, 98, 99, 100, 101, 102, 103

In the past, Evergreen took the position that its proposed site-specific standard was appropriate because it asserted that a target blood level of 10 ug/dL was appropriate. *See* Attachment 3 -- Q&A 70 ("Evergreen derived a site-specific direct contact numeric value in their 2015 risk assessment based on a target blood lead level of 10 mg/dL.").[2] But in response to two recent questions, Evergreen has stated that "[i]f the PADEP changes their assumptions related to lead, such as permissible blood lead levels, Evergreen will update the SSS accordingly." *Id.*, Q&A 100, 102.

In December 2020, the Department decided to change its assumption regarding a target blood lead level. In the pending rulemaking, it is now proposing a direct contact numeric value based on a target blood lead level of 5 ug/dL:

> Decisions Based on Workgroup Analysis
>
> - ***Use a Target Blood Lead Level of 5 ug/dL***
> - Use a Probability of Exceeding the Target Blood Lead Level of 5%
> - Use all environmental media inputs
> - Resulting lead values in Table 4A:
> o Non-residential direct contact value = 1,100 mg/kg
> o Residential direct contact value = 150 mg/kg
> (Both rounded to two significant figures)

DEP, Overview of Chapter 250 Draft-Final Rulemaking, page 9 (slide presentation, December 16, 2020) (bold italics added for emphasis); *see also* DEP, Draft Chapter 250 Rulemaking Table 4A (December 16, 2020) (striking "2,500" and inserting "1,100" for proposed direct contact

[2] In this Q&A there is a typographical error with respect to the units. Evergreen assumed a target blood lead level of 10 ug/dL, not 10 mg/dL. The error is not material to the analysis.

numeric value); *cf.* 50 Pa. B. 1011, 1072, Table 4A (February 15, 2020) (initially proposing direct contact numeric value of 2,500 mg/kg).[3]

Evergreen should follow through with its responses and abandon its proposed site-specific standard of 2240 mg/kg.

The Council will address the proposed site-specific standard in more detail in Comment #13, below. The Council is also attaching its comments on the proposed Act 2 Rulemaking, explaining why the Department should use a target blood lead level of 5 ug/dL, rather than 10 ug/dL. *See* Attachments 4-8 -- Comments of Clean Air Council, dated April 30, 2020. The reasoning set forth in the Council's comments to the Department is also applicable to Evergreen's proposed site-specific standard.

C. Fate and Transport Remedial Investigation Report
Q&A 7, 10, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 26, 30, 31, 32, 66, 75, 84, 94, 99)

The Technical Guidance Manual recognizes that a fate and transport analysis is a part of a remedial investigation. *See* Comment #11, below. However, Evergreen asserts that it is necessary to have all of the present remedial investigation reports approved before it completes a fate and transport model:

> [Q&A 23]
>
> How much more information do you need to complete the fate and transport model?
>
> We believe we have sufficient information to complete the model. ***However, we need to have agreeance on that from DEP prior to submittal. In other words, all of the Remedial Investigation Reports must be approved first (meaning, that DEP feels we have sufficiently defined the contamination so that a model can be accurate and complete).*** Once the RIR Addendums for AOI's 4 and 9 are submitted and approved, the fate and transport model will be finalized and submitted to PADEP for approval.

See Attachment 3 -- Q&A 23 (bold italics added for emphasis). But Evergreen makes this assertion only because Evergreen persuaded the Department to allow this. *See e.g.*, 2017 Approval Letter (AOI-5) ("Evergreen will complete separate Act 2 reporting to satisfy additional remedial investigation requirements for a fate-and-transport analysis (Title 25 Pa.

[3] The December 2020 materials are available on the Department's webpage for the meeting of the Cleanup Standards Scientific Advisory Board. *See* DEP, December 16, 2020 – Cleanup Standards Scientific Advisory Board Meeting (virtual meeting via WebEx).

Code Section 250.408(a)"). (Similar statements are made in the Department's approval letters for AOI-1, AOI-2, AOI-3, AOI-4, AOI-6, AOI-7, and AOI-9).

Moreover, the legal authority cited in the Department's letter does not compel the conclusion that a remedial investigation report should be fragmented in the manner sought by Evergreen. It merely sets forth requirements for a remedial investigation where a site-specific standard is sought. *See* 25 Pa. Code Section 250.408(a). In fact, that section refers to a "site characterization" and a "report" in the singular, not in the plural. *See id.*

Apparently, Evergreen assumes that the remedial investigation report for AOI-11 was disapproved only because of a flawed fate and transport analysis. Indeed, Evergreen draws the erroneous conclusion that the reports for AOI-11 were approvable apart from the fate and transport analysis:

> [Q&A 12]
>
> 1)We are concerned about lead in surface soil. The standard Evergreen has proposed does not address the risk.
> ***2) Evergreen has not obtained approval from DEP for remedial investigation reports for several of the more contaminated areas of interest. Including the aquifer.***
> 3) The work done so far does not consider the impacts of climate change, rising sea level and worsening storms. Note: for the purpose of response, this comment was split into three topics by Evergreen.
>
> ….
>
> 2)DEP did not approve two of the RIRs – AOI-4 and AOI-9 – based on the need for additional offsite characterization, not a level of contamination over other AOIs. ***The characterization portion of the AOI-11 report was sufficient for approval; however, the fate and transport portion of the AOI-11 reports was not, which is why the report was not approved***. Data has been collected from the lower aquifer wells as part of the other AOI remedial investigations since 2013 and reported in the Remedial Investigation Report submitted since 2013.
>
> ….

See Attachment 3 -- Evergreen's Q&A 12.

> [Q&A 75]

> ***Can you comment on why AOI11 deep groundwater report has not yet been approved?"***
>
> ***There were both an AOI 11 Remedial Investigation Report and a Final Report that were submitted. Both were disapproved solely for the fate and transport analysis that was included in the reports. The remedial investigation portion of those reports were good***. Note that before we started a site wide model concept, each of the AOI reports had separate individual models completed, but we have since updated that approach because the only disapproval points for those reports were based on the fate and transport, In subsequent talks with PADEP, we decided that the next phase of reporting for AOI 11 would be in the site-wide Fate and Transport RI report. Also note that AOI 11 has been monitored continually and data reported in other AOI RIRs.

See id., Q&A 75.

Evergreen goes even further, making the flawed assertion that conditions are protective of human health both onsite and offsite:

> [Q&A 26]
>
> ***There has been some concern that because of the aquifer under the water, pollutants from the refinery may impact drinking water in downstream New Jersey. Do you think this was ever a concern?*** If yes, will it continue to be one even as the refinery shuts down?
>
> Evergreen's role is to evaluate and remediate groundwater conditions created based on use of the facility up through 2013. Based on extensive data collected over the last 20+ years, and groundwater modeling performed to date, it is highly unlikely that those groundwater impacts affect drinking water quality in New Jersey. As part of the Act 2 process, Sunoco and Evergreen have performed several preliminary risk assessments, including accounting for the projection of dissolved contaminant migration in groundwater. ***All assessments to date have shown that conditions with respect to groundwater beneath the facility are protective of human health both onsite and offsite***. Evergreen is working on a complete groundwater fate and transport analysis, which projects where and how far contaminants will travel and at what concentrations, as well as other reports that will provide additional and more detailed analysis.

See id., Q&A 26.

The Council submits that this is not the case. For reasons set forth throughout the Council's comments, there are a number of flaws in the reports' discussion of the deep aquifer, including Evergreen's insufficient characterization of the relationship between the unconfined aquifer and the deep aquifer. Contrary to Evergreen's assertions, it is not true that "[t]he characterization portion of the AOI-11 report was sufficient for approval," or that "[t]he remedial investigation portion of those reports were good." The whole thing was a remedial investigation report and the report for the remedial investigation was disapproved.

Despite its assertions to the contrary, Evergreen actually acknowledges that its characterization of the relationship between the unconfined aquifer and the deep aquifer is flawed, when it promises "pressure gradients" and mapping of the clay layer in a future Fate and Transport Remedial Investigation Report:

> [Q&A 19]
>
> When will Evergreen conduct the fate and transport analysis for the lower aquifer? ***There is no aquitard between upper and lower aquifer across most of the site. Won't the heavily contaminated shallow aquifer gradually leach contaminants into the lower aquifer?*** (a critical drinking water source for New Jersey)
>
> The fate and transport analysis for the lower aquifer will be performed once the Remedial Investigation Reports for AOI 4 and AOI 9 have been approved. ***There are areas beneath the Site where connections exist between the lower aquifer and water table aquifer are less extensive than the areas where we have that important clay layer present***. The cross section shown during the August 27th Public Information Session was just one example from the site model that straddles the Schuylkill River where the aquitard is interpreted to be missing. ***Other cross sections show the continuity of that clay layer***. Even where the aquitard is missing, it does not necessarily mean that water and contaminants will move down into the deeper aquifer. ***That potential has to do with pressure gradients that the model can simulate. The fate and transport model will simulate future scenarios based upon current conditions***.
>
> ***It is noted that the fate and transport analysis will include mapping of the middle clay unit aquitard***. Water quality in the lower aquifer is monitored through routine sampling of groundwater from approximately 80 wells, and to date significant contamination has not been observed in the lower aquifer beneath the Site. Considering the aging and degrading petroleum sources

> in the water table from historic Sunoco sources, we do not expect groundwater hydrocarbon plumes to expand under current groundwater conditions.

See id., Q&A 19.

But Evergreen cannot have it both ways. It asserts that the future report is dependent on the present reports, at the same time that it asserts that the present reports are dependent upon the future report. Stated differently, all that Evergreen does is validate the notion that the material is interrelated, and Evergreen wants to break it apart. Moreover, in promising "pressure gradients" and mapping of the middle clay unit aquitard in a future remedial investigation report, Evergreen appears to be offering new data and information not present in the current reports. Accordingly, they are really one report and Evergreen is trying to break it apart.

Evergreen incorrectly assumes that the present remedial investigation reports reflect current conditions:

> [Q&A 13]
>
> Why is there no mention of climate change in discussion of the Water-table aquifer? ***These levels could change by multiple feet in the next few decades.***
>
> One of Evergreen's primary objectives through the remedial investigations under Act 2 was to characterize the facility's geologic framework and the water-bearing units it supports. Potential flow pathways for contaminant transport could be evaluated in this manner using recent groundwater observations from hundreds of wells at the facility. ***Evergreen's groundwater model is calibrated and validated to these recent groundwater data to provide defensible fate and transport simulations that are based on current conditions***. A sensitivity analysis was performed on the groundwater model to evaluate the impact of changes to inputs on performance and increase confidence in its ability to make predictions.
>
> Evergreen recognizes that climate changes are predicted that could alter local hydrologic conditions near the facility, such as higher water levels in the water-table aquifer or higher tides in the Schuylkill River. An assessment of climate change from available, published resources and the potential implications to Evergreen's groundwater model will be included in the upcoming Fate and Transport RIR.

See id., Q&A 13. As discussed in Comment #6 above, the public is commenting on remedial investigation reports that are all at least three years old, and Evergreen has not integrated the data, information, and analysis of its recent groundwater remediation status reports into these remedial investigation reports.

Now we know that Evergreen could have done the fate and transport analysis for the present public comment period, but it chose not to do so. In response to a question from a commenter, it admits that its groundwater flow model is complete:

> [Q&A 17]
>
> What is the status of your groundwater and aquifer modeling for all pollutants?
>
> ***The groundwater flow model has been completed but cannot be finalized and submitted until all Remedial Investigation Reports are approved as data collected for these reports are used as the basis for the groundwater flow model***. Groundwater contaminant fate and transport model efforts will be conducted subsequent to approval of the Remedial Investigation Reports ***since the fate and transport modeling is dependent upon the information in the Remedial Investigation Reports*** and the groundwater flow model.

See id., Q&A 17. There is no apparent reason why Evergreen would need nearly a year after the end of this public comment period to prepare a report.

In fact, the public has every reason to fear being sandbagged by fragmenting the remedial investigation reports in this manner. If the current reports are approved, that could freeze data, information, and analysis and make it difficult for the public to make future comments on a fate and transport model that depend on these reports. Evergreen makes this clear in a response to a question from a commenter, when it states that reports do not get updated once approved:

> [Q&A 67]
>
> ***Many of the finalized online reports reflect reviews done between 2011 to 2016 with no updates. How can I learn what happened next?*** Is there a person to contact with specific, referenced questions, which would be onerous for a Zoom conference?
>
> ***RIR reports do not get updated once approved***. Once RIRs are completed and approved, other report types are submitted with additional information, activities, and updates in the Act 2 process. Evergreen has multiple reports planned for 2021 and will provide a draft schedule on the website of upcoming reports.

> We have also provided copies of the semi-annual update reports on the website, which are not Act 2 submittals, but provide a routine update on remediation activities at the facility. You can ask questions in writing via email or live during the next Zoom meeting. In addition, Evergreen is currently planning smaller group meetings in the future which may make communication easier.

See id., Q&A 67 (bold italics added for emphasis).

Hypothetically, there could be circumstances that might compel a remedial investigation report to be finalized as a condition for preparing another report. For example, this might be the scenario for a cleanup plan. But that is not what is contemplated by Evergreen. It does not attempt to characterize it as a risk assessment, which Evergreen characterizes as separate from the present reports:

> [Q&A 94]
>
> It may have been more effective if this presentation was made available a week ago and we could have spent these two hours asking pertinent questions, ***such as: 1. what are the critical paths for considering the risks of lead and benzene to the adjacent communities;*** 2. how are increased climate-change risks being assessed; 3. how is ground and surface water run off being considered in the plans; 4. how is Hilco assessing the additional risks of (what looks like will be) hard scape pavement of 85-90% of the site?
>
> 1-Pathways and routes of exposure are discussed in the RIRs and they will be presented in more detail in the Risk Assessment Report. ***The Risk Assessment Report will be submitted after the public comments on the Remedial Investigation Reports, and after completion of the Public Comment RIR and the Fate and Transport RIR***.
>
> ….

See id., Q&A 94 (bold italics added for emphasis). Rather, Evergreen simply contemplates diverting material that should be in the current remedial investigation reports into another remedial investigation report to be made available later this year, under the name "Fate and Transport Remedial Investigation Report."

Stated differently, that future remedial investigation report is simply the long-awaited remedial investigation report for AOI-11, following the disapproval of the report for AOI-11 over seven years ago. The subject matter of the AOI-11 report was shifted into the individual

reports for the other individual Areas of Interest, and now Evergreen is attempting to shift them out into a standalone report again. Evergreen may not launder the deficiencies and fragment the remedial investigation reports in this manner.

The Council will address this in more detail in Comment #11, below.

D. Water quality and compliance with permit requirements (Q&A 82, 85)

Two commenters posed questions regarding the quality of water discharged from remediation systems and Evergreen's compliance with permit requirements. In response, Evergreen did not answer these questions. Evergreen should answer the questions.

In response to Question 83, Evergreen summarizes the nature of the process of sampling, but it does not answer the question regarding the quality of the water discharged from the remediation system:

> [Q&A 83]
>
> ***What is the quality of the water discharged from the Pollock St well system into the Schuylkill?***
>
> Groundwater collected from the Pollack St well system is not discharged directly to the Schuylkill River. Groundwater discharged from any remediation system is either processed through the facility's wastewater treatment plant which operates under a National Pollutant Discharge Elimination System (NPDES) permit held by PES ***or discharged to the Philadelphia Water Department (PWD) sewer system via a Groundwater Discharge Permit held by Evergreen***. ***Evergreen samples groundwater discharge to the PWD sewer per the permit requirements*** and the discharge from the facility's wastewater treatment plant is sampled by PES in accordance with their NPDES Permit.

See Attachment 3 -- Q&A 83. To be sure, Evergreen has a permit for an indirect discharge and the property owner Philadelphia Energy Solutions Refining and Marketing LLC (now owned by Hilco) has a permit for a direct discharge to the Schuylkill River. But this is a legal distinction that avoids the question posed about water quality. Certainly, Evergreen has the ability to obtain information regarding the quality of water discharged to the Schuylkill River, even though it is not a direct discharger.

In response to Question 85, Evergreen acknowledges that there are monthly discharge monitoring requirements, but does not answer the question whether permit requirements have been met:

[Q&A 85]

Is there a permit for the discharge of water from the wastewater treatment system to the PWD, who is the permit holder, ***and have the permit requirements been met?***

Evergreen has a permit for any contaminated water that we discharge to PWD, and Evergreen is the permittee. ***The permit has monthly discharge monitoring requirements that need to be achieved to meet the requirements of the permit***. Some of the discharge from Evergreen's systems go directly to the PES wastewater treatment plant. PES had a NPDES permit to operate their wastewater treatment plant, which is permitted through the PADEP, which is different from a PWD permit. Hilco Redevelopment Partners (HRP) will now be running the waste water treatment plant and will be permittee for the NPDES permit.

See id., Q&A 85.

Evergreen should properly answer the two questions.

E. Air quality and soil vapor intrusion
Q&A 10

One commenter posed a question about soil vapor intrusion and whether sampling for air quality would be done in residential areas nearby. Applying circular reasoning, Evergreen asserts that sampling is not warranted because there is no known contamination:

[Q&A 10]

Air quality measurements were made within existing buildings, ***but no air quality data was collected in surrounding neighborhoods or onsite at contaminated locations***.

Evergreen must investigate air quality stemming from subsurface contamination only, not from refinery operations above ground. As documented in the Remedial Investigation Reports, air samples were collected from inside site buildings, and from outdoor air locations both as background and above areas of known LNAPL plumes. ***There are no known residential areas where the contaminated groundwater has migrated from the facility to beneath those areas, which would possibly warrant sampling***. Also, future movement of contaminant plumes over time will be part of future site activities, including fate and transport modeling

> and evaluation of any potential risk associated with the migration of offsite plumes as part of a vapor intrusion assessment.

See id., Q&A 10. Of course, the only way one would have knowledge of contamination would be through sampling. Not having taken samples, Evergreen says it has no knowledge of contamination that would justify taking samples. And Evergreen will not have knowledge of contamination if it does not take samples. Evergreen should provide a better answer than this.

The last sentence of the response is not adequate because it is a vague reference to future fate and transport modeling that would avoid the question posed and would fragment this remedial investigation. Evergreen admits it has taken air samples from buildings onsite, and it has not relied solely on future fate and transport modeling in place of taking those samples. It should provide an explanation why air sampling in neighboring residential areas should be treated differently.

F. Delineation of nature and extent of lead contamination
Q&A 103

One commenter posed a question how Evergreen could have delineated the extent of lead contamination, having used an inappropriate site-specific standard. In response, Evergreen states that it compared the concentrations of soil samples to both the soil-to-groundwater numeric value and the site-specific standard, in the context of its tables attached to the reports:

> [Q&A 103]
>
> Since Evergreen used an inappropriate standard as a basis for its remedial investigation reports, ***how does it justify that it has correctly defined the extent of lead contamination?***
>
> As noted in response to other questions concerning the lead, the calculation of the site-specific standard was appropriate in accordance with the Act 2 regulations and recommendations from the USEPA and the PADEP. As part of the remedial investigations, ***the lead data was compared to the Act 2 SHS MSC, which is 450 ppm, based on the soil to groundwater pathway, to define the extent of lead contamination. This comparison is shown on the figures/tables in the RI Reports and in the 8/27/20 Public Information Session, so the extend [sic] of lead has been delineated to 450 ppm at the Site. Data was also compared to the site-specific standard.***

See id., Q&A 103. This is misleading because the soil-to-groundwater numeric value and the site-specific standard do not receive the same consideration in terms of Evergreen's synthesis and narration of the data.

When Evergreen asserts that "the lead data was compared to the Act 2 SHS MSC, which is 450 ppm, based on the soil to groundwater pathway, to define the extent of lead contamination," it is merely pointing out that it dropped a column in a spreadsheet to set forth both the soil-to-groundwater numeric value and the site-specific standard. This does not mean that this received any meaningful analysis in the narrative text of the reports -- which it did not.

Moreover, the following illustration from the 2017 report for AOI-5 demonstrates that Evergreen's assertion is simply incorrect. The spreadsheet of data only includes a column for the site-specific standard (2240 mg/kg), and there is no column for the soil-to-groundwater numeric value (450 mg/kg) or the direct contact numeric value (1000 mg/kg):

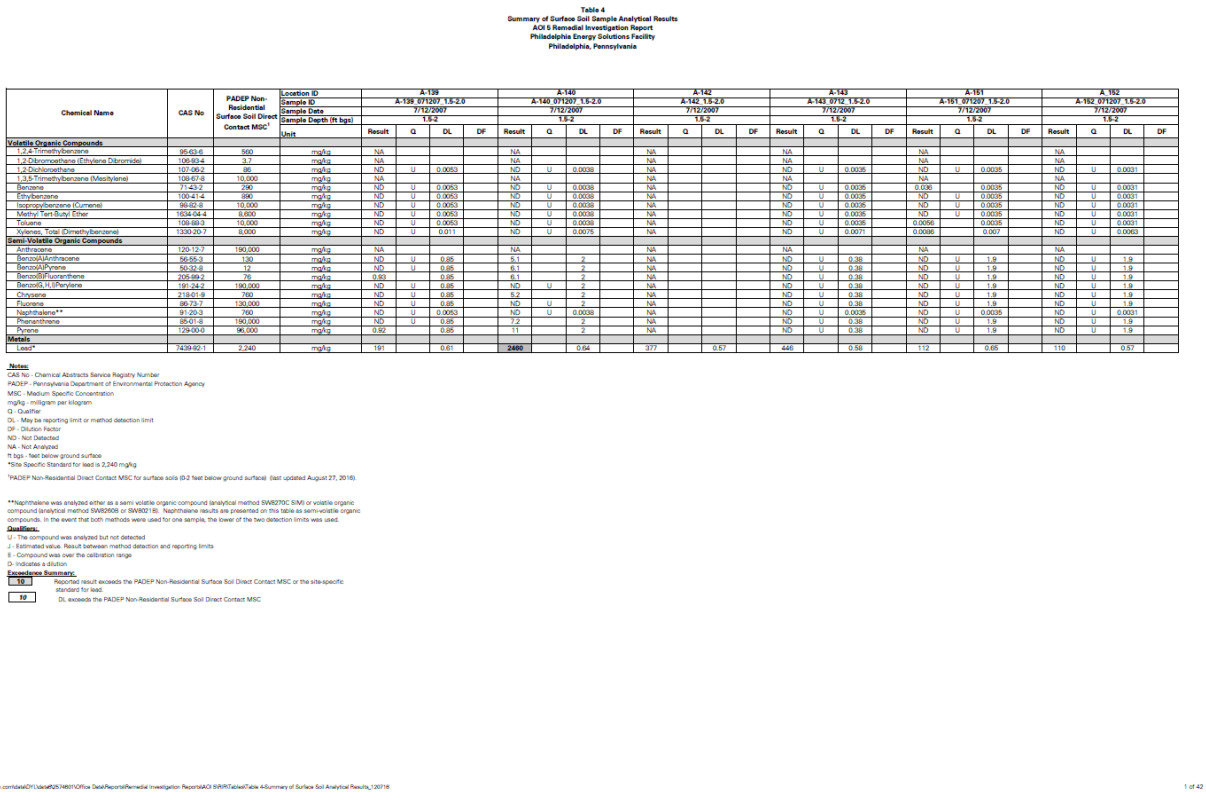


Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Unit	Location ID	A-139				A-140				A-142				A-143				A-151				A_152			
				Sample ID	A-139_071207_1.5-2.0				A-140_071207_1.5-2.0				A-142_1.5-2.0				A-143_0712_1.5-2.0				A-151_071207_1.5-2.0				A-152_071207_1.5-2.0			
				Sample Date	7/12/2007				7/12/2007				7/12/2007				7/12/2007				7/12/2007				7/12/2007			
				Sample Depth (ft bgs)	1.5-2				1.5-2				1.5-2				1.5-2				1.5-2				1.5-2			
					Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																												
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg		NA				NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg		NA				NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg		ND	U	0.0053		ND	U	0.0039		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg		NA				NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg		ND	U	0.0053		ND	U	0.0039		NA				ND	U	0.0035		0.036		0.0035		ND	U	0.0031	
Ethylbenzene	100-41-4	990	mg/kg		ND	U	0.0053		ND	U	0.0039		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg		ND	U	0.0053		ND	U	0.0039		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg		ND	U	0.0053		ND	U	0.0039		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
Toluene	108-88-3	10,000	mg/kg		ND	U	0.0053		ND	U	0.0039		NA				ND	U	0.0035		0.0056		0.0035		ND	U	0.0031	
Xylenes, Total (Dimethylbenzenes)	1330-20-7	8,000	mg/kg		ND	U	0.011		ND	U	0.0075		NA				ND	U	0.0071		0.0086		0.007		ND	U	0.0063	
Semi-Volatile Organic Compounds																												
Anthracene	120-12-7	190,000	mg/kg		NA				NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg		ND	U	0.85		5.1		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Benzo(A)Pyrene	50-32-8	12	mg/kg		ND	U	0.85		6.1		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Benzo(B)Fluoranthene	205-99-2	76	mg/kg		0.93		0.85		6.1		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg		ND	U	0.85		ND	U	2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Chrysene	218-01-9	760	mg/kg		ND	U	0.85		5.2		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Fluorene	86-73-7	130,000	mg/kg		ND	U	0.85		ND	U	2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Naphthalene**	91-20-3	760	mg/kg		ND	U	0.0053		ND	U	0.0039		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
Phenanthrene	85-01-8	190,000	mg/kg		ND	U	0.85		7.2		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Pyrene	129-00-0	96,000	mg/kg		0.92		0.85		11		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Metals																												
Lead*	7439-92-1	2,240	mg/kg		191		0.61		2460		0.64		377		0.57		446		0.58		112		0.65		110		0.57	

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

\\langan.com\data\DH\Data\525748911\Office Data\Reports\Remedial Investigation Report\AOI 5\RIR\Tables\Table 4-Summary of Surface Soil Analytical Results_120716 1 of 42

See 2017 Report (AOI-5), Table 4 (Summary of Surface Soil Sample Analytical Results), pdf pages 86-127. This means that Evergreen disregarded the lower soil-to-groundwater numeric value (450 mg/kg) when it delineated the contamination.

This is not just a matter of one spreadsheet. In just this one report, there are 42 of these spreadsheets for lead in surface soil. There are nine other areas of interest in which lead samples were taken, and some of them have two reports, and not just one report. Evergreen should explain why it made the assertion in the Q&A that it compared the concentrations of soil samples with the two numeric values. The Council addresses this in more detail in Comment #12, below.

Evergreen should also explain why merely inserting a column listing the two numeric values would be sufficient to delineate the contamination with respect to those values. Again, what is important is that there be meaningful public participation in this process. *See* Comment #1, above. When Evergreen simply points to long data tables, that does not provide a meaningful public understanding. It needs to do analysis and synthesis, and it needs to explain things better.

G. Pre-2012 and post-2012 contamination
Q&A 56, 87 (duplicate)

One commenter posed the question about dividing contamination into pre-2012 contamination and post-2012 contamination, to allocate responsibility following the 2012 sale by Sunoco to the current owner Philadelphia Energy Solutions Refining and Marketing LLC. (The latter continues to be the owner/operator in 2021, as a subsidiary of Hilco).

In response, Evergreen acknowledged that there has been post-2012 contamination and that in some instances responsibility has been divided between Sunoco and the owner:

> [Q&A 56, 87]
>
> ***How is it determined what ground pollution is from 2012 and before…and what is from 2012 to the present?***
>
> When the facility was sold to PES in 2012, Sunoco had a good understanding of the nature and extent of contamination at the facility. It was assumed that any known contamination at the time of the sale was Sunoco's responsibility to cleanup. After the sale of the property, if changes in the contaminant profile on-site occurred, or known spills happened, the resulting cleanup became PES' responsibility. ***In some instances, new contamination co-exists with old contamination, and the responsibility is shared***.

See Attachment 3 -- Q&A 56, 87. Evergreen should provide a more detailed explanation regarding post-2012 contamination and how it is shared.

This is important for several reasons. First, to the extent there has been post-2012 contamination (e.g., contamination resulting from releases due to the fire in June 2019), that would tend to avoid review in Evergreen's reports, unless there has been an overlap of contamination or data. If that is the case, the public would like to know where it could obtain information about such post-2012 contamination.

Second, this concern is even greater for releases of hazardous substances during the past three years. The remedial investigation reports are at least three years old and they would not reflect releases in the past three years.

5. <u>Evergreen's Conceptual Site Model is Fundamentally Flawed, Necessitating Substantially Revised Reports for Public Comment Before Submission to the Department.</u>

In the reports, Evergreen has set forth a Conceptual Site Model (CSM) that reflects its view of geologic conditions and the contamination of the soil and groundwater. The "model" literally takes the form of a narrative text that has evolved over time, through the following documents: (1) 2003 Consent Order, (2) 2003 Phase I Remedial Plan, (3) 2004 Current Conditions Report, and (4) reports for the individual Areas of Interest. As developed and revised by Evergreen, this model is flawed in a number of ways, set out more fully in Comments #6, 7, 8, 9, 10, 11, 12, 13, 14, and 15.

The Conceptual Site Model is at least three years old, with the last report being submitted in 2017. While Evergreen has prepared groundwater remediation status reports since that time, Evergreen has not synthesized material from those reports with the remedial investigation reports that are the subject of this comment period. *See* Comment # 6, below. Evergreen should bring the information and analysis up-to-date.

The model does not appropriately characterize geologic conditions (including the relationship between the unconfined aquifer (water table) and the deep aquifer). Evergreen's inadequately attempts to address concerns regarding the potential pathway of migration of contamination by way of the deep aquifer to water supplies in New Jersey. *See* Comment # 7, below.

Evergreen does not analyze the apparent Light Non-Aqueous Phase Liquids in combination with groundwater flow direction data and exceedances for Semi-Volatile and Volatile Organic Compounds and metals in the deep aquifer. Evergreen has not provided a meaningful analysis and synthesis of shallow and deep aquifer monitoring data.

The model does not provide a complete delineation of metals in the deep aquifer. With respect to the investigation of AOI-11, Evergreen sampled for a wider range of metals including arsenic and manganese before 2013. But since that time, it has scaled back this effort in the reports for the other Areas of Interest, without providing a meaningful explanation. *See* Comment # 8, below.

Evergreen provides no meaningful analysis regarding the sheet pile wall -- the last line of defense against the migration of contaminated groundwater, which tends to flow toward the Schuylkill River, as admitted by Evergreen. This is an 8400-foot wall along the perimeter of AOI-5, AOI-6, AOI-7, and AOI-2. Repetitive statements about it being protective are conclusory and circular. *See* Comment # 9, below.

Evergreen does not consider climate change in delineating contamination for a site that has a high water table and neighbors the Schuylkill River, which is anticipated to experience sea level rise of two feet by 2050. This is significant given the widespread lead contamination in the surface soils (0-2 feet) throughout the site. *See* Comment # 10, below.

To address numerous deficiencies in the reports, Evergreen has attempted to divert them into a Fate and Transport Remedial Investigation Report to be prepared later in 2021. *See* Comment # 11, below. This would put the public into the awkward position of commenting on only part of a remedial investigation, with an important part missing. These parts are interrelated. In addition, if the current reports were to be approved, an objection would inevitably be made that the scope of future public comments should exclude material relating to the current reports. This would result in fragmentation of the remedial investigation reports and it would be fundamentally unfair to the public.

Evergreen skips important steps in delineating soil contamination according to numeric values of the Act 2 regulations. Areas of the site have a high water table (at times, it is less than ten feet from the surface of the soil). Where the soil buffer distance for a particular contaminant is less than the depth of the water table, Evergreen should have characterized exceedances of the more stringent soil-to-groundwater numeric value (450 mg/kg, for lead), rather than the less stringent direct contact numeric value (1000 mg/kg, for lead). *See* Comment # 12, below. Where Evergreen has referred to the soil-to-groundwater numeric value, it has marginalized its significance, relegating it to data in long tables and not providing a proper focus in the narrative text. In some instances, the reports have erroneously ignored the soil-to-groundwater numeric value altogether.

The model mistakenly relies on a proposed site-specific standard for lead in residential soils of 2240 mg/kg, calculated in 2015 based on an assumed target blood level of 10 ug/dL. Even at that time, that value was contradicted by the Centers for Disease Control and Prevention, which used a reference value of 5 ug/dL for case management for children exposed to lead. *See* Comment # 13, below. Last month, the Department changed its mind regarding a proposed direct contact numeric value of 2500 mg/kg for lead, which had been calculated assuming a target blood level of 10 ug/dL. *See* Comment # 4, above. Because the Department is now assuming a target blood lead level of 5 ug/dL in support of a proposed direct contact numeric value of 1100 mg/kg, Evergreen should abandon the proposed site-specific standard.

The flaws in this approach have a significant impact on the nature and characterization of lead in the surface soils. *See* Comment # 14, below. This is especially the case for AOI-5 and AOI-9 -- two of the more heavily contaminated areas of the site.

When revising the reports, Evergreen should prepare and submit a work plan to include Per- and Polyfluoroalkyl Substances (PFAS) as a Constituent of Concern in this remedial investigation. *See* Comment # 15, below. These substances are associated with the use of foams provided for firefighting. There is a history of catastrophic fires at the refinery -- including a terrible fire that resulted in the deaths of eight firefighters in 1975. PFAS has been the subject of remedial investigations in other states. In a pending rulemaking, the Department has proposed to establish Medium-Specific Concentrations for three PFAS chemicals.

To properly address these flaws, Evergreen will have to make significant revisions that will change the reports in a material way. Therefore, the public should be allowed an

opportunity to comment on them again before submission to the Department. No prejudice to Evergreen will result from this. It currently has a ten-year timetable to come into attainment with applicable remediation standards. *See* 2020 First Amendment to Consent Order and Agreement, page 5 of 77. The last report was submitted over three years ago. Evergreen has not yet corrected deficiencies in a report relating to the deep aquifer that was disapproved by the Department in 2013 -- over seven years ago.

Under the revised consent order, Evergreen must provide a public comment period on the current reports by March 23, 2021. *See* 2020 First Amendment to Consent Order and Agreement, page 5 of 77. But the consent order is silent as to when Evergreen must submit the reports once it has received public comments. *See id.* Therefore, Evergreen has time to address the flaws in the model and the Department can require another public comment period before the submission of those revised reports.

6. **Evergreen Should Revise the Reports to Reflect Up-To-Date Material (Including Data and Analyses From Groundwater Monitoring Status Reports).**

While the Council appreciates the reopening of the public comment period for the reports, the public is now in the awkward position of providing comments on reports containing information, data, and analyses that may be out-of-date. The most recent report was submitted for AOI-8 in December 2017 -- over three years ago. *See* Evergreen, Act 2 Documents. In order for this public comment process to be meaningful, Evergreen should revise the reports to reflect more recent information, data, and analyses. It should also make the revised reports available for public comment again before submission to the Department.

The Department recognizes that a remedial investigation should address recent data that are representative of soil and groundwater conditions. According to its guidance document, soil data that are over two years old may be used in a site characterization only if conditions are not reasonably expected to change:

> Historical data (i.e., data more than two years old) can be used during site characterization ***if there is no reasonable expectation that the site conditions associated with the release being investigated have changed*** (e.g., changes in property use resulting in changes in exposure).

DEP, Technical Guidance Manual, Section II(A)(4)(b)(i), page II-13 (bold italics added for emphasis). The Department makes a similar statement regarding groundwater data for a site characterization:

> Remediators can use historic data for identifying trends at sites ***that are not reasonably expected to have changes in site conditions associated with the release being investigated*** (e.g., natural attenuation or degradation).

Id., Section II(A)(4)(b)(ii), page II-15 (bold italics added for emphasis).

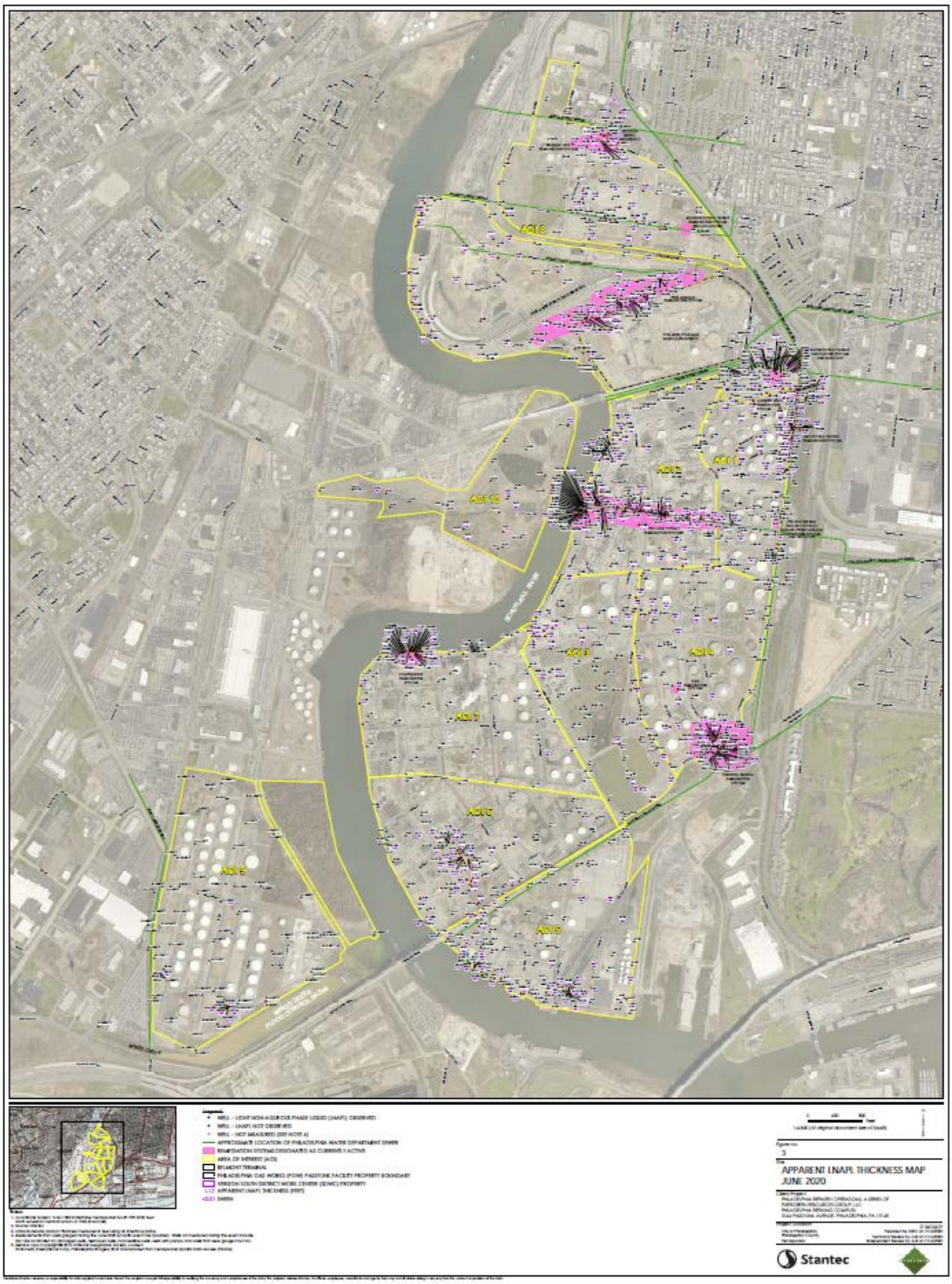
Because the last Evergreen report was submitted over three years ago, all the data underlying the reports are now considered "historical data," which should be used only if there is no reasonable expectation that the site conditions associated with the release being investigated have changed.

Presumably, Evergreen has the means to address this problem. Evergreen should synthesize the material from the groundwater remediation status reports prepared every six months since 2015. *See generally* Evergreen, Semi-Annual Remediation Status Reports. Those reports contain more recent data on groundwater. It would be a challenge for the public to undertake an analysis of those reports and synthesize them with the remedial investigation reports. This is something that Evergreen can and should do.

Those reports alone would not bring data and information up to date, as the ostensible purpose of them was different. But Evergreen will have gathered other information, data, and analyses relevant to the reports subject to this comment period. (In fact, we know that this is the case because Evergreen is attempting to divert a fate and transport analysis into another remedial investigation report later this year).

The groundwater remediation status reports identify wells that had not been installed when earlier reports were prepared. The 2013 report for AOI-11 does not reflect at least 15 additional deep wells that were apparently constructed since that time. *See* 2013 Report (AOI-11), Figures 5 and 6; *see also* Semi-Annual Remediation Status Report (Second Half 2019), Table 2 (Sitewide Fourth Quarter 2019 Gauging Data) (identifying 58 wells in the lower aquifer). They also provide more recent data on groundwater data in the deep aquifer.

In addition, those reports provide a more precise delineation of Light Non-Aqueous Phase Liquids in shallow wells. Figure 3 in a recent groundwater remediation status report not only shows the presence of additional wells installed since 2017, but also demonstrates the apparent thickness of Light Non-Aqueous Phase Liquids:



See Semi-Annual Remediation Status Report (First Half 2020), Figure 3 (Apparent LNAPL Thickness Map), pdf page 14 of 52. These liquids were present in shallow wells S-414 (thickness of 1.50 feet), S-382 (thickness of 0.92 feet) and S-283 (thickness of 0.54 feet). In

contrast, the remedial investigation report for AOI-3 shows no Light Non-Aqueous Phase Liquids in these shallow wells. *See* 2017 Report (AOI-3), Section 5.7 (LNAPL Characterization Results), pages 33-35, Figure 16 (Figure 16: Apparent LNAPL Thickness and Type), pdf page 173 of 760.

Evergreen should have synthesized and integrated material from those reports and done a similar analysis for all Areas of Interest.

Certainly, the data exist for doing this. In the tables in the groundwater remediation status reports there are columns setting forth the thickness of LNAPL. *See e.g.*, Semi-Annual Remediation Status Report (First Half 2020), Table 1 (First Quarter 2020 Gauging Data), Table 2 (Sitewide Annual 2020 Gauging Data), Table 3 (Comparison of Gauging Data for Select Wells). These data are not necessarily included in the remedial investigation reports.

Consistent with the Technical Guidance Manual, Evergreen should revise the reports so that the public is not commenting on reports containing historical data that are more than three years old. (It would not be a satisfactory response to this comment for Evergreen to simply assert that it has checked the groundwater remediation status reports and that it does not feel the need to revise the remedial investigation reports).

7. Evergreen Has Not Sufficiently Delineated the Nature and Extent of Contamination in the Deep Aquifer and the Unconfined Aquifer (Water Table).

There are fundamental flaws in Evergreen's analysis regarding the nature and extent of contamination in the deep aquifer and unconfined aquifer (water table), as well as in its analysis regarding the relationship between these aquifers.

A. Evergreen has not substantiated its assertion that significant contamination has not been observed in the lower aquifer.

In an answer to a question on its website, Evergreen makes the following statement:

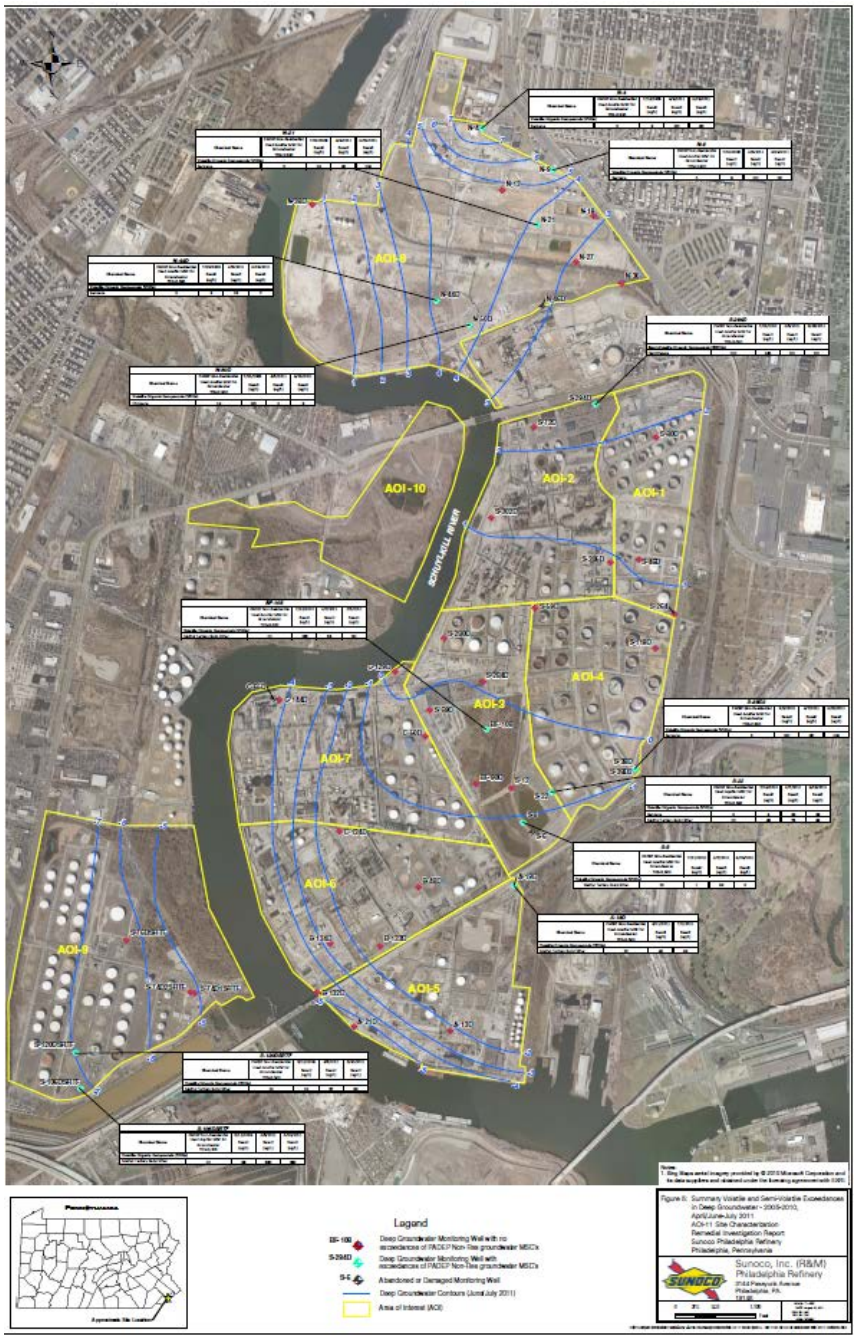
> Water quality in the lower aquifer is monitored through routine sampling of groundwater from approximately 80 wells, ***and to date significant contamination has not been observed in the lower aquifer beneath the Site.***

See Attachment 3 -- Q&A 19 (bold italics added for emphasis). It is not known what Evergreen means by this statement. Presumably, it means that there is contamination but that it is not significant. Reviewing the reports, it appears that the assertion is simply not correct.

In its comments on the first report for the deep aquifer, the Department noted exceedances of Medium-Specific Concentrations for a number of contaminants;

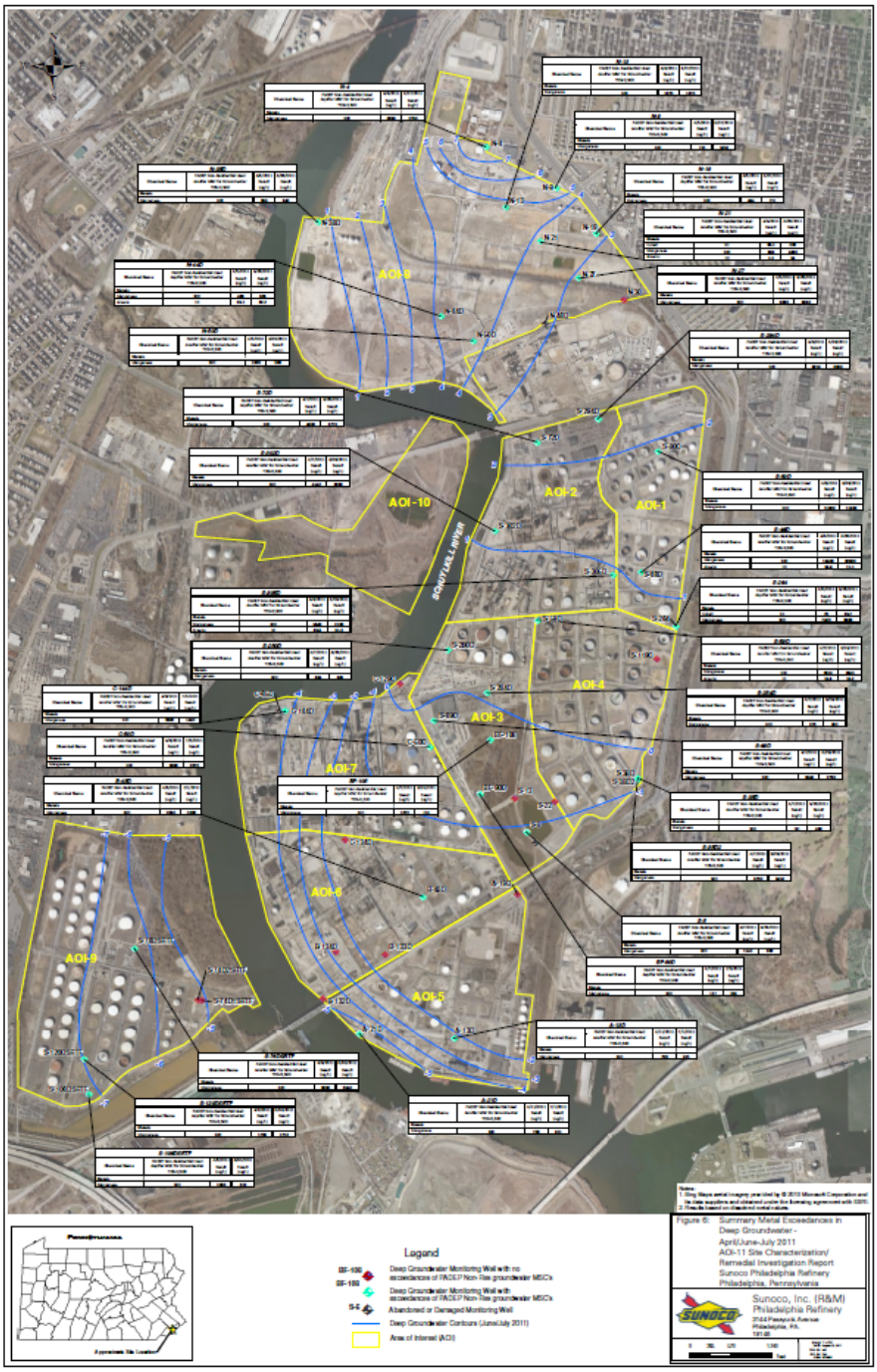
> ***Contaminants of concern (COC) that exceed the Department's non-residential statewide health standards*** (NRSWHS) in deep groundwater medium ***are***; ***chrysene, benzene, MTBE, naphthalene, cobalt, arsenic and manganese***. Iron exceeds the SMCL.

2011 Comments (AOI-11), paragraph 2 (bold italics added for emphasis). This was illustrated in the following Figures in the 2011 report. The figure for organic chemicals shows a large number of exceedances:



2011 Report (AOI-11), Figure 5 (Summary Volatile and Semi-Volatile Exceedances in Deep Groundwater - 2005-2010, April/June-July 2011); *see also id.,* Table 4 (2005-2010 Summary of Deep Groundwater Analytical Results); *see also id.,* Table 5 (April 2011 Summary of Deep Groundwater Analytical Results); *see also id.,* Table 6 (June-July 2011 Summary of Deep Groundwater Analytical Results), pdf pages 47-68, 75 of 76.

The figure for inorganic chemicals shows an even larger number of exceedances:

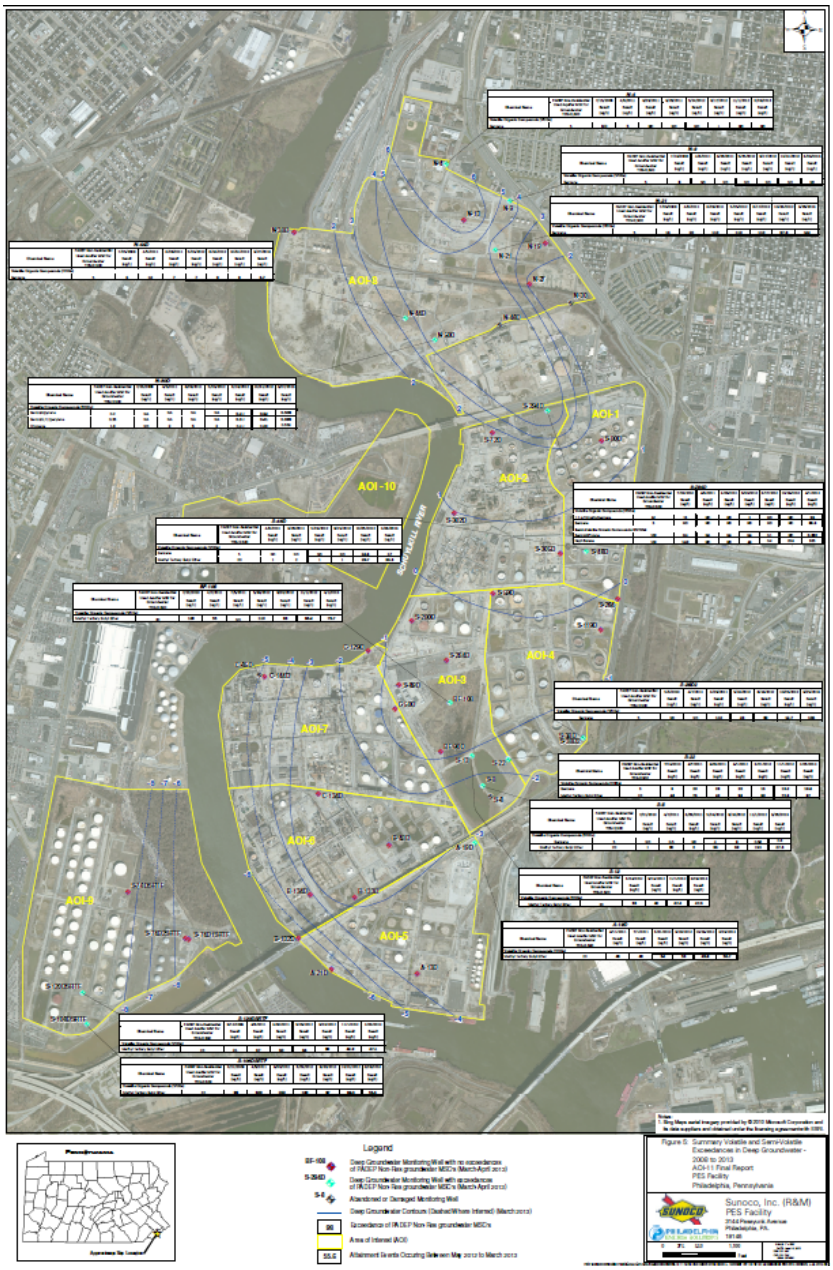


See id., Figure 6 (Summary Metal Exceedances in Deep Groundwater - April/June-July 2011); *see also id.*, Table 4 (2005-2010 Summary of Deep Groundwater Analytical Results); *see also id.*, Table 5 (April 2011 Summary of Deep Groundwater Analytical Results); *see also id.*, Table 6 (June-July 2011 Summary of Deep Groundwater Analytical Results), pdf pages 47-68, 76 of 76.

Evergreen also provides a textual narrative of the exceedances in its report. *See id.*, Section 5.1, pages 22-25.

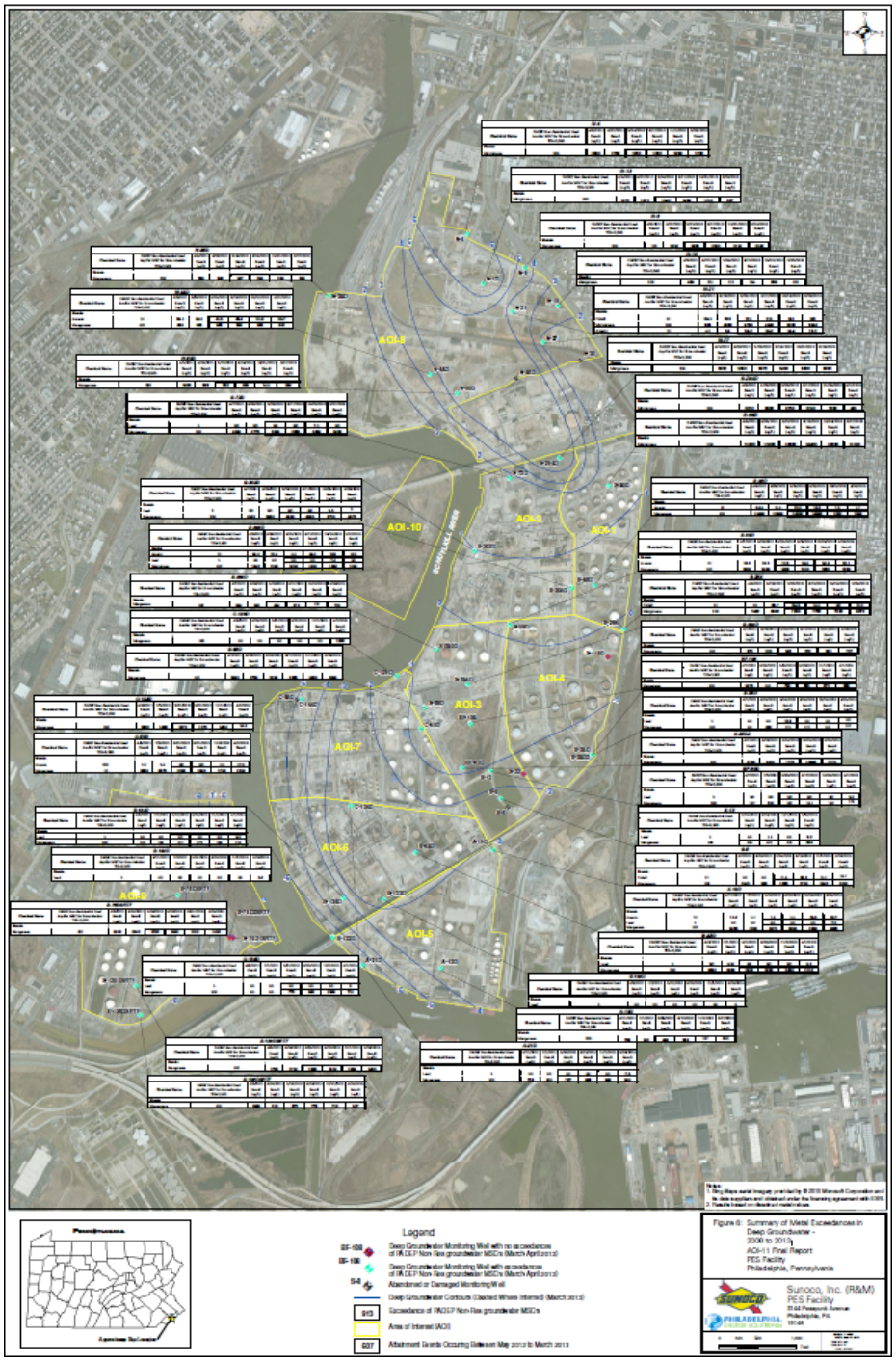
One would think that contamination is "significant" if the concentrations of contaminants are greater than a Medium-Specific Concentration for groundwater. That would make this contamination significant. If Evergreen is using another criterion to support its assertion regarding what is "significant," it should explain what it means.

The 2013 reports also demonstrate contamination of the deep aquifer above medium-specific concentrations. *See* 2013 Report (AOI-13), Section 5.2, pages 14-18. The figure for organic chemicals shows a large number of exceedances:



See id., Figure 5 (Summary Volatile and Semi-Volatile Exceedances in Deep Groundwater -- 2008 to 2013); *see also id.*, Table 4 (Summary of Deep Groundwater Analytical Results - 2005 to 2011), Table 5 (Summary of Attainment Sampling Deep Groundwater Analytical Results 2012-2013), pdf pages 45-77, 84 of 85.

The figure for in organic chemicals shows an even larger number of exceedances:



See id., Figure 6 (Summary of Metal Exceedances in Deep Groundwater - 2008 to 2013); *see also id.*, Table 4 (Summary of Deep Groundwater Analytical Results - 2005 to 2011), Table 5 (Summary of Attainment Sampling Deep Groundwater Analytical Results 2012-2013), pdf pages 45-77, 85 of 85.

In its comments at the time it disapproved the report in 2013, the Department noted elevated levels of Volatile Organic Compounds:

> The AOI 11 conceptual site model (§8.0) does not address the cause(s) for the occurrence of hydrocarbons in the Lower Sand aquifer. ***If the Middle Clay is a barrier to vertical migration of contaminants, then why are there elevated VOC levels in many areas? For example, at wells S-22 (AOI 3) and N-21 (AOI 8) benzene and/or MTBE are consistently elevated***, but the Middle Clay is ~20′ thick at these locations.

See 2013 Comments (AOI-11), paragraph 1 (bold italics added for emphasis). In addition, the Department noted the existence of plumes that were not properly characterized:

> 12. ***Keep in mind that deep aquifer "plumes" were characterized with single, isolated wells***. Sunoco did not delineate sources with peripheral wells, so we don't know if the concentrations at the presumed "source" wells are really reflective of the source area. ***They could be hundreds of feet downgradient or side-gradient of the greatest contamination***.

See id., paragraph 12 (bold italics added for emphasis).

In addition, subsequent remedial investigation reports demonstrate contamination of the deep aquifer in a number of Areas of Interest:

Area of Interest	**Title**	**Evergreen's References to Exceedances in the Deep Aquifer**
AOI-1 Point Breeze No. 1 Tank Farm	2016 Report (approved)	Section 4.3, page 4.29 ("Concentrations of the following COCs were detected in lower aquifer groundwater above the SHS during the 2014 sampling events: benzene, MTBE, and lead. It is noted that the 2014 exceedances of the SHS for benzene were only observed in offsite wells ARCO-1D, S-399D, and S-394.")
AOI-2 Point Breeze Processing Area	2017 Report (approved)	Section 7.3, page 44 ("Prior to 2016, lead, 1,2,4-TMB, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and naphthalene were the COCs in the lower aquifer groundwater that were detected above their respective PADEP non-residential groundwater MSCs.

		There were no detections of COCs in the lower aquifer above the respective PADEP non-residential MSCs during both the August and October 2016 groundwater sampling events.")
AOI 3 Point Breeze Impoundment Area	2017 Report (approved)	Section 5.4, page 32 ("Historically, lead, benzene, and MTBE are the only COCs that have been detected in the lower aquifer groundwater within monitoring wells in AOI 3 at concentrations exceeding their respective PADEP non-residential groundwater MSCs. EDB (also known as 1,2-dibromoethane) exceeded the PADEP non-residential groundwater MSC of 0.05 micrograms per liter (ug/l) at four of the seven lower aquifer wells sampled during the June 2015 event, with the highest detected concentration of 0.086 ug/l at monitoring well S-8. However, EDB (also known as 1,2-dibromoethane) was not detected in any of the six lower aquifer wells sampled, including monitoring well S-8, during the most-recent AOI 3 lower aquifer groundwater sampling event in December 2015.")
AOI-4 No. 4 Tank Farm	2013 Report (disapproved) 2017 Report (disapproved)	Section 5.3, pages 19-20 (only discussing samples for shallow aquifer) Section 10.5.2, page 10.64 ("Concentrations of the following COCs were detected above the SHS in lower aquifer groundwater during 2016 characterization sampling events (see Table 4-3): benzene, MTBE, and lead. Available historical analytical data from previous groundwater sampling events was reviewed by Stantec. That data indicates that no additional Evergreen Comprehensive List COCs were identified at concentrations in excess of the current SHS during past AOI 4 lower aquifer groundwater sampling; however, historical arsenic exceedances were noted.")
AOI-5 Girard Point South Tank Field	2011 Report/Cleanup Plan (disapproved)	Section 5.3, page 25 ("A MTBE concentration of 34 ug/L was detected in deep monitoring well A-19D located in the northern portion of AOI 5. No other COC concentrations above the PADEP nonresidential used aquifer (TDS<2,500) groundwater MSCs were

		detected in groundwater from monitoring well A-19D or the other two Lower Sand wells in AOI 5.")
	2017 Report (approved)	Section 5.7, page 51 ("Lower aquifer groundwater in monitoring well A-19D historically exhibited concentrations of MTBE exceeding the respective PADEP non-residential groundwater MSC. No other COCs have historically been detected in the lower aquifer within AOI 5 above their respective PADEP non-residential groundwater MSCs.")
AOI-6 Girard Point Chemicals Area	2013 Report (disapproved) 2017 Report (approved)	Section 5.3, pages 21-22 (only discussing samples for shallow aquifer) Section 9.3.2, page 36 ("None of the monitoring wells screened in the lower, semi-confined aquifer had exceedances of the non-residential groundwater MSCs.")
AOI-7 Girard Point Fuels Area	2012 Report (disapproved) 2013 Addendum to Report (disapproved) 2017 Report (approved)	Section 5.3, page 27 ("There were no COCs detected in deep monitoring wells at concentrations above their respective PADEP non-residential groundwater MSCs.") (only discussing samples for soil) Section 9.3.2, page 38 ("None of the monitoring wells screened in the lower, semi-confined aquifer had exceedances of the non-residential groundwater MSCs.")
AOI-8 North Yard	2012 Report (approved)	Section 5.3, pages 25-26 ("Benzene was detected in three deep (Lower Sand) monitoring wells (N-9, N-21, N-44D) at concentrations slightly above its respective non-residential PADEP groundwater MSC. Toluene, MTBE, 1,2-dichoroethane, xylenes (total), cumene, ethylbenzene, ethylene dibromide, pyrene, phenanthrene, fluorene, naphthalene, and lead were not detected in deep

	2017 Report (approved)	groundwater in AOI 8 at concentrations above their respective PADEP non-residential groundwater MSCs." Section 9.4.2, page 9.63 ("Along with benzene, several SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, BEHP (also known as di(2-ethylhexyl) phthalate), phenanthrene, pyrene, and naphthalene), and metals (lead, manganese, arsenic, chromium, and cobalt) were detected above the respective SHS in certain lower aquifer wells (Table 4-3).")
AOI-9 Schuylkill River Tank Farm	2015 Report (disapproved) 2017 Report Addendum (approved)	Section 5.7, page 39 ("In 2009, MTBE was detected in the deep groundwater in monitoring wells at a concentration exceeding its respective PADEP non-residential groundwater MSC. …. During the baseline March 2015, August 2015, and November 2015 sampling events, benzene and MTBE were detected in deep groundwater and 1,2-dichloroethane was detected in newly installed well, S-110D SRTF, at concentrations exceeding their respective MSCs.") Section 4.3, page 18 ("In 2016, MTBE was the only site COC that was detected in the lower aquifer groundwater in two monitoring wells (S-118DSRTF and S-143SRTF) at concentrations exceeding its respective PADEP non-residential groundwater MSC.")
AOI-10 West Yard	2011 Report (approved)	Section 4.4, page 19 (only discussing results for shallow and intermediate wells)
AOI-11 Deep Aquifer Beneath Complex	2011 Report	Section 5.1, page 23 ("COCs at concentrations above their respective non-residential groundwater MSCs included: benzene, chrysene, methyl tertiary butyl ether (MTBE), naphthalene, arsenic, cobalt, and manganese.")

	2013 Report (disapproved)	Section 6.2, page 15 ("COCs detected at concentrations above their respective non-residential groundwater MSCs during the AOI 11 groundwater attainment sampling included: benzene, benzo(a)pyrene, benzo(G,H,I)perylene, methyl tertiary butyl ether (MTBE), 1,2,4 – trimethylbenzene, chrysene, naphthalene, lead, arsenic, cobalt, and manganese. Iron was detected over the SMCL.")

B. Evergreen does not sufficiently address the concern for contamination potentially migrating to New Jersey.

In its comments on the first report for AOI-11, the Department stated that Sunoco had not supported its assertion that the PRM aquifer system is not a pathway for exposure through a drinking water supply in New Jersey:

> 9. On Page 10 of the SCR/RIR, the following statement appears: "The PRM aquifer system no longer is used as a source of water supply in Philadelphia because of highly elevated concentrations of iron … etc." ***This statement is somewhat misleading since it is offered without any further information about water uses associated with this aquifer. DEP requests that the SCR/RIR also provide information to the effect that the PRM aquifer system is used as a source of water supply in New Jersey***. According to USGS's 2003 report, "Ground-water flow from areas of contamination in South Philadelphia to adjacent downgradient areas of New Jersey has the potential to affect supply wells drawing water from the lower aquifer of the PRM." (Sloto, 2003, page 35).

2011 Comments (AOI-11), paragraph 9 (bold italics added for emphasis).

The Department made a similar statement when it disapproved the report for AOI-11 in 2013:

> 21. ***The report did not address potential downgradient receptors of the Lower Sand aquifer contamination, particularly for inorganics.*** This was a concern in DEP's 9 Dec 2011 comments on the Sep 2011 RIR (item 9). The deep aquifer is a water supply for New Jersey. ***Sunoco proposes eliminating the groundwater exposure pathway in a 1-mile distance around the facility, but this would not include wells in New Jersey***.

2013 Comments (AOI-11), paragraph 21 (bold italics added for emphasis).

In fact, this was one of the deficiencies identified in disapproving the report;

> ***The evaluation of groundwater exposure pathways for potential human receptors was insufficient. Sunoco should examine an unidentified well downgradient of AOI 9 and water supply wells in New Jersey***. The receptor evaluation is required by Section 250.404(a).

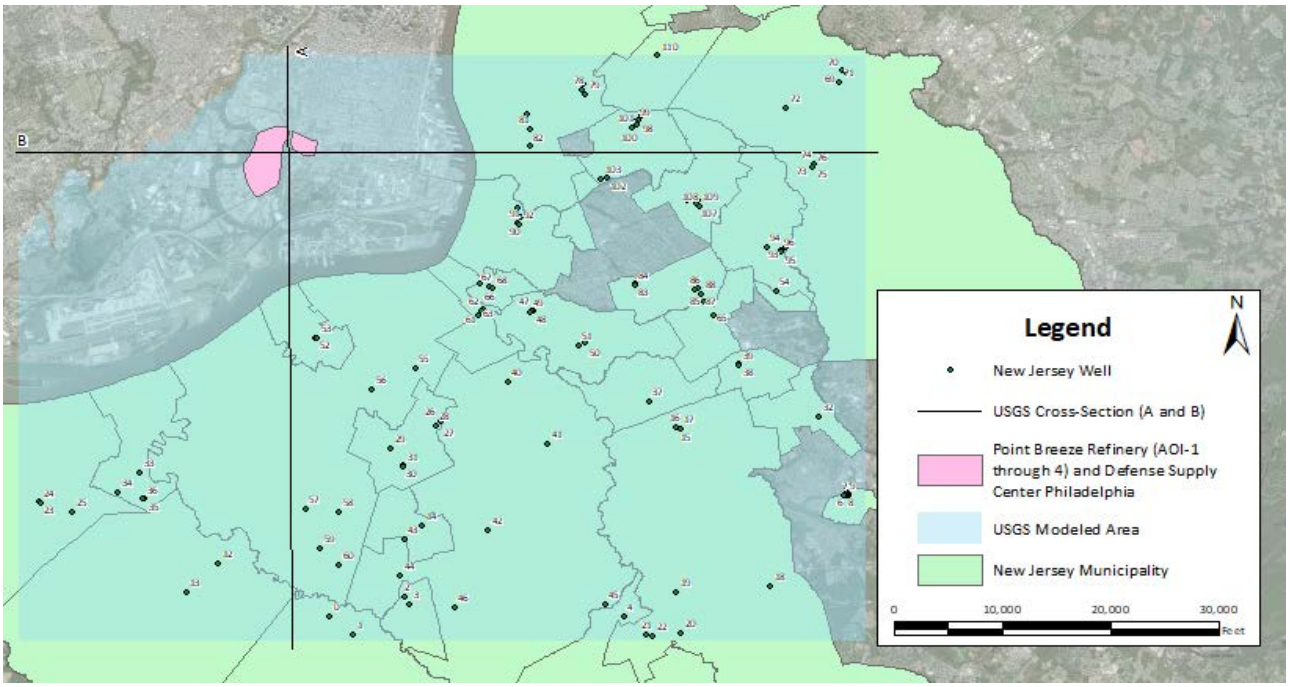
2013 Disapproval Letter (AOI-11), paragraph 2 (bold italics added for emphasis).

C. New Jersey's efforts to limit but not restrict withdrawals from the deep aquifer do not eliminate a pathway of contamination.

New Jersey continues to rely on the deep aquifer as a sole source supply. As of 2015, supply wells within the modeled study area in the 2001 USGS report were withdrawing approximately 4 billion gallons of water each year.

Created by the Council, the following Figure shows the New Jersey Potomac-Raritan-Magothy Aquifer supply wells used in the USGS model, in relation to the refinery site. The refinery site is colored in pink and is located to the west of the A cross-section and to the north and south of the B cross-section:

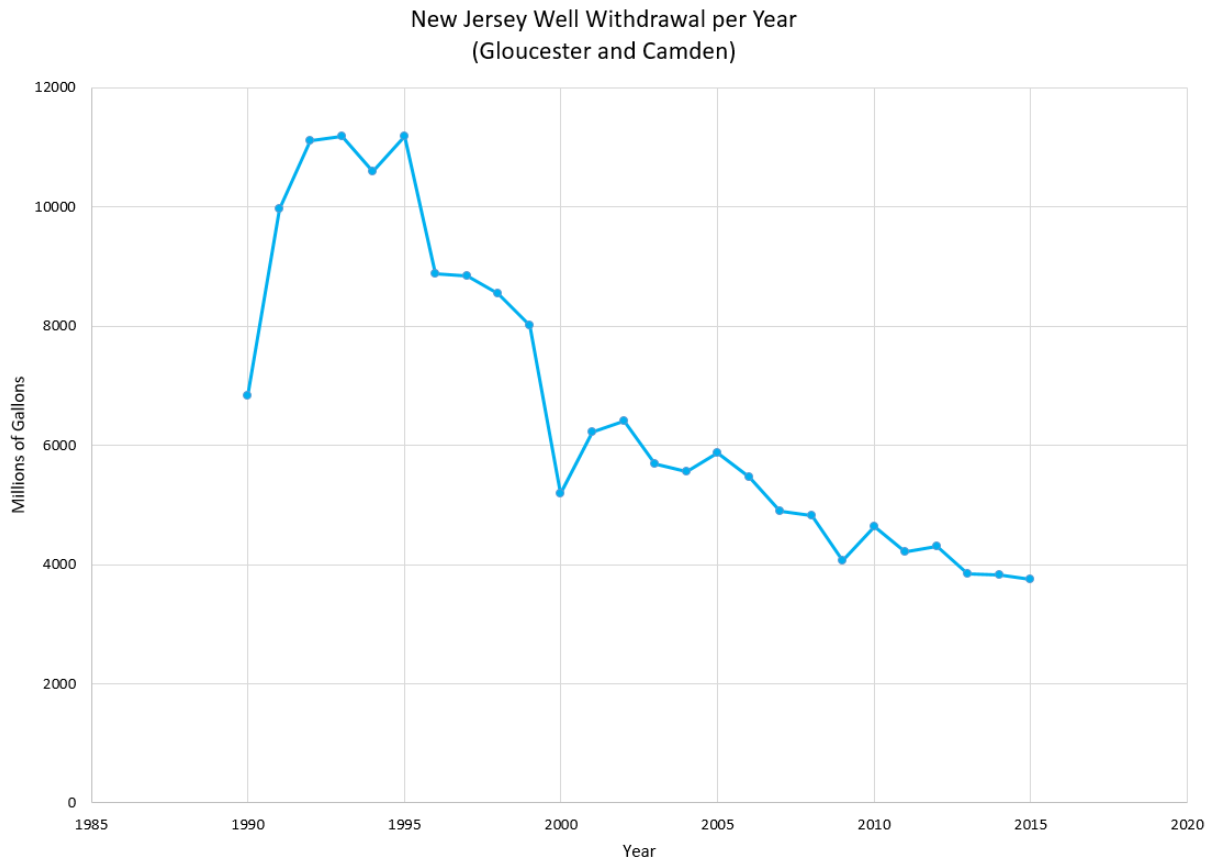
Modeled Wells in 2001 USGS Report
(prepared by Clean Air Council)



Source of data: USGS Report 2001-4218 (2001).

Created by the Council, the following Figure shows the amount of groundwater withdrawals from these supply wells, for the years 1990-2015:

Graph of Modeled Pumping Wells Withdrawal
In 2001 USGS Report
(prepared by Clean Air Council)



Source: USGS Report 2001-4218 (2001) and New Jersey Department of Environmental Protection Digital Geodata series DGS10-3, New Jersey Water Withdrawals.

The 2001 USGS report concluded that "the increased pumping in New Jersey maintained the downward vertical gradients." *See* USGS Report 2001-4218 (2001), page 22. This indicates a concern for the migration of contaminants to New Jersey.

There continues to be a risk of migration of contaminants by way of the deep aquifer to water supply wells in New Jersey, despite the fact that New Jersey has taken steps to decrease its reliance upon the deep aquifer for water supply. While the yearly withdrawal from Gloucester County and Camden County public supply wells declined from approximately 11,000 million gallons in 1995 to about 4,000 million gallons in 2015, that still is a significant level of withdrawal above the level of zero. *See* USGS 2001-4218 Report (2001), page 15; *see also* Graph of Modeled Pumping Wells Withdrawal In 2001 USGS Report (prepared by Clean Air Council, above).

The decrease appears to have resulted from the designation of Water Supply Critical Areas (N.J.A.C. 7:19-8) in two areas in the New Jersey Coastal Plain. The Department designated Water Supply Critical Area 2 to encompass all of Camden County and most of Gloucester County, as well as parts of other Counties. *See* N.J.A.C. 7:19-8.5(b), https://www.nj.gov/dep/rules/rules/njac7_19.pdf. It is the understanding of the Council that this program reduced groundwater withdrawals in areas of overdraft in conjunction with development of new surface water sources.

To support this initiative, the Tri-County Project is the primary water source to meet growing demands in the region. Major infrastructure improvements allowed the areas that previously solely relied upon the local PRM withdrawals to tap into this regional solution which is primarily a surface water source obtained from the Delaware River.

It is the understanding of the Council that Water Supply Critical Area 2 applies to the PRM aquifer system in parts of Ocean, Burlington, Camden, Gloucester and Atlantic Counties. Withdrawals are not prohibited from the PRM aquifer system in these counties, but are restricted. *See* N.J.A.C. 7:19-8.5, https://www.nj.gov/dep/rules/rules/njac7_19.pdf.

It is the Council's understanding that New Jersey has delineated well head protection areas for unconfined wells completed above the Potomac, but that this does not extend into Pennsylvania. *See* Spayd and Johnson, Guidelines for Delineation of Well Head Protection Areas in New Jersey (2003). To the extent that this report contemplates limiting wells tapping into the confined or deep aquifer, it only contemplates setting up a 50-foot wellhead protection area subject to a site-specific delineation based on the presence or absence and nature of intervening confining units. *See id.*, page 4. This does not suggest that the use of the confined aquifer in New Jersey is strictly prohibited.

While New Jersey maintains a database for water quality data, this is limited by the reporting by public supply wells in New Jersey, who are required to monitor and report water quality data quarterly. *See* NJ DEP, Drinking Water Watch. The presence or absence of an exceedance for a particular chemical in the raw water found in this database would not alone be dispositive of the question of a pathway between the refinery and the water supply in New Jersey.

D. The reports indicate the presence of a vertical pressure gradient, which Evergreen inappropriately attempts to avoid through the preparation of another remedial investigation report later in the year.

When Evergreen offers an analysis of "pressure gradients" in a future report, it admits that its analysis of the missing aquitard is deficient. *See* Comment 4 (relating to Evergreen's Q&A 19). It is not clear whether Evergreen's analysis of "pressure gradients" in a future report would involve new data or existing data. But at a minimum, Evergreen's analysis would be new because it is not located in the reports on which the public is now commenting.

In addition, available data in Evergreen's own reports indicates that there is a downward pressure gradient throughout most of the site:

Area of Interest	Title	Evergreen's References to Downward Gradients
AOI-1 Point Breeze No. 1 Tank Farm	2016 Report	Section 5.4, page 5.39 ("Overall, hydraulic head potentials range from approximately 5.5 feet to -2.5 feet."
AOI-2 Point Breeze Processing Area	2017 Report (approved)	Section 2.2.3, page 15 ("The observed head differences correspond to downward vertical hydraulic gradients ranging between 0.015 ft/ft to 0.051 ft/ft."
AOI 3 Point Breeze Impoundment Area	2017 Report (approved)	Appendix I, page I-5 ("The observed head differences correspond to downward vertical hydraulic gradients ranging between 0.005 to 0.05 feet/feet (ft/ft).")
AOI-4 No. 4 Tank Farm	2013 Report (disapproved) 2017 Report (disapproved)	Appendix F, Section F.5.3, page F-8 ("For these wells the hydraulic gradient (0.0035) measured in the southern portion of AOI 4 during the 2005 Site Characterization Report (SCR) was used for their QD simulations.") Section 10.2, page 10.59 ("Across most of the study area (including all well pairs in AOI 4), the hydraulic head potential between observed aquifers was positive (downward) in May 2016 (Figure 5-8)."
AOI-5 Girard Point South Tank Field	2011 Report/Cleanup Plan (disapproved) 2017 Report (approved)	Section 2.3.2, page 11 ("Groundwater elevations in A-13D, A-19D, and A-21D were lower than elevations observed in nearby shallow wells indicating a downward vertical gradient exists between the shallow and the deep monitoring wells.") Section 2.2.3, page 15 ("The observed head differences correspond to downward vertical hydraulic

		gradients of 0.082 and 0.16 ft/ft at the A-13 and A-21 monitoring well pairs, respectively.")
AOI-6 Girard Point Chemicals Area	2013 Report (disapproved) 2017 Report (approved)	Section 2.2.1, page 8 ("Based on the December 2012 groundwater gauging event, the hydraulic gradient in the shallow/intermediate monitoring wells ranged from 0.003 near B-135 in the central portion of AOI 6 to 0.062 near B-169 in the western part of AOI 6 near the sheet pile wall"). Section 5.2.3, page 28 ("There is a downward gradient between the unconfined and lower aquifers. These gradients are consistent with previous data collected in AOI 6 (2013 RIR).")
AOI-7 Girard Point Fuels Area	2012 Report (disapproved) 2013 Addendum to Report (disapproved) 2017 Report (approved)	Section 2.3.2, page 13 ("Groundwater elevations in the deep zone are lower than the shallow/intermediate zone, exhibiting a downward vertical hydraulic gradient.") Section 9.2.3, page 37 ("There is a downward gradient between the unconfined and lower aquifers. These gradients are consistent with previous data collected in AOI 7 (2010 RIR and 2012 RIR).") Section 5.2, page 30 ("It is also noted that hydraulic head potentials between the unconfined and lower aquifers are downward across AOI 7.")
AOI-8 North Yard	2012 Report (approved) 2017 Report (approved)	Section 8.0 Site Conceptual Model, page 46 ("A downward vertical flow gradient exists between the shallow and deep zone as indicated by the groundwater elevations in the following monitoring well pairs: N-3/N-4, N-12/N-13, N-8/N-9, N-18/N-19, N-20/N-21, N-29/N-30, N-38/N-38D, N-43/N-44D, N-47/N-46D and N-51/N-50D. This is consistent with vertical gradients elsewhere in the refinery." Section 5.4.1, page 5.44 ("The positive potentials in AOI 8 ranged from approximately 3 feet to 11 feet. Near-equal hydraulic heads are assumed to be present in the lower aquifer subcrop area, as exemplified by wells N-137 and N-4; however, separation of geologic

		units in the area is difficult using existing lithologic logs.")
AOI-9 Schuylkill River Tank Farm	2015 Report (disapproved) 2017 Report Addendum (approved)	Section 2.2.3, page 14 ("As defined above, the deep aquifer is the Lower Sand which is a semi-confined to confined aquifer except where the clay aquitard is absent. Groundwater flow in the deep aquifer in the area where the Lower/Middle clay is absent is divergent due to gradual downward vertical groundwater migration through this area from the shallow aquifer. Following recharge from the shallow aquifer groundwater generally flows towards the southwest in the direction of regional flow patterns.") Appendix I, page I-5 ("The head differences measured in October 2016 between paired monitoring wells in the unconfined and lower aquifer (S-74D2SRTF/S-7D1SRTF, S-118SRTF/S-118DSRTF S-137SRTF/S-138SRTF, and S-142SRTF/S-143SRTF) ranged between zero (S-118SRTF/S-118DSRTF) to 4.28 (S-74D2SRTF/S-74D1SRTF). The observed head differences correspond to a downward vertical hydraulic gradient of 0.067 feet per feet (ft/ft) near the potentiometric high point of the unconfined aquifer (S-74D2SRTF/S-74D1SRTF) and transition to an upward vertical hydraulic gradient of 0.016 ft/ft (S-142SRTF/S-143SRTF) near Mingo Creek basin. The upward vertical hydraulic gradients observed are most likely attributable to the artificial lowering of the unconfined aquifer potentiometric surface due to the pumping in Mingo Creek basin.")
AOI-10 West Yard	2011 Report (approved)	Section 7.2, page 25 ("The vertical hydraulic gradient between the shallow and intermediate (Trenton Gravel) zones is downward at an average of 0.325 ft/ft"), but not addressing the gradient with respect to the deep aquifer)
AOI-11 Deep Aquifer Beneath Complex	2011 Report	Section 7.2, page 28 ("Downward vertical gradients exist between the shallow/intermediate and deep monitoring wells throughout the refinery with the exception of AOI 9 where deep groundwater flows vertically upward at the edges of the semi-confining clay.")

	2013 Report (disapproved)	Section 8.2, page 25 ("Downward vertical gradients exist between the shallow/intermediate and deep monitoring wells throughout the facility with the exception of AOI 9 where deep groundwater flows vertically upward at the edges of the semi-confining clay.")

According to a report regarding a hydrogeologic reconnaissance of the Swope Oil Superfund site and vicinity in Camden and Burlington counties in New Jersey, the downward leakage of water through confining units are the primary sources of recharge to the confined lower aquifer:

> Induced recharge into the Potomac-Raritan-Magothy aquifer system from the Delaware River ***and downward leakage of water through confining units*** toward pumping centers in Camden County ***are the primary sources of recharge to the confined lower aquifer***.

USGS Report 89-402 (1990), page 1. The pressure gradients described by Evergreen across the AOIs supports the downward leakage as a primary source of recharge through the clay at the refinery site.

Evergreen should quantify the range of pressure gradients in the AOIs where those data are not specified in the table above. The predominantly downward vertical gradient is influenced in part due to the pumping of the NJ deep aquifer wells, but this variable is fairly constant site-wide.

The unconfined and semi-confined to confined deeper aquifer interactions are complex. Evidence of this complexity is shown in the pressure gradient values listed above, which suggest variable, heterogeneous and anisotropic subsurface conditions. Thus the presence or absence of and nature of the clay (whether it is lensed with sand, is silty, soft, muddy, hard, etc.) likely has a significant impact on the pressure gradients. Larger gradients may have greater propensity for vertical leakage of shallow groundwater contamination into deeper aquifers. Smaller gradients may have the opposite effect.

Evergreen should prepare an analysis of the vertical gradients by quantifying those gradients in all Areas of Interest, understanding the significance of the values and drawing relationships between the gradients and the nature of and extent and thickness of the clays.

Specifically for AOI-9, Evergreen maps a perching clay layer within the unconfined aquifer. In its analysis of vertical gradients, Evergreen should explore the impact of this perching clay layer. In its characterization of the vertical gradients in the table above,

Evergreen does not reference or cite how the perching clay may impart influence on the gradients.

E. Evergreen fails to map the extent and thickness of the clay separating the unconfined and lower aquifer.

At the time of its disapproval of the report for AOI-11, the Department expressed a concern about the absence of the Middle Clay in AOI-9:

> 2. ***Why are there no downgradient property boundary wells at AOI 9 (i.e., along the western edge, see Fig. 5)?*** There are clearly potential storage tank and pipeline sources in the area between the existing deep monitoring wells and the property line. ***The Middle Clay is absent there***. Has Sunoco adequately determined conditions at the point of compliance?

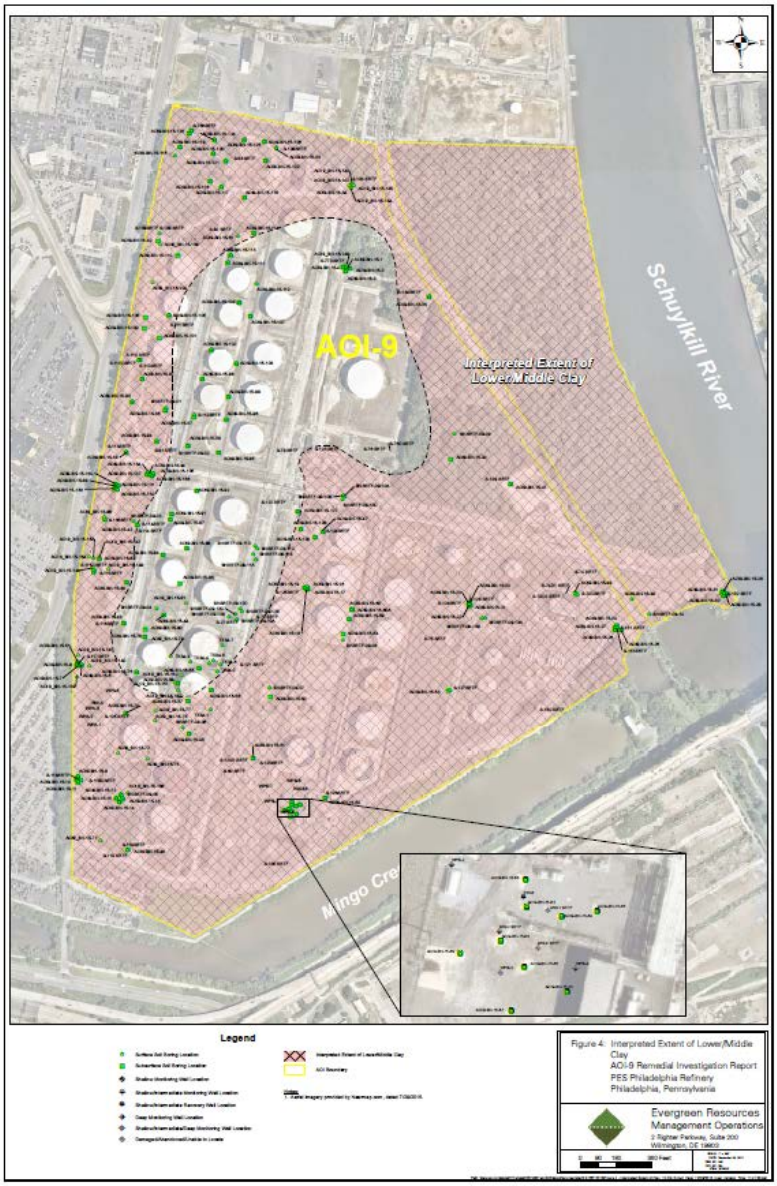
See 2013 Comments (AOI-11), paragraph 2 (bold italics added for emphasis).

As discussed above in the context of Evergreen's Q&A, Evergreen admits that its mapping of clay in the present reports is deficient, by offering to provide mapping of the middle clay unit aquitard in a future report. *See* Comment #4, above).

Evergreen fails to delineate the areal extent of the upper and middle/lower clay units. The unit is discontinuous across areas of the site. Where thick and present, this unit separates the unconfined shallow water table and deeper semi-confined and confined aquifer, and it may offer protection to the lower aquifer from shallow contaminants. The conceptual model does not map the continuity of this clay nor does it map areas of the site where it is thin to absent.

For example, for AOI-5 Evergreen asserts that the Lower/Middle Clay is believed to pinch out to the southeast in the direction of the confluence of the Schuylkill and Delaware Rivers. *See* 2017 Report, page 11. Cross sections provide more information. *See* 2017 Report, Figure 5a (Geologic Cross Section A-A') and Figure 5b (Geologic Cross Section B-B'). However, Evergreen fails to map the continuity of the clay and the areas where it is thin or absent.

Apparently in response to the Department's comment on the report for AOI-11, Evergreen has attempted to map the extent of a shallow (not deep) perching clay unit shown in AOI-9 reports:



See 2015 Report (AOI-9), Figure 4 (Interpreted Extent of Lower/Middle Clay); *see also id.*, Figures 4, 5, 7, 8, 9, 10.

Evergreen also did this in an addendum report for AOI-9:

2017 Report Addendum (AOI-9), Figure I-5 (Unconfined Aquifer MTBE Concentrations November 2016); *see also id.*, Figures I-2, I-3, I-4, I-5.

But Evergreen has not done this for the deep aquifer for AOI-9, and it has not done this for the other Areas of Interest. Evergreen should adopt a similar approach to mapping the extent of the clays for all Areas of Interest, for both shallow and deep units.

In its reports Evergreen fails to use isopach maps, which are a common technique for characterizing the nature of the geology at a site. Isopach maps can illustrate the extent of and thickness of intervening clay units. Where present and thick and uniformly clay, intervening clay units may protect the deeper aquifers from vertical leakage of shallow contaminated groundwater.

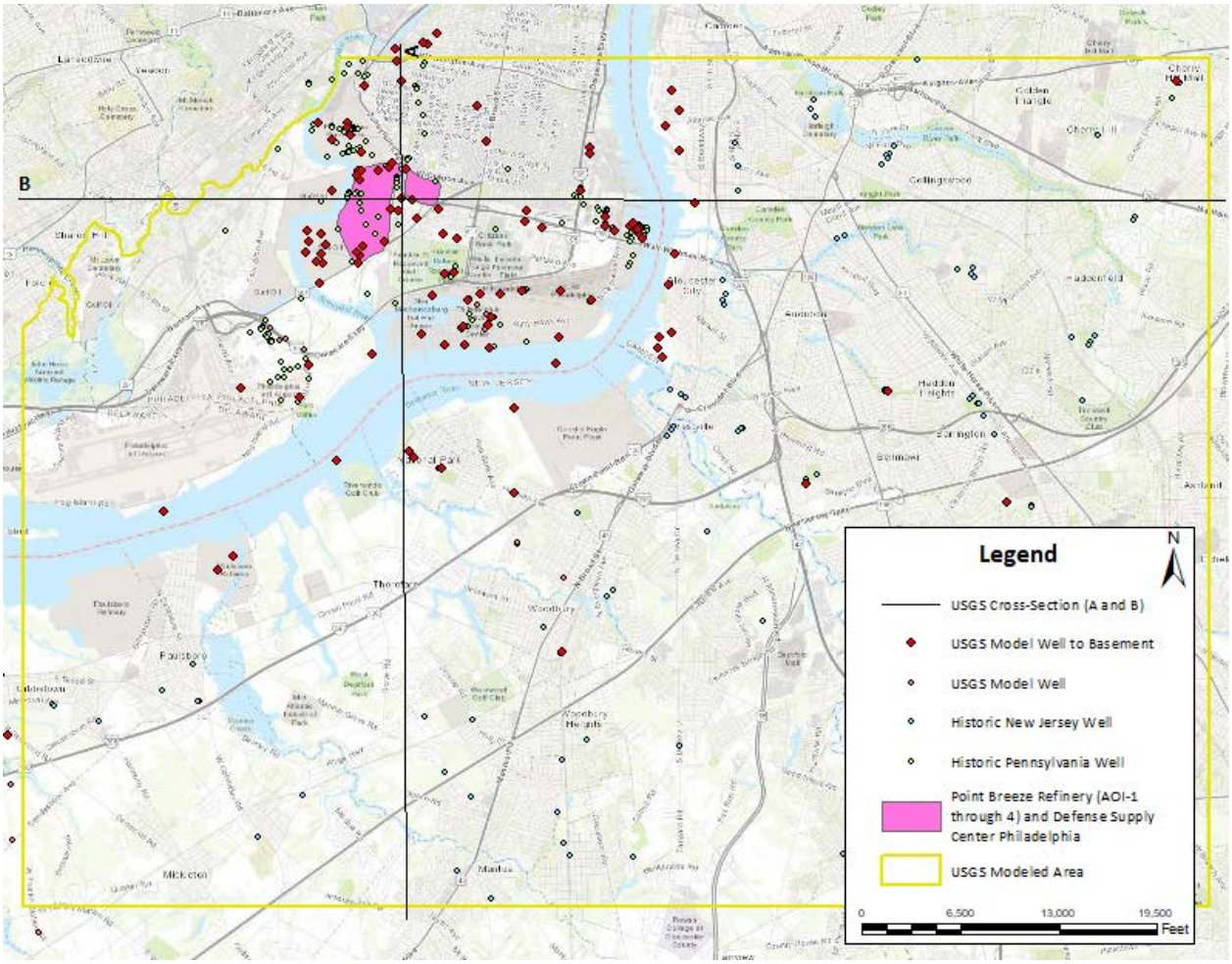
Conversely, in areas where the clay is absent, thin or non-uniform, the deeper aquifer may be less protected from vertical leakage of contaminated groundwater. Evergreen has included narrative and cross-section views to describe Areas of Interest where intervening clays may be present or absent.

Using the same example above, for AOI-5 Evergreen asserts that the Lower/Middle Clay is believed to pinch out to the southeast in the direction of the confluence of the Schuylkill and Delaware Rivers. *See e.g.* 2017 Report, Page 11. Cross section views provide more information *See e.g.* 2017 Report, Figure 5a (Geologic Cross Section A-A') and Figure 5b (Geologic Cross Section B-B'). However, Evergreen fails to present the information in planar or map view. The narrative and cross sections alone do not suffice or replace the need to characterize the clay spatially and vertically by also using isopach maps.

In contrast, the USGS has already developed a map of isopach clay thickness for the entire site, including AOI-1, AOI-2, AOI-3 and AOI-4. (In its own report, the USGS refers to these as the "Point Breeze Refinery"). The USGS actually uses some of the Evergreen wells in its analysis of geologic logs for borings extending to the basement rock. However, the USGS report pre-dates a number of the deep wells constructed at the refinery. Therefore, USGS has not integrated the whole of the refinery deep well logs and geologic data into its analysis.

Created by the Council, the following Figure shows a number of wells used by the USGS in its analysis, including many located on the refinery site:

Modeled Wells and
Cross-Sections A and B in 2001 USGS Report
(prepared by Clean Air Council)



Source of data: USGS Report 2001-4218 (2001), 10/22/2020 USGS email sharing the model archive summary for ancillary data used for this model.

From these data, the USGS has developed isopach thicknesses for the deeper clay units. Its isopach maps are an essential element of its conceptual model. The USGS sets them forth in the following three Figures:

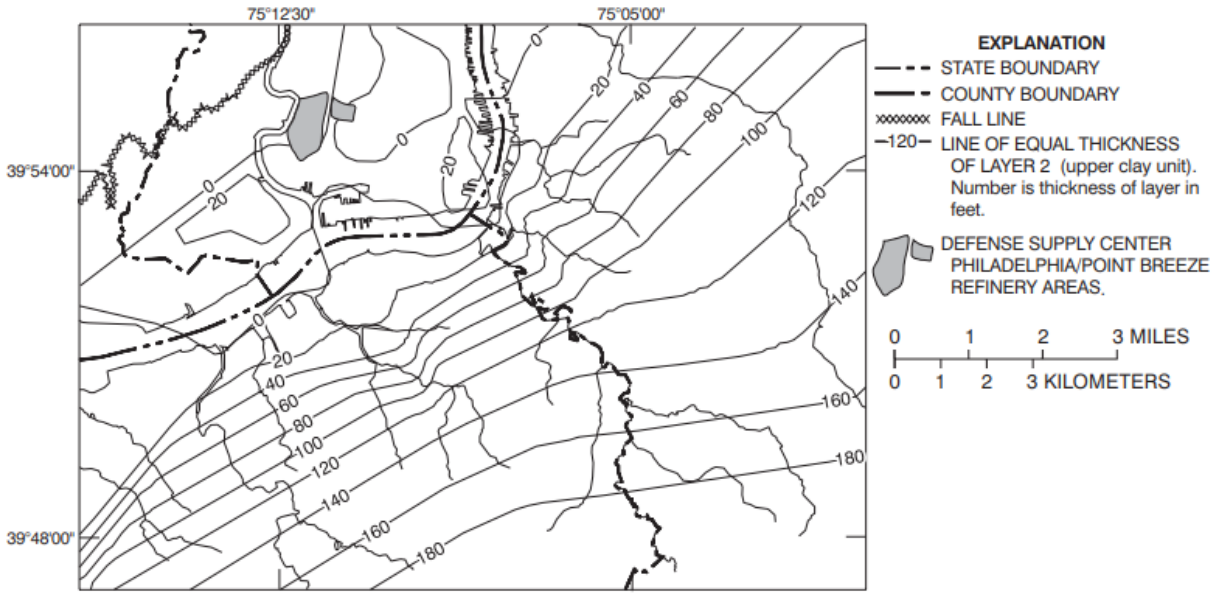


Figure 5. Thickness of the upper clay unit (model layer 2) of the Potomac-Raritan-Magothy aquifer system in the south Philadelphia area.

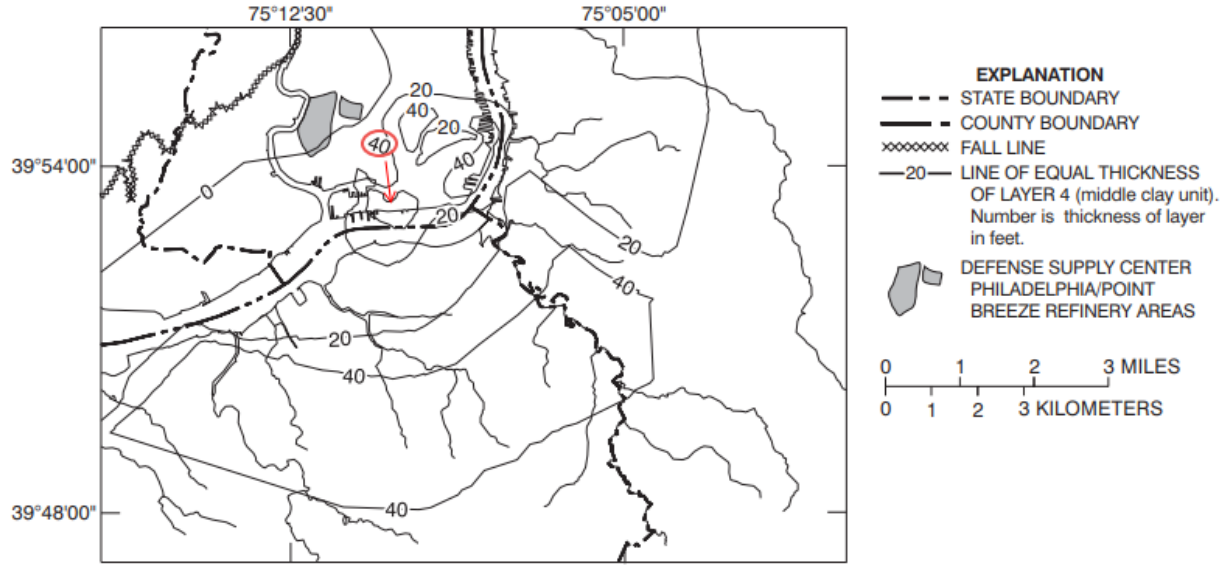


Figure 8. Thickness of the middle clay unit (model layer 4) of the Potomac-Raritan-Magothy aquifer system in the south Philadelphia area.

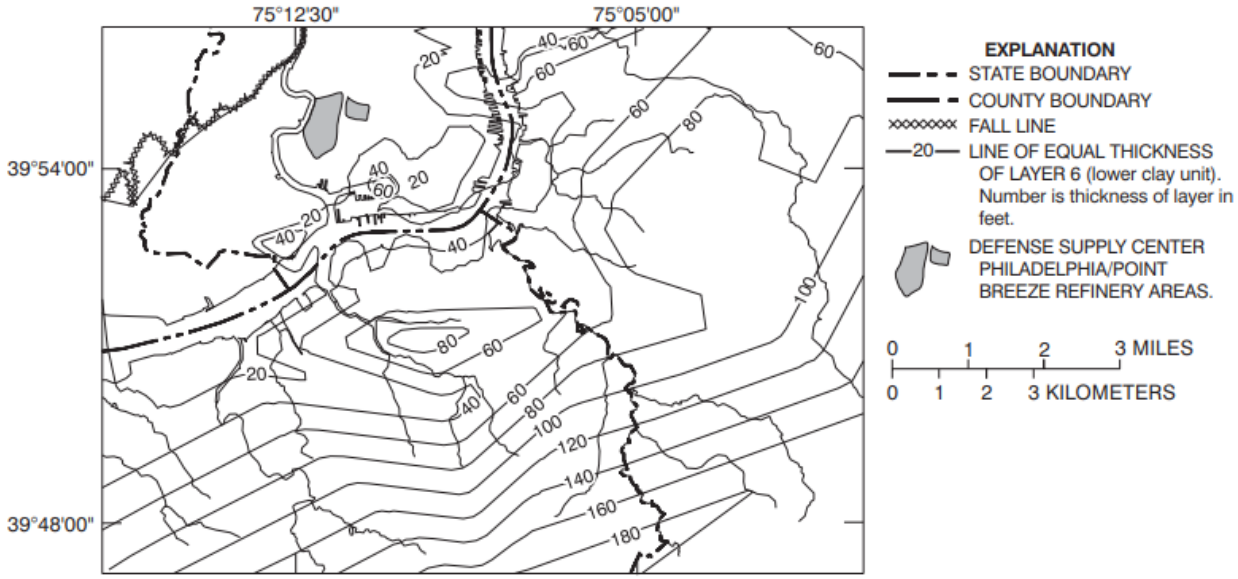


Figure 11. Thickness of the lower clay unit (model layer 6) of the Potomac-Raritan-Magothy aquifer system in the south Philadelphia area.

USGS Report 2001-4218 (2001), pages 8, 9, 11.

Evergreen did not prepare similar isopach maps for its reports. It should prepare similar maps to improve its conceptual model at the refinery site.

F. Evergreen has not established that the deep aquifer wells are properly located to sufficiently characterize the nature and extent of contamination.

While there are a number of deep wells throughout the site, it is not clear that they are all properly located and that the well network is reliable for delineating the nature and extent of contamination in the deep aquifer. The following comment addresses deep aquifer wells considered for the AOI-11 reports, subsequent remedial investigation reports for the different Areas of Interest, and the groundwater remediation status reports prepared up to 2020.

The Technical Guidance Manual underscores the importance of locating monitoring wells in areas of the property most likely to be impacted by contamination:

> B. Monitoring Well Types and Construction
>
> 3. Choice of Monitoring System
>
> Once ***the target zones, or areal locations and depths that are most likely to be impacted by the release are defined***, monitoring is often adequately accomplished by using ….wells that monitor the entire saturated thickness or a large portion of the target zone.

See Technical Guidance Manual, page A-7 (bold italics added for emphasis).

Locating wells in the deep aquifer is more challenging than locating wells in the unconfined aquifer:

> C. Locations and Depths of Monitoring Wells
>
> 5. Well Depths, Screen Lengths and Open Intervals
>
> Impacts to the aquifer under unconfined conditions are ***more easily evaluated than under confined or semi-confined conditions***…

See id., Technical Guidance Manual, page A-24 (bold italics added for emphasis).

The Technical Guidance Manual also underscores the importance of considering groundwater movement and the spatial distribution of contamination when establishing target zones for placement of monitoring wells:

> C. Locations and Depths of Monitoring Wells
>
> 4. Areal Placement of Wells
>
> For establishing the target zones, ***the remediator should consider the topics of groundwater movement and contaminant distribution….***
>
> Even well-defined groundwater flow direction maps should be evaluated carefully ***when choosing the target zones for upgradient and downgradient wells.***

See id., Technical Guidance Manual, pages A-23 to A-24 (bold italics added for emphasis).

Moreover, it is important to evaluate a confined aquifer in combination with an unconfined aquifer:

> ***...Sites with confined aquifers that have potential to be impacted will need to be evaluated in combination with the unconfined aquifer***. Such a situation would require more detailed vertical and discrete zone monitoring

See id., Technical Guidance Manual, page A-25 (bold italics added for emphasis).

The existence of groundwater remediation status reports may help to evaluate the appropriateness of the deep well network, because they define target zones or areal locations most likely to be impacted by releases. *See* Groundwater Remediation Status Report (First Half 2020), Figure 3 (Apparent LNAPL Thickness Map).

As discussed above in Comment #7(A), the detection of contaminants of concern in the deep aquifer demonstrates that it not only has the potential to be impacted, but that it has been impacted. *See* 2013 Report, Figure 5 (Summary Volatile and Semi-Volatile Exceedances in Deep Groundwater 2008 to 2013). The presence of volatile or semi-volatile organic compounds that exceed the Medium-Specific Concentrations is apparent in approximately 30% or 13 of the 43 sampled wells across AOI-11. Because of the identified contamination in the deep aquifer, Evergreen should evaluate the deep aquifer in combination with the shallow unconfined aquifer.

In its comments on the report for AOI-11, the Department was critical of Evergreen's characterization of the deep aquifer:

> Keep in mind that deep aquifer "plumes" were characterized with single, isolated wells. ***Sunoco did not delineate sources with peripheral wells, so we don't know if the concentrations at the presumed "source" wells are really reflective of the source area***. They could be hundreds of feet downgradient or side-gradient of the greatest contamination.

See 2013 Comments (AOI-11), Comment 12, page 2. This underscores the importance of evaluating the existing well network.

Past site characterization has led to the implementation of remediation at ten currently active systems in AOI-1, AOI-2, AOI-4, AOI-7, and AOI-8. Based on a recent groundwater remediation status report, the ten remediation systems designated as "currently active" are listed in the table below, prepared by the Council. *See* Groundwater Remediation Status Report (First Half 2020, Figure 2 (Site Plan), page 13. The table summarizes the position of deep aquifer well(s) respective to these system boundaries, setting forth the separation distance (distance from remediation system boundary to well location), monitoring well system type (well clustered or not), and estimated percent of deep aquifer screened (the portion of the well through which water from the aquifer may flow). Fields left blank indicate that well information was either not available or not located.

Currently Active Remediation Systems and Deep Well Position

(Prepared by Clean Air Council)

Remediation System	**Deep Wells Under System**	**Well Cluster (Y/N)**	**Percent of Deep Aquifer Screened (Estimate)**	**Nearest Deep Wells Outside System (Estimate)**	**Well Cluster (Y/N)[4]**	**Percent of Deep Aquifer Screened (Estimate[5]**
AOI-1 (Belmont Terminal / Loading Rack Remediation System)[6]	None			S-80D (700ft S) S-294D (1100ft W) S-393D (150ft E)	N N Y	55% 30% 30%
AOI-1 (Shunk Street Sewer Ventilation System and Biofilter)	None			S-393D (<50ft W)	Y	30%
AOI-1 (26th Street North Remediation System)	None			S-871 (<100ft S) S-389D (100ft SW) S-388D (700ft S) S-390D (800ft SW) S-391D (1400ft W)	Y Y Y Y Y	 40% 30% 30% 25%

[4] A well cluster refers to at least one well screened in the unconfined aquifer and one well screened in the deep aquifer, that are in close proximity. This is based on Figures in the remedial investigation reports and the groundwater remediation status reports.

[5] Clean Air Council made these estimates based on a review of cross sections and geologic well logs provided in the appendixes to the reports. The Estimated Deep Aquifer Screen refers to the section of the well where groundwater flows from the aquifer into the well through perforations.

[6] This represents the Loading Rack System (the Frontage Road System is offline). *See* Groundwater Remediation Status Report (First Half 2020), page 2.

AOI-1 (26th Street and Packer Avenue Sewers Biofilter Remediation System)	None			S-388D (300ft N) S-46D (500ft W) S-264D (900ft S) ARCO-1D (800ft SE) S-392D (900ft SW) S-399 (900ft SW)	Y N Y Y Y Y	30% 70% 40% 30% 45% 0%
AOI-2 (Pollock Street Horizontal Well Remediation System)[7]	None			S-302D (100ft N) S-305D (100ft S) S-46D (300ft E) S-390D (700ft N) S-391D (1000ft N)	Y Y N Y Y	60% 55% 70% 30% 25%
AOI-4 (Penrose Avenue Remediation System)	S-38D S-38D2	Y Y	100%	S-22 (500ft W) S-218D (1000ft N) S-39D (1100ft N)	Y Y N	40% 40% 20%
AOI-4 (S-30 Remediation System)[8]	None			S-218D (400ft N) S-22 (500ft N) BF-108 (1100ft N)	Y Y N	40% 40% 5%
AOI-7 (Separator Remediation System)[9]	C-144D C-65D	N Y	90% 80%	C-129D (1400ft NW)	Y	50%
AOI-8 (PGW Border Remediation System)	N-46D N-50D N-148D	Y Y N	5%	N-149D (700ft W) N-33 (700ft N) N-27 (300ft N) N-44D (400ft NW) N-30 (300ft E)	Y N N Y Y	

[7] The Pollock Street West End Remediation System has been turned off since 2016. *See id.*, page 3.
[8] The August presentation characterizes it as the "S-30 LNAPL Recovery System and the S-36 remediation system." *See* Evergreen, Act 2 Program Information Session (August 27 2020), page 47.
[9] The August presentation characterizes it as the "No. 3 Separator/Bulkhead Area." *See id.*

AOI-8 (Jackson Street Sewer Remediation System (Water Curtain)[10]	None			N-19 (200ft N) N-27 (300ft S) N-30 (300ft E) N-21 (600ft W)	Y N Y Y	
AOI-8 (Maiden Lane Remediation System)[11]	N-157 N-155	Y Y		N-9 (700ft E) N-4 (50ft N) N-13 (500ft S) N-21 (1100ft S)	Y Y Y Y	

Source: Groundwater Remediation Status Report (First Half 2020), 2013 Report (AOI-1), 2013 Report (part 2).

As indicated in the second column, there are no deep wells located under the area of the following active remediation systems: the four systems for AOI-1, the one system for AOI-2, one system for AOI-4, and one system for AOI-8. *See* Groundwater Remediation Status Report (June 2020), Figure 2 (Site Plan).

Moreover, at least 15 new deep wells have been installed since the time of the 2013 report for AOI-11. The data that are present in the groundwater remediation status reports do not establish that the deep aquifer well locations are sufficient to evaluate the nature and extent of the contamination in combination with the shallow aquifer. Those reports do not present a meaningful analysis regarding the appropriate location of the wells for purposes of the remedial investigation.

The movement of groundwater below the active remediation system boundaries should have been considered, but Evergreen has not explained or addressed it. While deep wells that are in or on the periphery of an active remediation system may help to characterize the nature and extent of contamination, the position (upgradient and downgradient) and presence or absence of clay layers separating the unconfined aquifer from the deep aquifer should be considered. Evergreen has not provided an explanation how it considered these groundwater movement details in placing deep monitoring wells.

[10] The Jackson Street Sewer Remediation System is offline, and therefore inactive. *See* Groundwater Remediation Status Report (First Half 2020), page 2. But Figure 2 characterizes the water curtain as an active remediation system. *See id.*, Figure 2. *See id.*

[11] A new total fluids groundwater remediation system has been installed (Maiden Lane Remediation System) and is expected to be operational in the second half of 2020. *See* Groundwater Remediation Status Report (First Half 2020), page 7. *See id.*

If Evergreen had been limited in where it could access locations for installing deep wells when the site was operated as a refinery in the past, that concern is no longer prevalent following the shutdown of refinery operations.

Based on this analysis, Evergreen should develop a thorough analysis of the adequacy of the deep well network to delineate the nature and extent of contamination.

G. Evergreen does not explain why only some deep wells located inside the active remediation systems are sampled in the groundwater remediation status reports.

Another problem is that Evergreen is not sampling all the deep wells that it has installed, even in the course of the active remediation. Prepared by the Council, the table below summarizes the status of water quality sampling at the deep wells inside the currently active remediation systems discussed above. Although they are within the remediation system boundaries, the majority of them are not sampled or not available to be sampled. *See* Groundwater Remediation Status Report (Second Half 2019).

Water Quality Sampling Performed
For Deep Wells in Active Remediation Systems
(Prepared by Clean Air Council)

Remediation System	**Deep Wells Under System**	**2016-2019 Groundwater Remediation Status Reports** **Water Quality Sampling Performed**
AOI-1 (Belmont Terminal Remediation System)	None	N/A - No Deep Wells
AOI-1 (Shunk Street Sewer Ventilation System and Biofilter)	None	N/A - No Deep Wells
AOI-1 (26th Street North Remediation System)	None	N/A - No Deep Wells

AOI-1 (26th Street and Packer Avenue Sewers Biofilter Remediation System)	None	N/A - No Deep Wells
AOI-2 (Pollock Street Horizontal Well Remediation System)	None	N/A - No Deep Wells
AOI-4 (Penrose Avenue Remediation System)	S-38D S-38D2	Not Sampled Sampled
AOI-4 (S-30 Remediation System)	None	N/A - No Deep Wells
AOI-7 (Separator Remediation System)	C-65D	Not Sampled, well abandoned or damaged
AOI-8 (PGW Border Remediation System)	N-46D N-50D N-148D	Not Sampled, well abandoned or damaged Not Sampled Not Sampled
AOI-8 (Jackson Street Sewer Remediation System (Water Curtain)	None	N/A - No Deep Wells
AOI-8 (Maiden Lane Remediation System)	N-157 N-155	Sampled Not Sampled

Source: Groundwater Remediation Status Report (First Half 2020), Figure 3 (Apparent LNAPL Thickness Map), Groundwater Remediation Status Report (2nd Half 2019), Table 3 (October/November 2013 Groundwater Sampling Analytical Results), 2013 Report (AOI-11), Figure 5 (Summary Volatile and Semi-Volatile Exceedances in Deep Groundwater - 2008 to 2013), 2013 Report, Appendix C (Deep Soil Boring Logs and Monitoring Well Construction Summaries).

As demonstrated in the table above, the only deep wells under the active remediation systems that were sampled were the following wells: S-38D2 (AOI-4), N-157 (AOI-8). The other 6 wells under the active remediation systems were not sampled.

Evergreen does not provide an explanation why all these deep wells inside the remediation system are not sampled. For well N-46D in AOI-8 (PGW Border Remediation

System) Evergreen indicates that it is not sampled because it is abandoned or damaged. But there is no explanation why N-50D is not sampled. This is particularly important because there were exceedances for volatile organic compounds in this well in the 2013 report. *See* 2013 Report, Figure 5. In addition, N-148D was drilled and constructed sometime after the 2013 report was submitted, N-148D. But Evergreen has not sampled this well, and it has provided no explanation for this.

H. Evergreen has not constructed the deep aquifer wells to screen the entire saturated thickness to sufficiently characterize the nature and extent of contamination.

As noted in the table in Comment #7(F), the estimated deep aquifer screen is far less than 100% for most of the 23 deep aquifer levels for which we have actual construction information. (Clean Air Council made these estimates based on a review of cross sections and geologic well logs provided in the appendixes to the reports). The deep aquifer screen refers to the section of the well within the deep aquifer where groundwater flows into the well through perforations. This means that Evergreen is not necessarily characterizing the contamination for the full length of the well. Evergreen has not provided an explanation for this.

The Technical Guidance Manual underscores the importance of the depth and screen length of monitoring wells:

> C. Locations and Depths of Monitoring Wells
>
> 5. Well Depths, Screen Lengths and Open Interval
>
> Groundwater monitoring networks should ***monitor the entire saturated thickness of the target zone***, or a very large percentage of it. ***If large vertical intervals of the target zone are unmonitored, chances are dramatically increased that groundwater contamination may go undetected or be underestimated if detected.***

Technical Guidance Manual, page A-25 (Appendix A, Groundwater Monitoring Guidance) (bold italics added for emphasis).

Relying on deep wells with partially penetrating screen intervals (that is, where the deep aquifer screen is less than 100%) dramatically increases the risk of inadequate site characterization.

Evergreen has not offered an explanation as to why deep aquifer wells are partially penetrating, and it has not provided an analysis as to how the partially screened construction of deep wells impacts its characterization of the nature and extent of contamination.

I. Evergreen should provide an explanation for its failure to use well clustering for all deep wells under or near the active remediation systems.

As noted in connection with the Council's table in Comment #7(F), a well cluster refers to at least one well screened in the unconfined aquifer and one well screened in the deep aquifer, that are in close proximity. (Clean Air Council made determinations based on Figures in the remedial investigation reports and the groundwater remediation status reports). Approximately 25% of the wells identified in the table where construction information is available in Comment #7(F) are not clustered wells. This means that Evergreen is not necessarily characterizing the vertical stratification of contamination across the unconfined and deep aquifer. Evergreen has not provided an explanation for this.

The Technical Guidance Manual underscores the importance of the design of the monitoring wells using well clusters.

> Monitoring Well Types and Construction
>
> 3. Choice of Monitoring System
>
> Monitoring is often adequately accomplished by using….single-screened wells that monitor the entire saturated thickness or a large portion of the target zone.
>
> ***When contamination has been detected and definition of vertical contaminant stratification is desired, wells that monitor more discrete intervals of the target zone, or individual aquifers, usually need to be constructed***. In this case, ***well clusters*** such as shown in Figure A-3 ***will often be the construction design of choice***.

Technical Guidance Manual, page A-7 (Appendix A, Groundwater Monitoring Guidance) (bold italics added for emphasis).

An objective of the monitoring system is to define the vertical contaminant stratification. The Technical Guidance Manual cites well cluster monitoring as a construction design of choice. Evergreen has not established that the non-clustered deep aquifer wells are of a sufficient design to characterize the nature and extent of contamination. Evergreen should provide an explanation as to why all the deep wells are not clustered.

J. Evergreen should provide a critical analysis of the reliability of its deep aquifer network and unconfined well network.

With respect to a deep well network, quality may be as important as quantity. While Evergreen reports the installation of 80 deep wells which have been installed and sampled over the years, there does not appear to be any analysis in the reports regarding whether the number and location of the wells is sufficient.

This is important because groundwater monitoring is a dynamic process. Data generated from successive sampling events provide an opportunity for evaluating the reliability of the

network. Repeat sampling of the existing deep well network only provides additional data from the same perspective, but does not address whether that perspective is appropriate. Evergreen should provide a more complete analysis of the reliability of the network.

The Technical Guidance Manual underscores the importance of a reliable deep aquifer network, based on locations and depths of wells:

> C. Locations and Depths of Monitoring Wells
>
> 1. Importance
>
> ***The locations and depths of monitoring wells are the most important aspects of a groundwater monitoring network. A monitoring point that is misplaced***, or not constructed properly to monitor constituents with unique physical characteristics, ***is of little use and may misrepresent the quality of the groundwater migrating to or from a site***. On the other hand, a properly positioned and constructed monitoring well that detects the earliest occurrence of contamination could save both time and money spent on cleanup of a site. It is important to note that the placement and construction of a groundwater monitoring network at an Act 2 site shall be conducted by a professional geologist licensed in Pennsylvania (25 Pa. Code §§ 250.204(a), 250.312(a), and 250.408(a)).

See id., *See id.*, Technical Guidance Manual, page A-15 (Appendix A, Groundwater Monitoring Guidance) (bold italics added for emphasis).

In the report for AOI-11, the analytical data for the deep aquifer are over seven years old. *See* 2013 Report (AOI-11), Tables 4 and 5. While data from subsequent sampling events were apparently included in reports for individual Areas of Interest (as well as in the groundwater remediation status reports), those reports do not provide a meaningful analysis whether the number and location of deep aquifer wells is sufficient for the remedial investigation. *See* Evergreen, Semiannual Remediation Status Reports; *see also* Evergreen, Act 2 Documents.

The lack of approved reports for AOI-4 and AOI-9 contributes to the concern for deep aquifer network. *See* 2014 Disapproval Letter (AOI-4), 2016 Disapproval Letter (AOI-9). In order to characterize deep aquifer contaminants of concern, it is important to have a reliable understanding and characterization of shallow aquifer contaminant sources, which may be linked to the deep aquifer.

Evergreen should provide a critical analysis of the reliability of its deep aquifer network. It should also do the same thing for its unconfined well network.

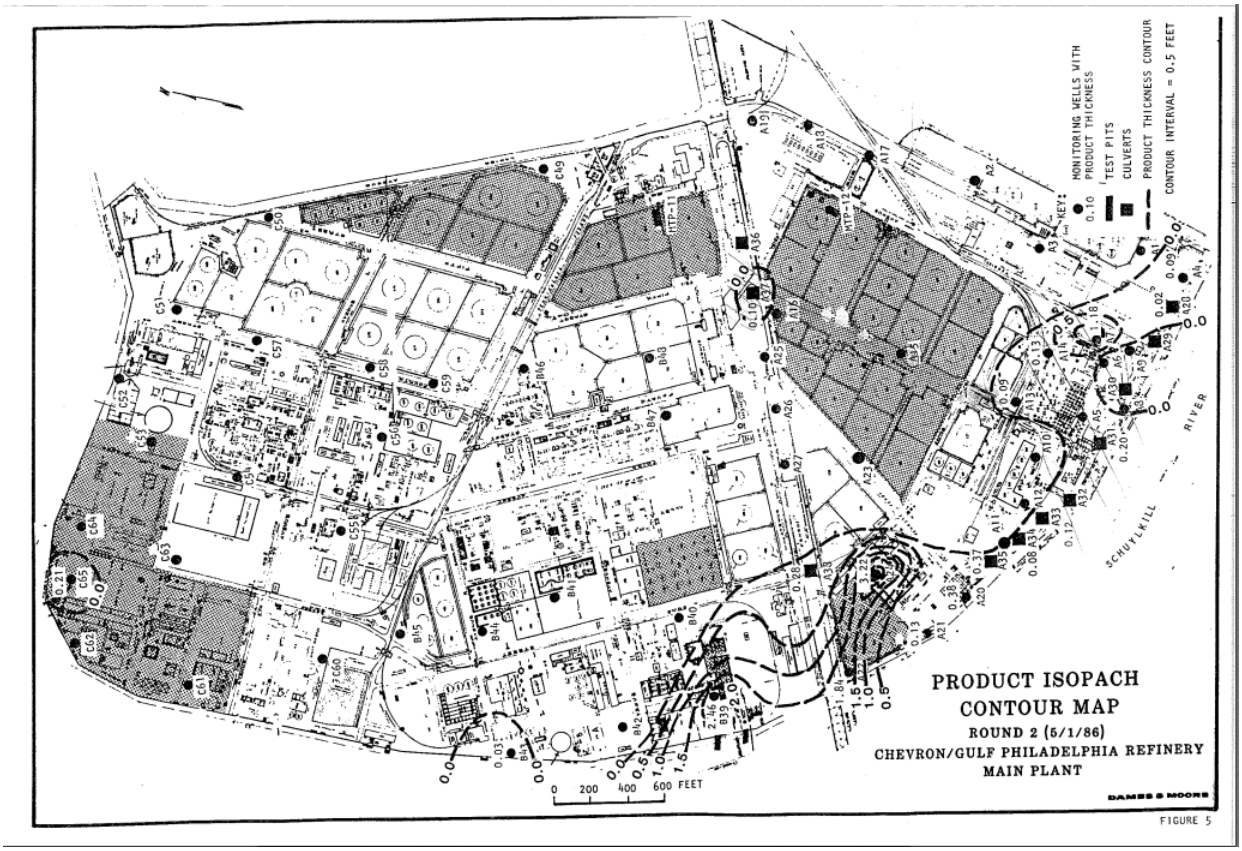
K. Evergreen should prepare isopach contour maps and synthesize the LNAPL analysis with deep aquifer monitoring data.

Evergreen presents the shallow aquifer free product thickness data separately from the deep aquifer groundwater monitoring data. *See e.g.*, 2016 Report (AOI-1), Figure 6-1 (Summary of Available LNAPL Sample Data – AOI 1 and Belmont Terminal), Figure 6-2 (May and Vicinity), Figure 10-6 (Historic Groundwater Analytical Results -- Deep Aquifer), Appendix E (LNAPL Conceptual Site Model), pdf pages 114, 115, 123 of 261. This makes it difficult to characterize the nature and extent of the contamination. Evergreen has not synthesized these data to evaluate whether contaminants are migrating from the LNAPL vertically into the deeper aquifer.

In the reports, Evergreen attempts to delineate the extent of Light Non-Aqueous Phase Liquids (also known as free products) floating on the surface of the shallow water table. As discussed above in Comment #6, the groundwater remediation status reports also map the apparent thicknesses of these liquids for a given shallow well location. But these reports do not analyze the extent of the free product in combination with the deep aquifer groundwater.

Also, Evergreen does not use isopach thickness maps. Isopach thickness maps are an important tool to characterize the extent of free product or LNAPL. Maps representing the thickness of liquids can provide important information regarding the nature and extent of the contamination. It is from these liquids that contaminants dissolve into groundwater and then spread laterally and/or vertically into the shallow and deep aquifers.

To illustrate, there is an isopach map in a historic report characterizing AOI-5, AOI-6 and AOI-7 from 1986, that the Council found deep in the documents:



See Phase I Final Progress Report, Figure 5 (Product Isopach Contour Map) (May 23, 1986), pdf page 19 of 39. The three sections in the Figure above correspond to AOI-7, AOI-6, and AOI-5 today.

This isopach map from 1986 is different from Evergreen's thickness maps because the latter only show distinct well points and identify the measured depth of the LNAPL. In contrast, the 1986 map delineates contour lines of equal thickness, characterizing an area of LNAPL.

Evergreen should expand upon the information and analysis set forth in its LNAPL thickness maps by adopting a similar approach. *See* Groundwater Remediation Status Report (First Half 2020), Figure 3.

In addition, Evergreen should update the data and map on water quality exceedances in the deep aquifer (*See* 2013 Report (AOI-11), Figure 5 (Summary of Volatile and Semi-Volatile Exceedances in Deep Groundwater – 2008 to 2013), and present and map those data along with the isopach contours and groundwater flow.

This exercise can help to evaluate the adequacy of the deep monitoring well network. Absent this analysis and mapping, the public cannot tell whether the deep aquifer wells are appropriately placed and adequate to characterize the nature and extent of the contamination.

L. Evergreen has inappropriately used detection limits that exceed relevant Medium-Specific Concentrations.

In a number of instances, the laboratory instrumentation used by Evergreen was not sufficient to gather reliable data on contaminants at concentrations necessary for making comparisons with Act 2 numeric values. The regulations require adherence to data quality standards set by EPA:

> Attainment of a standard shall be demonstrated with adherence to Data Quality Objective (DQO) and Data Quality Assessment (DQA) processes as specified by EPA.

See 25 Pa. Code § 250.702 (Attainment requirements).

In a guidance document, EPA states that a more sensitive method should be used if a method detection limit exceeds an action level:

> ***If the detection limit for a measurement method exceeds or is very close to the Action Level, then a more sensitive method should be specified*** or a different analytical approach should be used.

See EPA Guidance on Systematic Planning Using DQO (February 2006), page 41 (bold italics added for emphasis).

Where laboratory detection limits (which determine the ability of a laboratory to detect contaminants at threshold levels) are greater than a cleanup standard, one cannot reliably tell whether a cleanup level is met or not. To adequately characterize contaminants in groundwater, the laboratory detection limits appropriately need to be equal to or less than Medium-Specific Concentrations. Evergreen should address the data gaps arising from this problem.

To illustrate, for chrysene in the AOI-11, laboratory detection limits for chrysene were sometimes 5 ug/L or 10 ug/L, which are two to five times higher than the Medium-Specific Concentration of 1.9 ug/L. *See* 2013 Report (AOI-11), pdf pages 45-59, Table 4 (Summary of Deep Groundwater Analytical Results 2005-2011). In addition, laboratory detection limits exceeded the Medium-Specific Concentration for Benzo(A)Pyrene, Benzo(B)Fluoranthene, and Benzo(G,H,I)Perylene. *See id.*, pages 61- 77, Table 5 (Summary of Attainment Sampling Deep Groundwater Analytical Results 2012-2013).

In the case of the unconfined aquifer for AOI-5, a similar thing apparently happened for 1,2-dibromoethane (EDB). *See* 2017 Report (AOI-5), Table 7 (Summary of Groundwater Analytical Results), pdf pages 170-220 (setting forth laboratory detection limits as high as 0.5 mg/L, one order of magnitude higher than the Medium-Specific Concentration of 0.05 mg/L.

Similar anomalies may have occurred for other chemicals and other reports. Why certain sampling events and wells were subject to unreliable detection limits is unclear.

Evergreen should have used instrumentation with detection limits sufficient to allow the sampling to be meaningful.

Evergreen should address this explicitly in the narrative text of the reports, and it should conduct additional sampling to cure any unreliable data that have resulted from these anomalies.

8. Evergreen Fails to Properly Delineate the Contamination of Arsenic, Manganese, and Other Inorganics (Metals) in the Unconfined Aquifer and the Deep Aquifer.

Earlier in the course of this investigation, Evergreen was sampling for a wider array of inorganic chemicals (metals) than at present. There does not appear to be any explanation for why these chemicals were once sampled but are no longer sampled. Arsenic and manganese are two of the more notable metals, but there are others as well. Evergreen should provide a detailed explanation for why and how it has adopted this approach.

A. Evergreen's Q&A regarding the failure to sample for multiple metals is flawed.

In response to a recent question why Evergreen is focusing on lead to the exclusion of other metals, Evergreen asserts that this was decided by a 1992 RCRA Facility Investigation report, which is posted on its website:

> [New Q&A posted after December 30, 2020]
>
> ***Why is lead the only metals COC? Aren't there other contaminants such as copper, cadmium, arsenic that come from refining processes?***
>
> ***The site was tested for a complete list of metals as part of the 1992 RCRA Facility Investigation and none of these metals, except lead, were found to be a contaminant of concern and therefore were not identified as a contaminant of concern going forward. The 1992 Report is posted on the Evergreen website for reference.***
>
> However, both soil and groundwater samples from various areas of the facility with history of crude storage and processing have been sampled for a more comprehensive analyte list which included other metals as part of the remedial investigation activities. These data have all been included in the RIRs.
>
> Note: this response addresses other similar questions:
>
> The refinery was historically coal-fired. Where and how has the site been tested for Arsenic?
>
> Should other heavy metals be expected to be found given the history of heavy industrial use?
> .

See Evergreen, Q & A (bold italics added for emphasis). Presumably, Evergreen is referring to this report from 1992 in the historical reports section of its website: 1992 Results of a RCRA

Facility Investigation (ENSR, September 1992). Whether Sunoco considered something a contaminant of concern in 1992 is not dispositive as to the present remedial investigation, which is governed by a consent order executed in 2012 -- two decades later. That consent order does not exclude metals other than lead as Constituents of Concern .

In fact, the legal agreements do not identify Constituents of Concern. *See* 2003 Consent Order and Agreement (DEP Agreement); *see also* 2012 Consent Order and Agreement (DEP Agreement); *see also* 2012 Settlement Agreement and Covenant Not to Sue (EPA Agreement); *see also* 2020 First Amendment to Consent Order and Agreement (DEP Agreement). Rather, Evergreen proposed Constituents of Concern by including them in tables attached to reports that it submitted to the Department.

In addition, Evergreen's answer is contradicted by the fact that Sunoco did conduct sampling arsenic and manganese (and other metals), long after the 1992 report.

B. Over the course of time, Sunoco and Evergreen have pared down the focus of the remedial investigation for inorganics (metals) in groundwater.

When Evergreen prepared the reports for AOI-11, it identified arsenic and manganese (as well as several other metals) as Constituents of Concern with respect to the investigation of the deep aquifer. *See* 2011 Report (AOI-11), Table 1 (identifying arsenic, cobalt, iron, lead, and manganese), pdf pages 43-44 of 76; *see also* 2013 Report (AOI-11), Table 1 (identifying arsenic, cobalt, iron, lead, manganese, and mercury), pdf page 42 of 85. For arsenic and manganese, the form was "Total & Dissolved." *See id.*

But arsenic and manganese disappear as Constituents of Concern for the deep aquifer in subsequent reports, despite the fact that it was Evergreen's intent to shift its evaluation of the deep aquifer from the AOI-11 reports to the other reports:

Area of Interest	**Report**	**Comment:** **Metals As Constituents of Concern**
AOI-1 Point Breeze No. 1 Tank Farm	2016 Report (AOI-1), Table 1-1	(only metal identified is lead)
AOI-2 Point Breeze Processing Area	2017 Report (AOI-2), Table 1	(only metal identified is lead)
AOI 3	2017 Report (AOI-3), Table 2	(only metal identified is lead)

Point Breeze Impoundment Area		
AOI-4 No. 4 Tank Farm	2013 Report (AOI-4), Table 2 2017 Report (AOI-4), Table 1-1 Table 1-2	(only metal identified is lead) (only metal identified on Petroleum Short List is lead) (identifying cobalt, lead, nickel, vanadium, and zinc on Comprehensive List)
AOI-5 Girard Point South Tank Field	2011 Report/Cleanup Plan (AOI-5), Table 1 2017 Report (AOI-5), Table 1	(only metal identified is lead, for tables for soil and groundwater) (only metal identified is lead)
AOI-6 Girard Point Chemicals Area	2013 Report (AOI-6), Table 1 2017 Report (AOI-6), Table 1	(only metal identified is lead) (only metal identified is lead)
AOI-7 Girard Point Fuels Area	2012 Report (AOI-7), Table 1 2013 Addendum to Report 2017 Report (AOI-7), Table 1	(only metal identified is lead, for tables for both soil and groundwater) (not providing a table) (only metal identified is lead)
AOI-8 North Yard	2012 Report (AOI-8), Table 1 2017 Report (AOI-8), Table 1-2 Table 1-2	(only metal identified is lead, for both soil and groundwater) (only metal identified on Petroleum Short List is lead) (identifying cobalt, lead, nickel, vanadium, and zinc on Comprehensive List)
AOI-9	2015 Report (AOI-9), Table 1	(only metal identified is lead)

Schuylkill River Tank Farm	2017 Report Addendum (AOI-9), Table 1	(only metal identified is lead)
AOI-10 West Yard	2011 Report (AOI-10), Table 1a and 1b	(only metal identified is lead, for tables for both soil and groundwater)[12]

In addition, the table above shows an inconsistency in Evergreen's inclusion of some metals as Constituents of Concern for some Areas of Interest (AOI-4 and AOI-8), but not for others (cobalt, nickel, vanadium, and zinc). Evergreen should substantiate this inconsistency.

Evergreen should provide a detailed explanation for why and how it has arrived at its approach for identifying Constituents of Concern for sampling for metals in the deep aquifer.

C. Evergreen should revise the reports to include arsenic as a Constituent of Concern for all Areas of Interest, because this metal is associated with contamination at former refineries.

There are several reasons why Evergreen should be including arsenic as a Constituent of Concern during this remedial investigation. Arsenic can be a problem for refineries even if it is naturally occurring in the environment (if its "background") and not caused by a release of hazardous substances. The "natural attenuation" of hydrocarbon releases at a refinery may have the undesirable effect of mobilizing arsenic and causing it to disperse in groundwater. USGS, Natural Breakdown of Petroleum Results in Arsenic Mobilization in Groundwater, USGS GeoHealth Newsletter, Vol. 12, No. 1 (2015).

Of course, if there has been a direct release of arsenic from refinery operations, that would present another concern for the migration of arsenic in groundwater. In the case of the refinery, there appears to be such a concern, based on a report identifying a number of exceedances for arsenic in soils in AOI-10. *See* 2011 Report (AOI-10), 17, 18, 20, 25, 26, 27, 31, 32, 36, 37, Table 5 (Summary of Shallow Soil Sample Analytical Results for CAMU Delineation Samples), Table 6 (Summary of Shallow Soil Sample Analytical Results: CAMU Area Soil Samples), Table 7 (Summary of Analytical Results for Waste in CAMU Areas), Table 8 (Summary of Soil Sample Analytical Results for Vertical Delineation Soil Samples Beneath Waste in CAMU), pdf pages 63-89 of 762. From the report, it is not clear what was the source of the arsenic.

Evergreen should provide a complete explanation regarding the source of the arsenic -- whether it relates to an anthropogenic source or a background source. Evergreen should explain why it did not conduct similar sampling for all Areas of Interest.

[12] In contrast to the approach to the deep aquifer, Evergreen does identify arsenic and manganese (as well as other metals) as Constituents of Concern for surface water and sediments. *See id.*, Table 1c, 1d.

D. Evergreen should revise the reports to address whether the widespread manganese contamination in the deep aquifer is truly attributable to "background levels" and not the legal responsibility of Sunoco.

In 2011, Evergreen identified manganese as a Constituent of Concern for the investigation of the deep aquifer:

> For AOI 11, four additional metals (arsenic, cobalt, iron and ***manganese***) and wet chemistry parameters including ammonia, chloride, fluoride, nitrate, nitrite, sulfate, alkalinity, total organic carbon (TOC), and total dissolved solids (TDS) ***were added to the COC list to further characterize deep groundwater at the site in accordance with the CO&A***.

See 2011 Report (AOI-11), Section 1.2, page 2 (bold italics added for emphasis). It also made the following observation about the highly elevated levels of manganese in the aquifer:

> ***The PRM aquifer system no longer is used as a source of water supply in Philadelphia because of highly elevated concentrations of*** iron (as high as 429,000 ug/L), ***manganese (as high as 4,000 ug/L),*** and sulfate (as high as 1,720,000 ug/L) ***that have contaminated the aquifer in south Philadelphia*** and have made the ground water unusable for most purposes (Sloto, 2003).

See id., Section 2.3, page 10 (bold italics added for emphasis). The problem was also local to the refinery:

> ***The 1994 ENSR investigation of the shallow and deep groundwater quality of the refinery noted that there were elevated levels of iron and manganese in the Farrington Sand Aquifer*** and that the results were consistent with those found by the USGS's regional report released in 1991.

See id., Section 2.3, page 13 (bold italics added for emphasis).

Evergreen found concentrations above the Medium-Specific Concentrations for manganese. *See id.*, Section 5.1, page 23; see also id., Table 5 (April 2011 Summary of Deep Groundwater Analytical Results), Table 6 (June-July 2011 Summary of Deep Groundwater Analytical Results), Figure 6 (Summary Metal Exceedances in Deep Groundwater, April/June-July 2011), pdf pages 51-68, 71 of 75.

In fact, there were exceedances in 33 of the 45 deep aquifer wells:

> ***A total of 33 deep monitoring wells exhibited concentrations of groundwater COCs above their respective MSCs for manganese***.

> The highest manganese detections were observed along the central and eastern portions of AOI 1.

See id., Section 5.1, page 24 (bold italics added for emphasis).

The 2013 report tells a similar story. *See* 2013 Report (AOI-11), Section 2.0, page 3, Section 3.4, page 7, Section 3.4.1, page 8, Section 4.0, page 11, Section 5.2, page 15, Section 5.2, page 16, 17, 18, Section 8.3, page 25, Section 8.4, page 26, Section 9.1, page 29, Section 12.0, page 30, Table 4 (Summary of Deep Groundwater Analytical Results 2005 to 2011), Table 5 (Summary of Attainment Sampling Deep Groundwater Analytical Results 2012 - 2013), Table 6 (Regional Wide Groundwater Chemistry), Figure 6 (Summary of Metal Exceedances in Deep Groundwater 2008 to 2013), pdf pages 45-78, 85 of 75.

Evergreen should bring sampling in 2011 and 2013 up to date, and it should delineate Sunoco's contribution to the problem of manganese in the deep aquifer.

9. Evergreen Fails to Demonstrate that the Sheet Pile Wall and Bulkhead Provide Sufficient Protection Against the Migration of Contamination to the Schuylkill River.

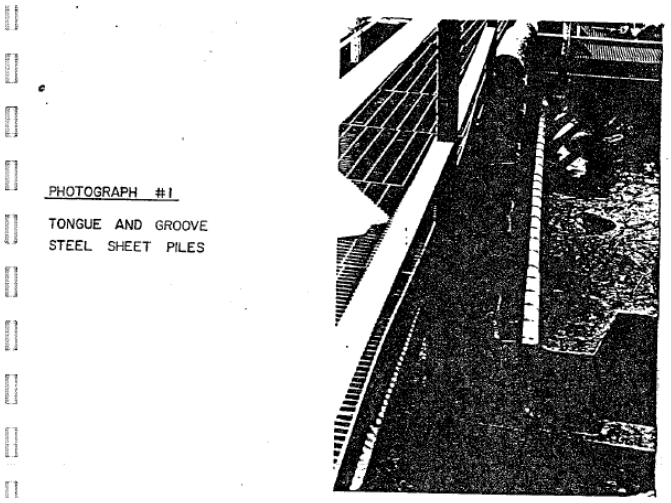
A. Evergreen has not fully characterized contamination in comparison with the sheet pile wall and bulkhead.

Along the perimeter of AOI-5, AOI-6, AOI-7, and AOI-2, a sheet pile wall was constructed in the 1950s -- presumably to protect the property from the influx of water from the Schuylkill River and to prevent the migration of contaminants into the river. In the reports, Evergreen assumes that it provides sufficient protection against migration of contamination to the river. But it offers no supporting evidence concerning the engineering specifications for this structure, its physical integrity, or any ongoing system of leak detection, maintenance, or repair. During this remedial investigation this failure is material because this means that Evergreen has not provided a sufficient delineation of the nature and extent of the contamination.

The most specific information we have about this structure is a 1985 memorandum identifying a tongue-and-groove steel sheet pile that is 8400 feet long:

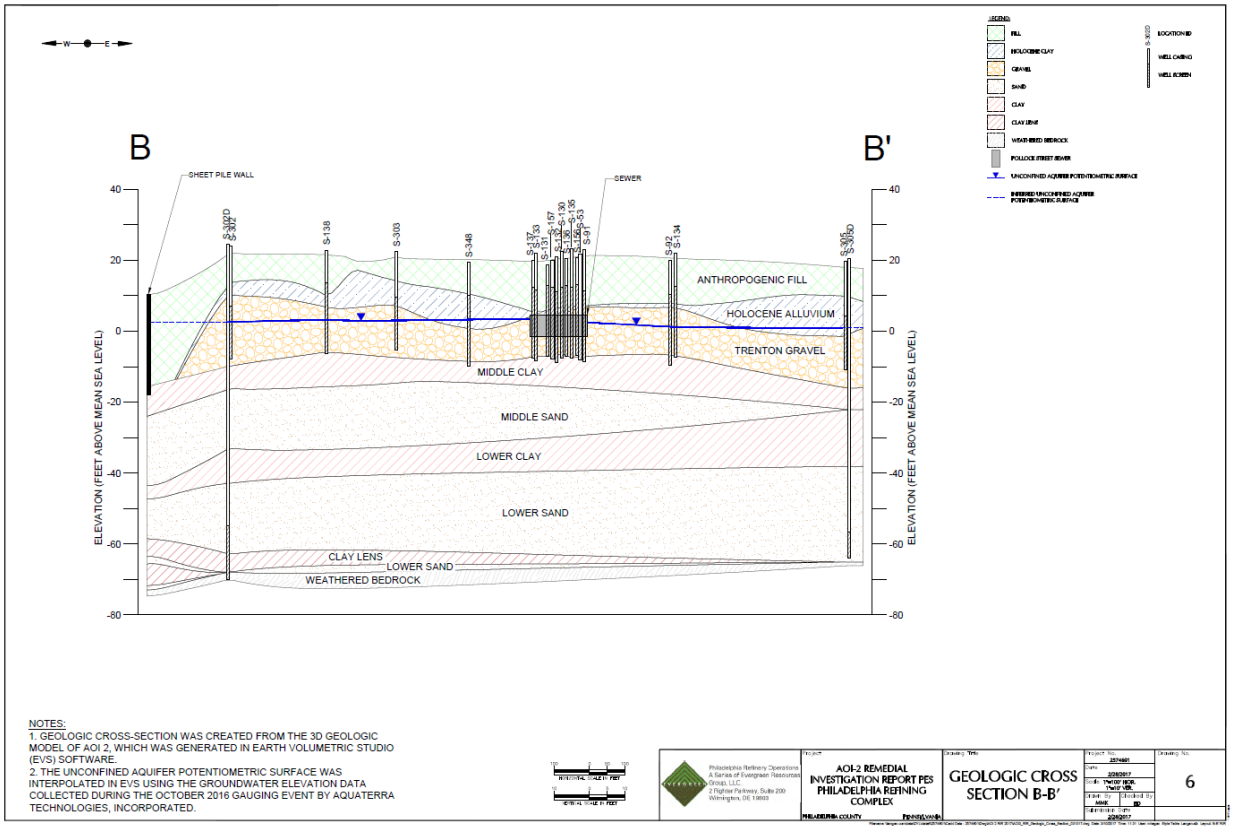
> Initially, the fill materials were placed behind a wooden seawall constructed in the early 1920's. ***This was replaced in the 1950's by 1400 feet of concrete seawall near the oil and grease plant and by 8400 feet of tongue-and-groove steel sheet pile along the remaining waterfront (Photograph #1).*** This fill-and-bulkhead system has led to the development of a shallow water table which is perched on the underlying marsh deposits. This water table is encountered at depths of 5 to 7 feet and is recharged by rainfall. Discharge of these groundwaters is to the Schuylkill River. The configuration of the water table cannot be determined without a sufficient number of monitor wells but flow directions are expected to be generally towards the river.

See 2017 Report, Appendix J (AOI-5), Appendix A (Historical Reports Combined), Memorandum dated May 8, 1985, page 5 (bold italics added for emphasis). The photograph is located here:



Id., pdf page 18. But this does not provide much detail regarding this structure, and it does not demonstrate that the sheet pile wall is effective.

A geologic cross section for AOI-2 provides some information regarding the relative position of the sheet pile wall:



See 2017 Report (AOI-2), Figure 6 (Cross Section B-B'), pdf page 206 of 215; *see also id.*,

Figure 4 (Geologic Cross Section Location Plan), Figure 5 (Cross Section A-A'), According to the Figure above, the sheet pile appears to be lie even with the surface of the ground, and appears to have a depth of about 28 feet, extending into the clay by one or two feet. *See id.* Because the sheet pile wall appears to lie right on the Schuylkill River, Evergreen has an obligation to delineate whether contaminated groundwater is migrating into the river.

Other cross sections do not appear to provide more information. One would expect the sheet pile wall to be picked up near the end of the cross section B-B' for AOI-6, but it does not appear to be located there. *See* 2017 Report (AOI-5), Figure 2 (Site Plan), Figure 4 (Geologic Cross Section Location Plan), Figure 5A (Geologic Cross Section A-A'), Figure 5B (Geologic Cross Section B-B'), pdf pages 227, 229-231 of 238. It should be located at the end of cross section E-E' for AOI-6, but it does not appear to be there. *See* 2017 Report (AOI-6), Figure 2 (AOI 6 Site Plan), Figure 8 (Stratigraphic Profile), pdf pages 53, 59 of 155. It should also be picked up for AOI-7, but it is not there, either. *See* 2017 Report (AOI-7), Figure 2 (AOI 7 Site Plan), Figure 8 (Stratigraphic Profile), pdf pages 56, 62 of 281.

In the reports, Evergreen provides no other meaningful information about the nature of this sheet pile wall. Rather, it simply makes repeated assertions that it is "keyed" into the Middle Clay Layer. *See* 2011 Report (AOI-5), page 6 ("A sheet pile bulkhead, keyed into the Middle Clay Unit, extends along the entire southern boundary of AOI 5 along the Schuylkill River."); *see also* 2013 Report (AOI-6), page 2 ("A sheet pile bulkhead, which is keyed into the Middle Clay Unit, extends along the entire western boundary of the AOI, between the AOI and the Schuylkill River."); *see also* 2012 Report (AOI-7), page 2 ("The entire western and northern boundary of AOI 7 along the Schuylkill River is bound by a sheet pile wall which is keyed into the Middle Clay Unit."); *see also* 2017 Report (AOI-2) ("A sheet pile bulkhead, which is keyed into the Middle Clay layer, extends along a portion of the western boundary of the AOI, between the AOI and the Schuylkill River."). Again, this does not demonstrate that the sheet pile wall is effective.

On the question of effectiveness, Evergreen's language is guarded. It asserts that the sheet pile "limits" the flow of groundwater to the Schuylkill River -- and thereby acknowledges the possibility of flow into the river. *See* 2011 Report (AOI-5), page 11 ("[s]hallow groundwater interaction with the Schuylkill River is limited by the sheet pile wall"); *see also* 2013 Report (AOI-6), page 9 ("[s]hallow groundwater interaction with the Schuylkill River is limited by the presence of the sheet pile wall"); *see also* 2012 Report (AOI-7), page 14 ("[s]hallow/intermediate groundwater interaction with surface water is limited by the sheet pile wall"); *see also* 2017 Report (AOI-2), page 35 ("[t]he presence of the sheet pile wall and the vertical wall in this area limits the discharge of dissolved phase COCs in the unconfined aquifer groundwater to the Schuylkill River"). Again, this does not demonstrate that the sheet pile wall is effective. Evergreen offers no meaningful evidence about this sheet pile wall in support of the proposition that it is an effective barrier to the migration of groundwater.

In the absence of such evidence, Evergreen offers circular reasoning to advance its proposition. Begging the question, it asserts that the movement of groundwater toward the river is limited because the groundwater can discharge no faster than the sheet pile wall permits:

> Along the sheet pile wall, ***the movement of groundwater and contamination*** through the alluvium/fill towards the Schuylkill River (the POC) ***is limited by the hydraulic conductivity of the sheet pile wall. This is because groundwater behind the sheet pile wall can discharge no faster to the Schuylkill River than the sheet pile wall permits***. The lower hydraulic conductivity of the sheet pile wall also causes groundwater to mound up behind it.

See 2011 Report (AOI-5), Appendix H, Section H.5.6, page H-6 (Hydraulic Conductivity (K)). *See also* 2013 Report (AOI-6), part 2, Appendix H, Section H.5.6, page 7 of 12. This begs the question whether the sheet pile wall is effective.

When Evergreen refers to the "lower hydraulic conductivity of the sheet pile" in the last sentence quoted above, Evergreen is simply implying that the hydraulic conductivity of the sheet pile wall is less than that of regular fill. *See* 2013 Report (AOI-6), part 2, Appendix F, Section F.4, page 3 of 12 ("For assessment purposes it was assumed that groundwater flow through sediments near the sheet pile wall are affected more by the lower sheet pile permeability relative to the higher hydraulic conductivity of the sediments."). It is not remarkable to assume that a sheet pile wall would tend to have a lower permeability than sediments, assuming it is functioning properly. But again, Evergreen assumes that the sheet pile wall is effective, without offering meaningful evidence.

Evergreen attempts to bolster its assertion by appealing to a coefficient of hydraulic conductivity, but that information is not specific to this sheet pile wall. Rather, Evergreen offers a putative number for hydraulic conductivity for unsealed sheet pile walls, obtained from a manufacturer of sheet pile walls (Waterloo Barrier):

> To account for the presence of the sheet pile wall in the QD and SWLOAD models ***the effective hydraulic conductivity used for simulating Zones 1 through 5 was 0.283 ft/d*** (10^{-5} cm/sec) ***which represents unsealed sheet piling (Waterloo Barrier, Inc.).***

See 2011 Report (AOI-5), Appendix H, Section H.5.6, page H-6; *see also id.*, Figures H.4 through H.8. Evergreen does not provide any foundation for how Waterloo Barrier arrived at this coefficient, and Evergreen does not cite any written report of Waterloo Barrier as a source of authority for this coefficient.

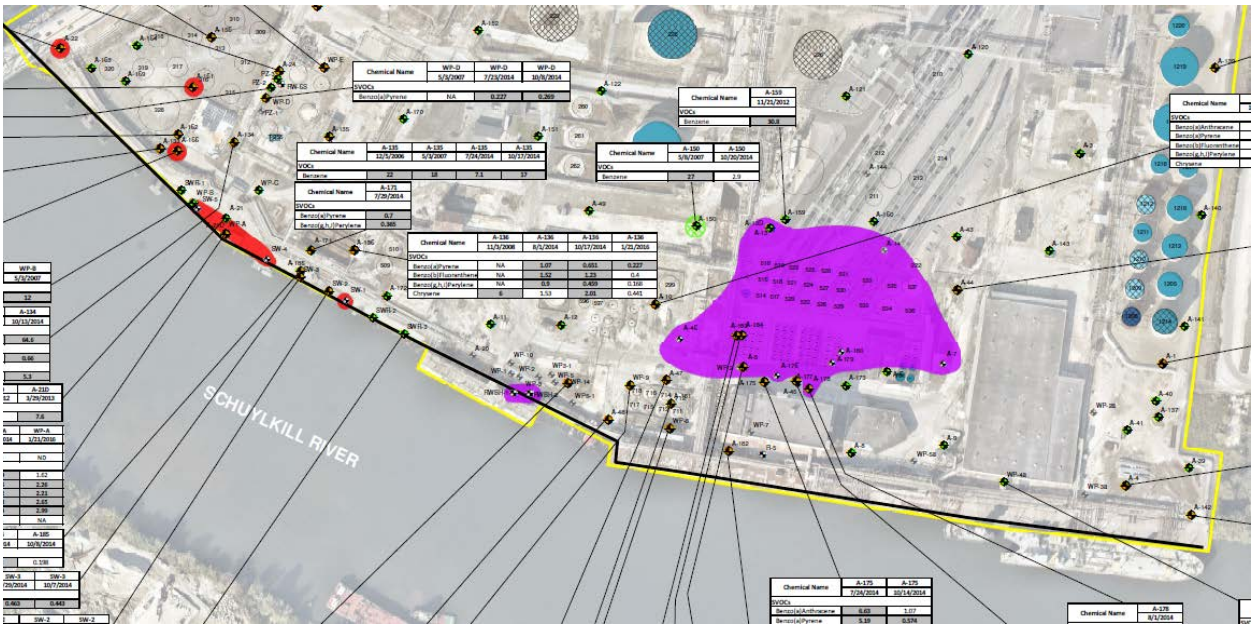
Presumably, the coefficient provided by Waterloo was based on unsealed sheet pile walls marketed at that time this report was prepared (around 2011). Apparently, that company has a proprietary sheet pile wall product developed in 1989. *See* Waterloo Barrier Inc., Waterloo Barrier® Groundwater Containment Wall. But there is no reason to suggest that Waterloo manufactured the sheet pile wall at the oil refinery (it was installed in the 1950s), or that the coefficient that Waterloo provided is a reliable one when applied to a sheet pile wall

constructed in the 1950s. It says nothing about the effectiveness of a sheet pile wall that has been subject to all the forces of nature and humankind for over sixty years.

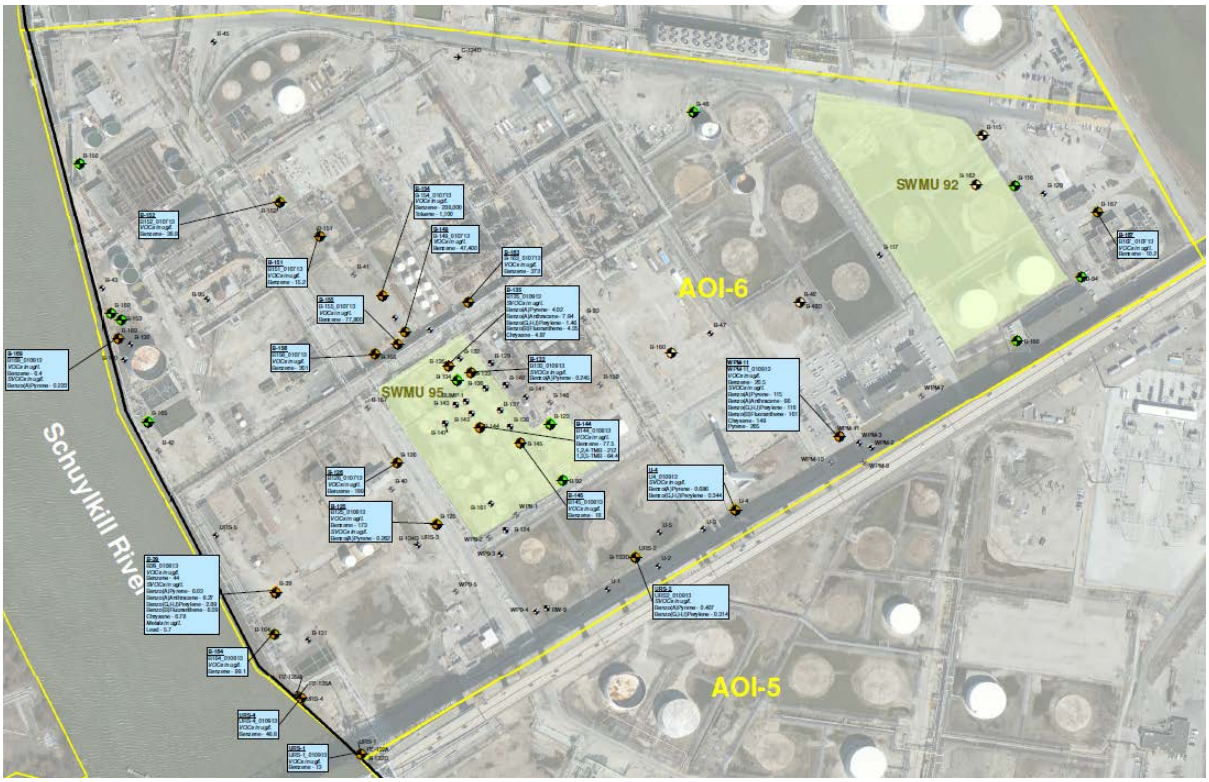
B. <u>There are compelling concerns about the protectiveness of the sheet pile</u>.

These forces include the migration of contaminants in groundwater that could contribute to corrosion of the sheet pile wall. Evergreen does not address this. This is important because Evergreen has gathered data demonstrating contaminants in monitoring wells in the shallow aquifer near the sheet pile wall, based on the reports for AOI-5, AOI-6, AOI-7, and AOI-2. (As discussed above, in AOI-2, the sheet pile appears to extend to a depth of approximately 28 feet, implicating the shallow aquifer).

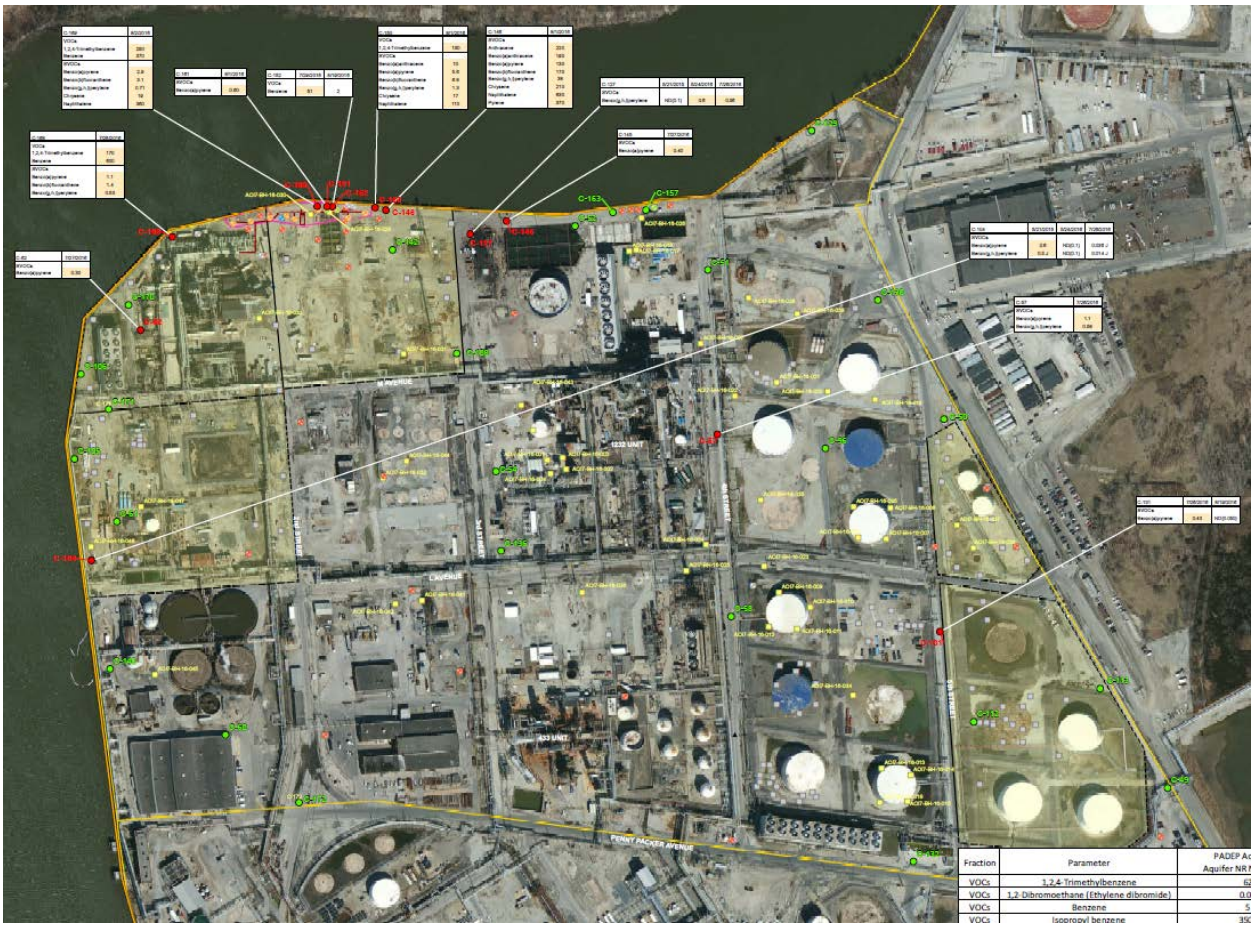
The following screenshots illustrate some of this contamination:



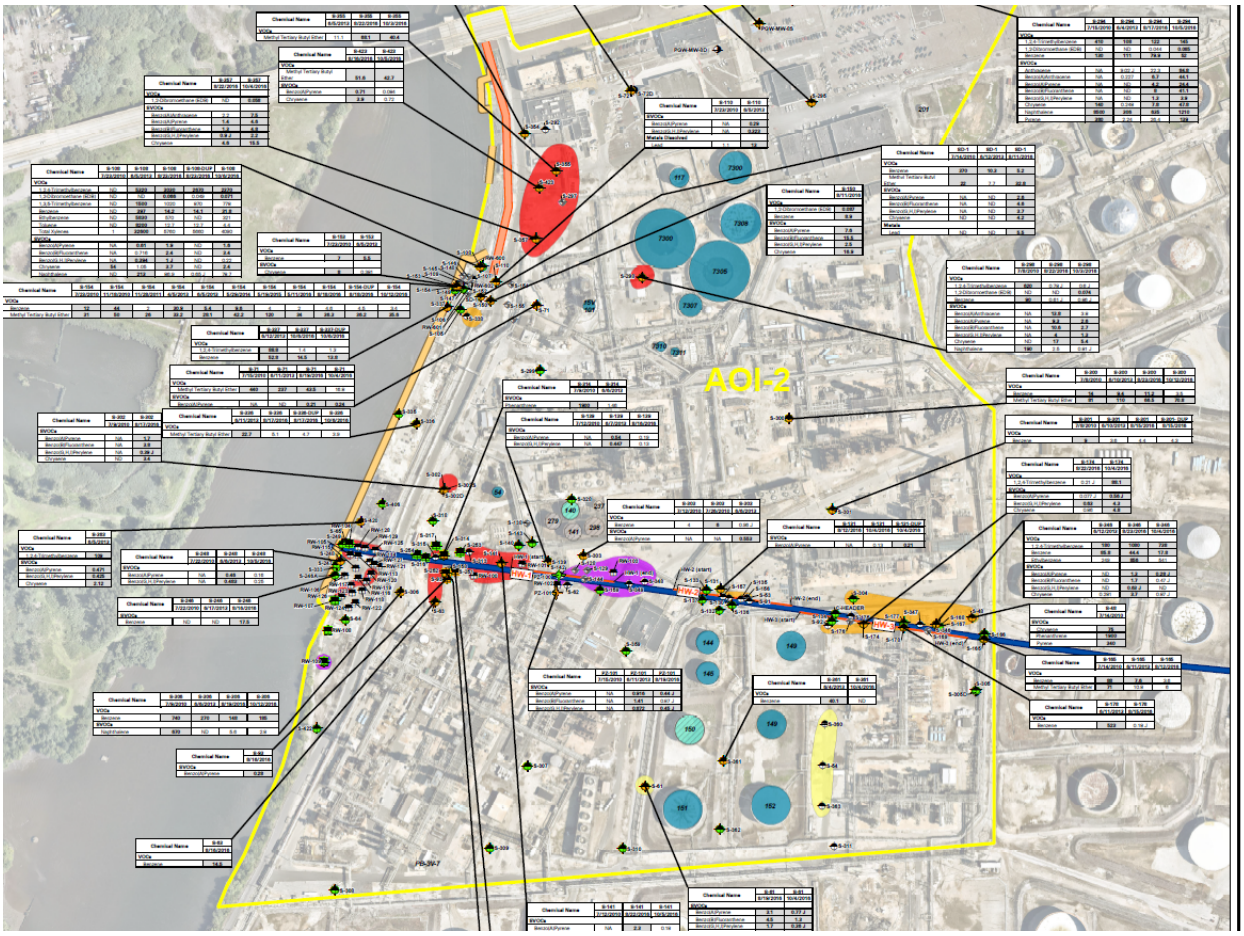
See 2017 Report (AOI-5), Figure 10 (Summary of Groundwater Sample Exceedances), pdf page 236 of 238.



See 2013 Report (AOI-6), Figure 11 (Summary of Groundwater Sample Exceedances), pdf page 100 of 101.



See 2017 Report (AOI-7), Figure 19 (Water Table Groundwater Results), pdf page 74 of 281.



See 2017 Report (AOI-2), Figure 12A (Summary of Unconfined Aquifer Groundwater Sample Exceedances), pdf page 212 of 215.

These forces include seismic events. Just four months ago, a magnitude 3.1 earthquake struck in East Freehold, New Jersey, causing impacts that were felt in Philadelphia. CBS Philly, *3.1 Magnitude Earthquake Strikes New Jersey, Shaking Reported Across State Including Philadelphia-Area* (September 9, 2020). This is important because seismic events could cause pressure and stress on the sheet pile wall, weakening its structure and making it more susceptible to wear and tear.

These concerns are not simply academic. Evergreen has already identified at least one instance of a breach of the sheet pile wall that required repair. *See* 2012 Report (AOI-7), page 29 (noting that as an interim remedial measure, Sunoco "[s]ealed a penetration in the sheet pile wall adjacent to the junction box, eliminating groundwater flow to the Schuylkill River"). This statement implies that there was groundwater flow into the Schuylkill River through the breach.

C. With respect to prevailing engineering standards, Evergreen should consider resources such as the U.S. Army Corps of Engineers' engineering manual.

As Evergreen considers the sheet pile wall in this remedial investigation, it should review modern engineering standards for sheet pile walls. For example, the U.S. Army Corps of Engineers has prepared a section on the design of sheet pile walls in its engineering manual. *See* U.S. Army Corps of Engineers, *Design of Sheet Pile Walls*, March 31, 1994 (EM 1110-2-2504 31) (75 pages), available on the Army Corps of Engineers' webpage on Engineer Manuals.

According to that engineering manual, the problem of corrosion is an electrochemical question. *See id.*, page 9-1, Section 9.2.b(3) ("The corrosion process is electrochemical in nature and occurs wherever there is a difference in electric potential on the piles surface."). The engineering manual states that "[p]ermanent installations should allow for subsequent installation of cathodic protection should excessive corrosion occur." *Id.*, page 2-2, Section 2.4.b. Evergreen should provide an analysis of what systems are in place for cathodic protection.

D. Evergreen has not responded to the Department's Comment relating to the sheet pile wall in the report for AOI-11 (deep aquifer).

It does not appear that Evergreen has addressed a question from the Department regarding the use of the coefficient of hydraulic conductivity obtained from Waterloo. *See* 2013 Comments (AOI-6). Among other things, the Department questioned Evergreen's use of this coefficient not only for the migration of contaminants within the short distance between the sheet pile wall and the river, but also for an additional distance of 150 feet to the east of the sheet pile wall. *See id.*, Comments 28-31. Evergreen's response did not address these comments. *See* 2018 Response to Comments (AOI-6). Evergreen should respond to these comments now, as well as the comments of the Council.

10. The Remedial Investigation Reports are Deficient Because They Fail to Address the Impacts of Climate Change -- Including Sea Level Rise and Storm Surges.

For years, it has been known that emissions of greenhouse gases have caused changes in climate, including sea level rise and changes in precipitation patterns. Despite the existence of state and regional climate change plans to address these impacts, Evergreen has not incorporated any analysis of these impacts into its remedial investigation. The former refinery is located on the banks of the Schuylkill River, which is projected to rise by two feet in 2050, which would cause flooding over a number of areas of the facility. Because of the failure to consider these impacts, the delineation of the nature and extent of contamination is deficient.

Climate change implicates at least two concerns for this remedial investigation. First, climate change could potentially affect remediation systems through sea level rise and increased storm events. This is not merely a hypothetical future concern. Although the present public comment period concerns remedial investigation reports, there is an overlapping remediation aspect that is a part of these reports. *See* Evergreen, Act 2 Program Information Session (August 27, 2020), Remediation Timeline, slide 47 (bar graph displaying active and inactive remediations since 1995, and identifying 11 active remediations as of August 2020).

In addition, the remedial investigation reports themselves cover sewer remediation systems. *See e.g.*, 2016 Report (AOI-1), Section 10.43, page 10.65-10.66, 2017 Report (AOI-2), Section 8.0, pages 49-51, 2017 Report (AOI-4), Section 10.43, page 10.63, 2017 Report (AOI-7), Section 10.42, page 42, 2017 Report (AOI-8), Section 9.2.5, page 9.60.

Second, because climate change could potentially affect the flow of surface water and groundwater, Evergreen should have considered it when evaluating the fate and transport of contaminants in the reports.

A. State and local agencies have adopted plans to address the impacts of sea level rise, which is projected to amount to two feet for Philadelphia in 2050.

Under the Pennsylvania Climate Change Act of 2008, the Department of Environmental Protection must prepare a Climate Change Plan every three years. *See* Act 70 of 2008, Section 7(a). The most recent climate change action plan recognizes the impacts of flooding in the City of Philadelphia:

> Climate impacts in Pennsylvania are happening now and will continue to put Pennsylvanians and local industries at risk. ***Key impacts in Pennsylvania (Shortle et al. 2015) include***:
> ….
> ***More frequent flooding and associated disruptions due to sea level rise in communities and cities in the Delaware River Basin, including the city of Philadelphia***
> ….

See DEP, Pennsylvania Climate Change Plan (2018), pages 25-26.

At a regional level, the City of Philadelphia has projected an increase in sea level rise of two feet by 2050 and four feet by 2100:

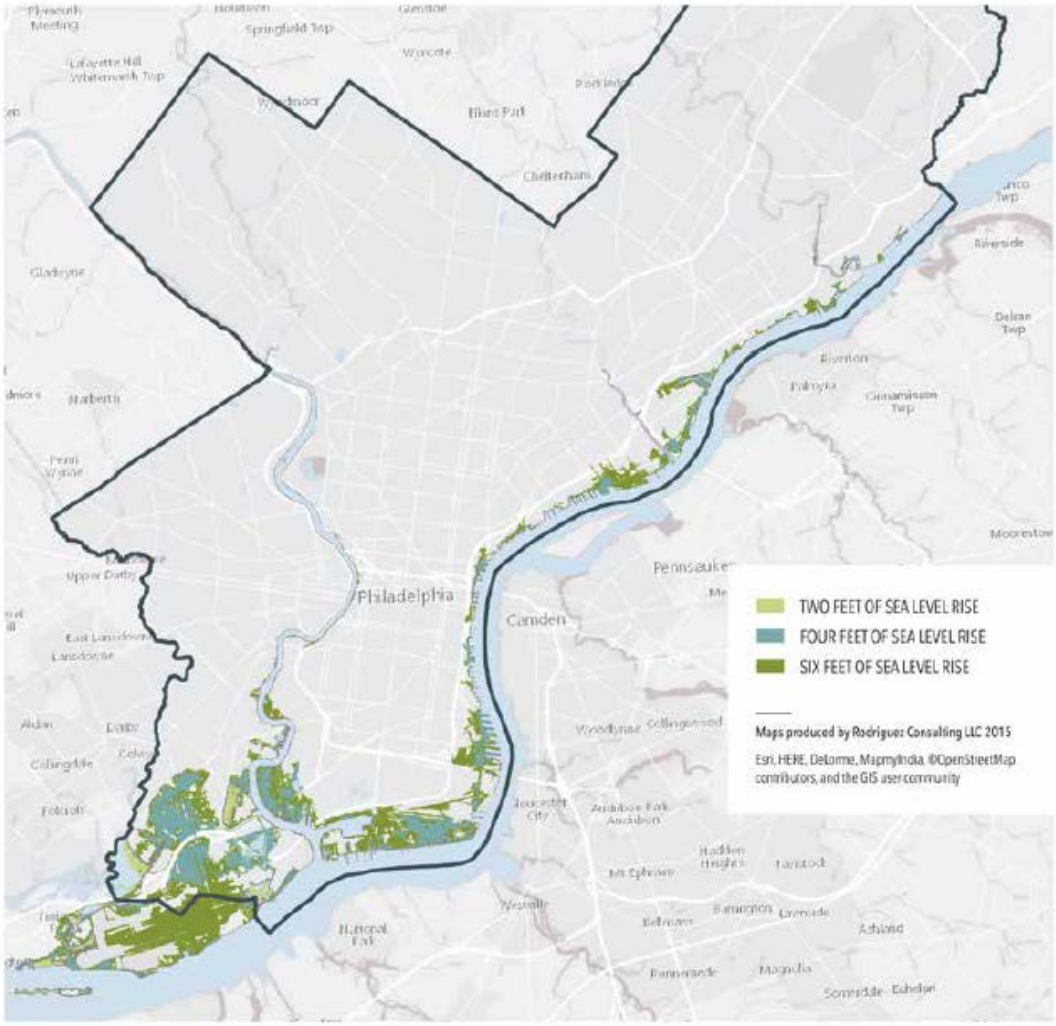
> SEA LEVEL RISE (SLR): Two scenarios consider just the impacts of sea level rise: ***two feet*** (***the local projection for 2050 assuming moderate carbon emissions worldwide***) and ***four feet*** (***the projection for 2100 given the same emissions assumptions***). [citing NOAA, the Digital Coast].

See City of Philadelphia, Mayor's Office of Sustainability and ICF International, *Growing Stronger: Toward a Climate-Ready Philadelphia* (November 2015) (bold italics added for emphasis).

This report includes a map of Philadelphia highlighting areas at risk of inundation from a sea level rise of two feet. Among them are a number of Areas of Interest at the former oil refinery (AOI-5, AOI-6, AOI-7, AOI-8, AOI-9, and AOI-10):

FIGURE 8

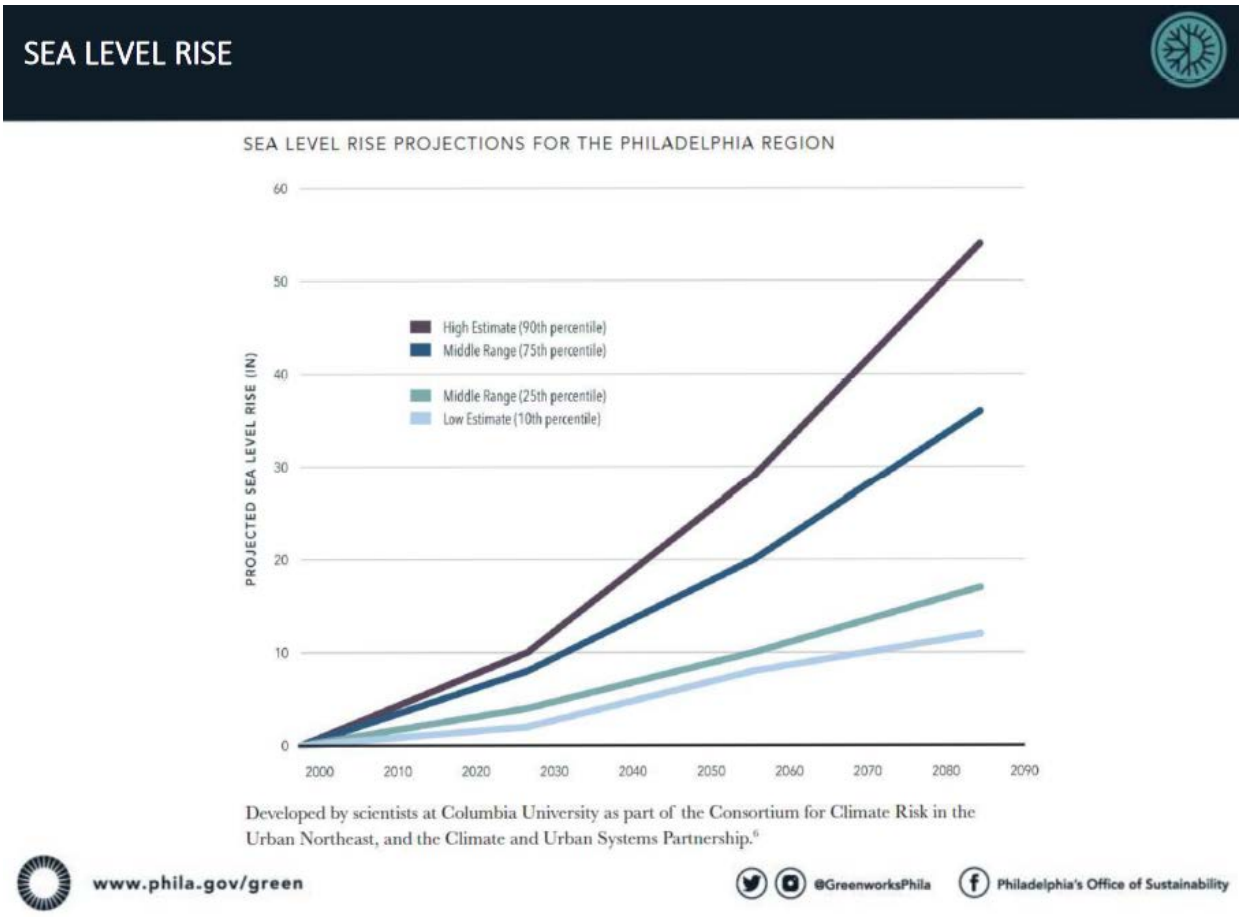
POTENTIAL INUNDATION FROM SEA LEVEL RISE



Areas in Philadelphia at risk of inundation under two feet of sea level rise, which is the expected sea level rise in 2050 under a scenario of moderate greenhouse gas emissions; four feet of sea level rise, which is the expected sea level rise in 2100; and six feet of sea level rise, which is the expected level in 2100 under a high-greenhouse-gas emissions scenario.

Id., page 16.

A more recent report of the city's Office of Sustainability projects an increase of sea level rise of two to seven inches during the period 2000-2020, with further increases thereafter:



City of Philadelphia, Office of Sustainability, *Greenworks: A Vision for a Sustainable Philadelphia* (May 31, 2018), page 13.

B. <u>The projected sea level rise of 2 feet by 2050 will place extensive areas of the former refinery underwater.</u>

The Sea Rise Viewer of the National Oceanic and Atmospheric Administration provides a vivid description of what this will mean for the former refinery. The following are a series of snipped figures showing the implications of sea level rise on the refinery site, downloaded on January 4, 2021.

In the following figures, the blue areas are areas of sea level rise because they are hydrologically connected to the ocean:

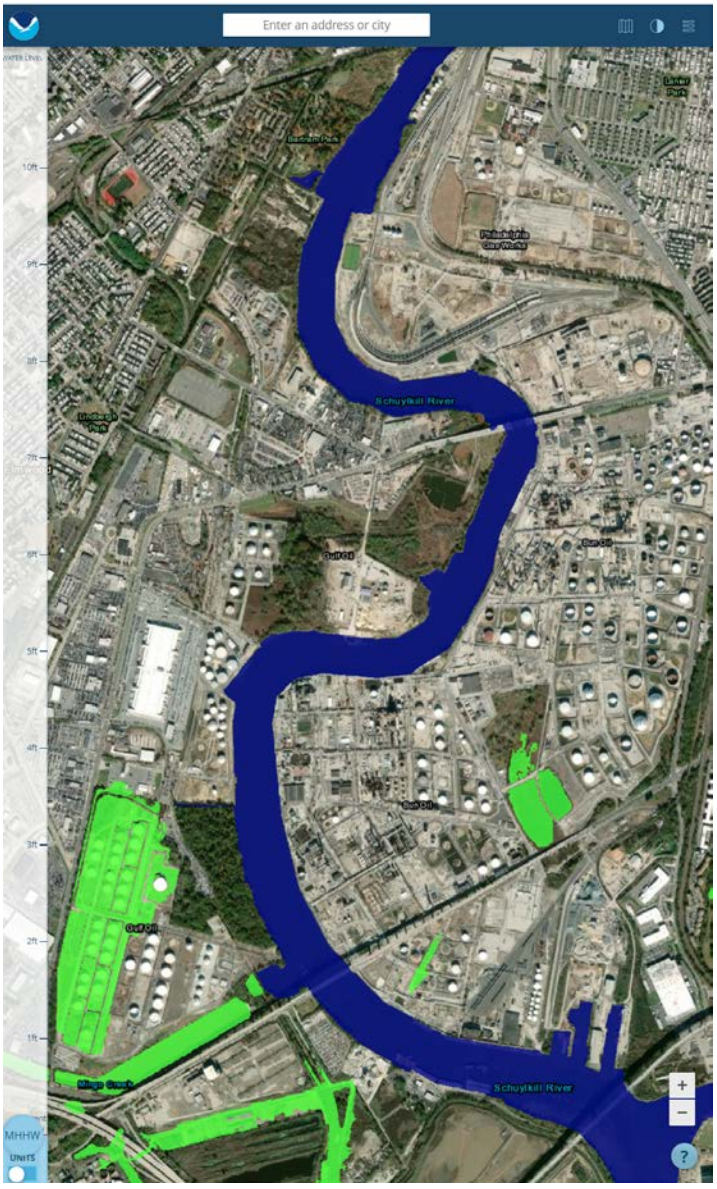
> Water levels are relative to local Mean Higher High Water Datum. ***Areas that are hydrologically connected to the ocean are shown in shades of blue (darker blue = greater depth***).

See NOAA, Sea Level Rise Viewer (click on the circular icon with the letter “i” in the lower left hand corner) (bold italics added for emphasis). The green areas are areas that may also flood even though they are hydrologically "unconnected" to the ocean:

> Low-lying areas, displayed in green, ***are hydrologically "unconnected" areas that may also flood***.

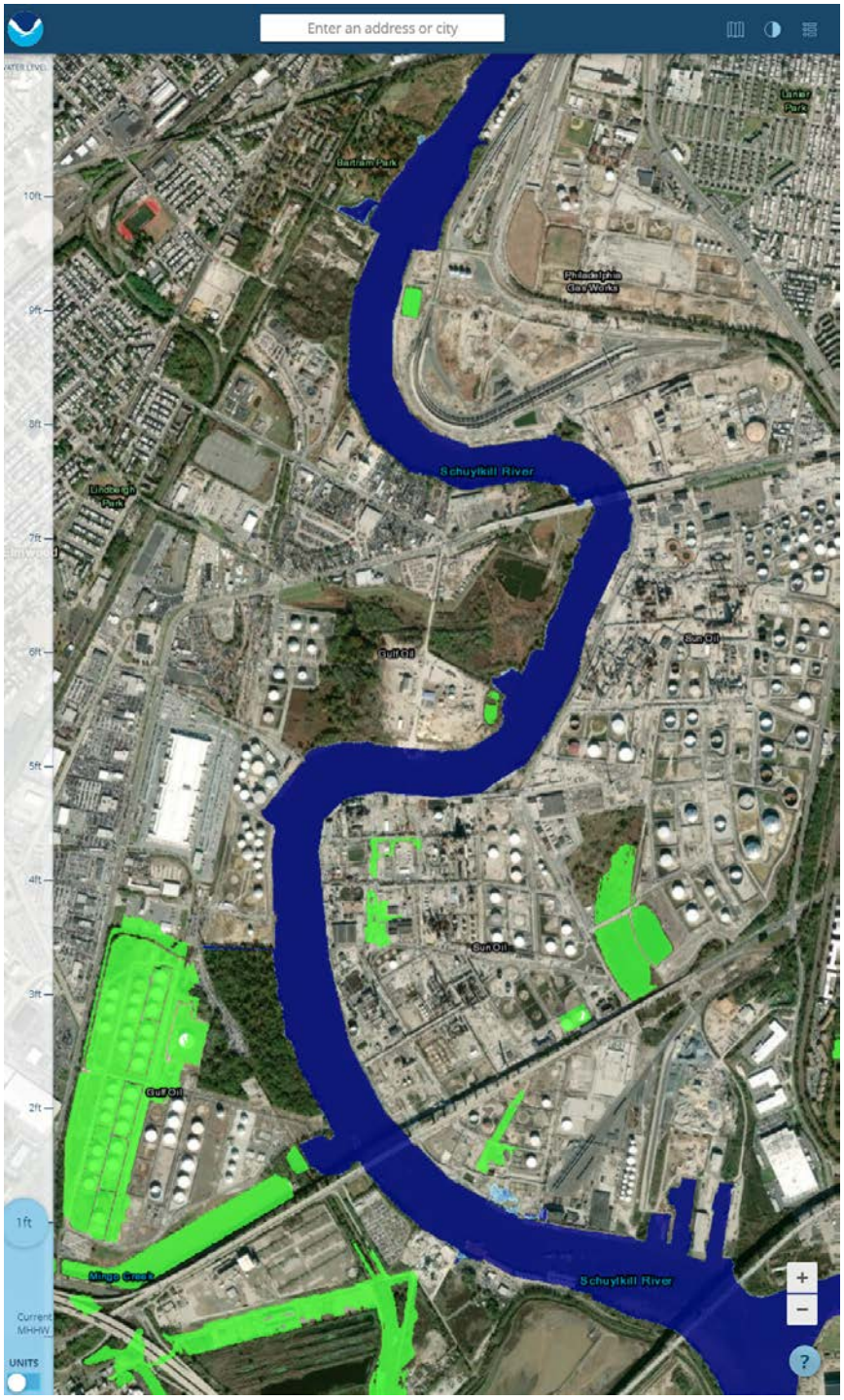
See id.

This first map shows current conditions:



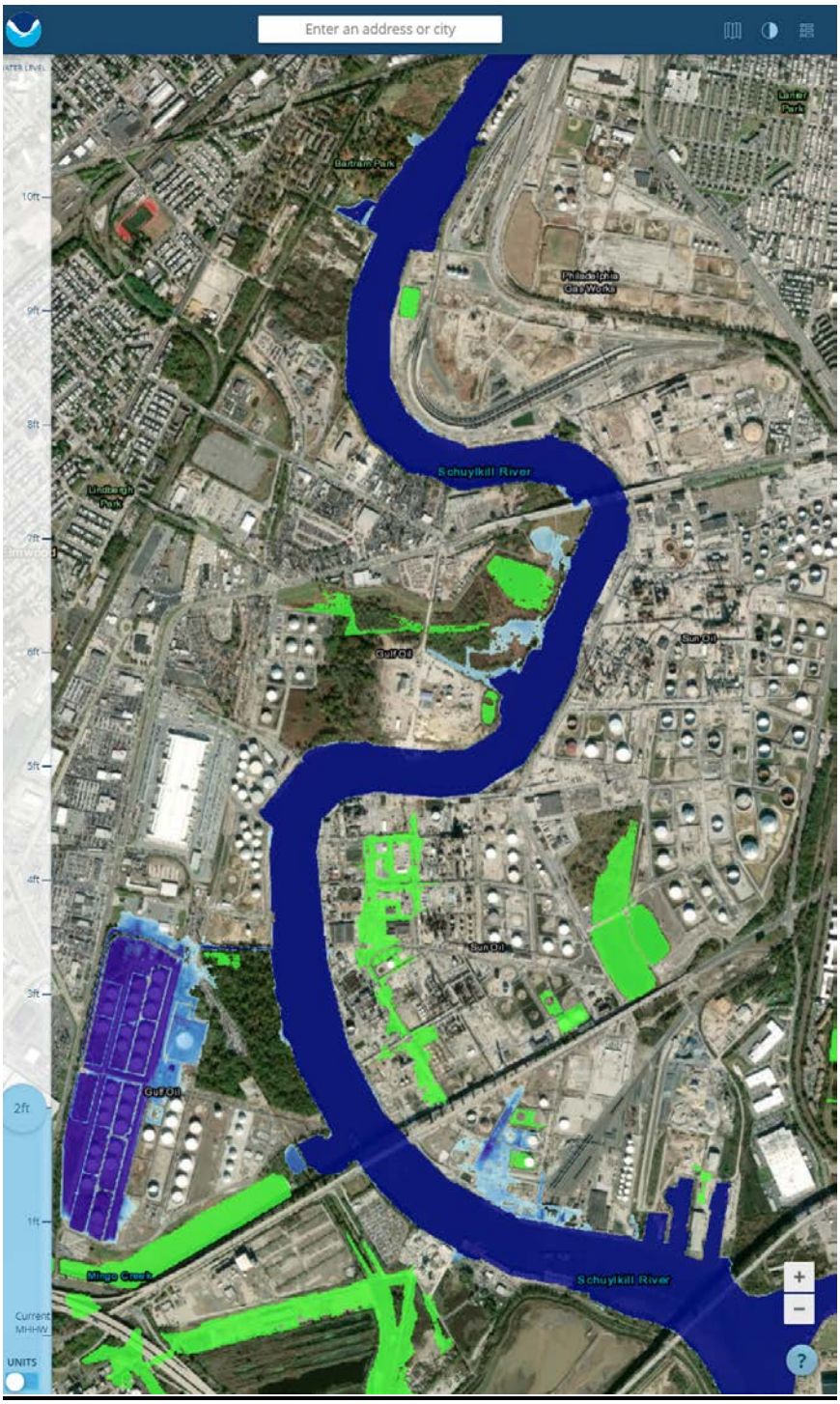
Source: NOAA Sea Level Rise Viewer (set for Mean Higher High Water (MHHW).

This second map shows that sea level rise of one foot will cover parts of AOI-5 and AOI-10:



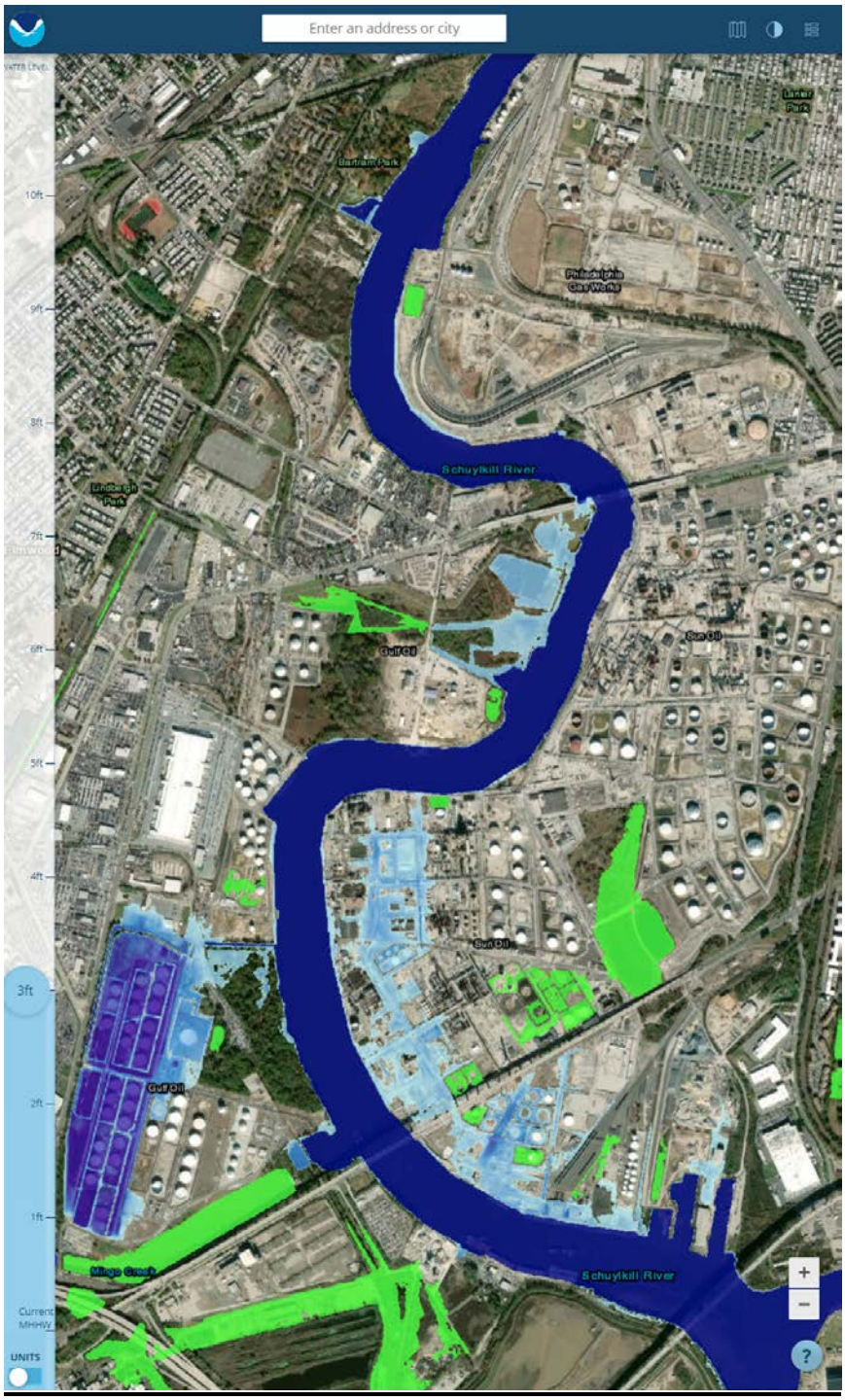
Source: [NOAA Sea Level Rise Viewer] (set for one foot)

The third map shows that sea level rise of two feet will cover extensive parts of AOI-5, AOI-9 and AOI-10, and small parts of AOI-6 and AOI-8:



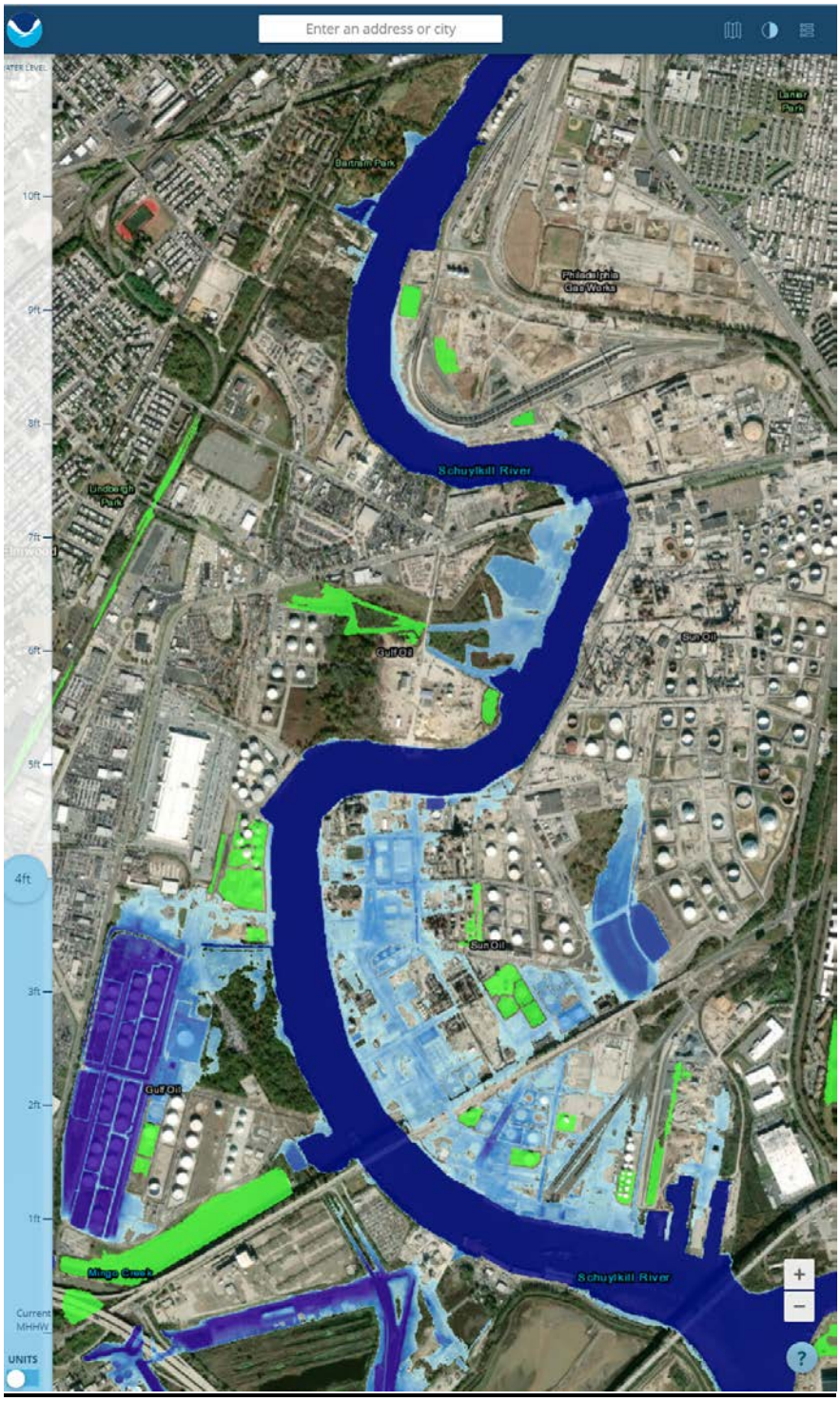
Source: [NOAA Sea Level Rise Viewer] (two feet)

The fourth map shows that sea level rise of three feet will cover extensive areas in AOI-5, AOI-6, AOI-7, AOI-9, and AOI-10, and parts of AOI-8:



Source: [NOAA Sea Level Rise Viewer](#) (three feet)

The fifth map shows that sea level rise of four feet will cover extensive areas in AOI-3, AOI-5, AOI-6, AOI-7, AOI-9, and AOI-10, and parts of AOI-8:



Source: [NOAA Sea Level Rise Viewer](#) (four feet)

C. <u>According to EPA Region III, a responsible party should consider the impacts of climate change during a remedial investigation</u>.

EPA Region III has jurisdiction over the remedial investigation at the oil refinery. It is the policy of EPA Region III to consider sea level rise at the remedial investigation stage, and it encourages state agencies to do the same. Region III makes this clear in its Climate Change Adaptation Implementation Plan:

> Priority Actions, Goal 3 Cleaning Up America's Communities & Advancing Sustainable Development:
>
> ….
>
> ***Perform vulnerability analyses during site investigation***, cleanup design, operations and maintenance, five year reviews, etc. ***Encourage states to consider doing the same for state-led states***.

See EPA Mid-Atlantic Region III, Climate Change Adaptation Implementation Plan (May 30, 2014), page 25.

For example, Region III notes that shallow groundwater aquifers are likely to be the most sensitive part of the groundwater system to climate change:

> D. Water Quality impacts from climate changes
>
> ***Shallow groundwater aquifers that exchange water with streams are likely to be the most sensitive part of the groundwater system to climate change***. ***Small reductions in groundwater levels can lead to large reductions in stream flow and increases in groundwater levels can increase stream flow***. Further, the interface between streams and groundwater is an important site for pollution removal by microorganisms. Their activity may change in response to increased temperature and increased or decreased streamflow as climate changes, this may affect water quality and affect Clean Water Act goals related to water bodies in non-attainment and affect TMDL development.
>
> A specific mid-Atlantic water quality concern[] is the Delaware River Basin, which includes portions of New York, Pennsylvania, New Jersey, and Delaware that drain to the 330-mile long Delaware River and Bay...."

Id., page 14 (bold italics for emphasis). We know that the water table is high in areas of the site. *See* Comment #12, below.

In addition, Region III acknowledges the potential for impacts of sea level rise on aquifers and groundwater:

> E. Severe flooding from sea-level rise and extreme precipitation is likely to increase
>
> ***Sea-level rise is expected to increase saltwater intrusion into coastal freshwater aquifers***, making some unusable without desalination. Increased evaporation or reduced recharge (drought) into coastal aquifers exacerbates saltwater intrusion. Like water quality, ***research on the impacts of climate change on groundwater,*** ecosystems, and infrastructure ***has been minimal and remedies may be difficult***.

Id., page 15 (bold italics for emphasis).

Finally, Region III acknowledges that flooding could affect the migration and management of contaminants:

> A. Restoring and Preserving Land
>
> Increased flooding and sea-level rise may increase the risk of contaminant releases from vulnerable RCRA Corrective Action sites, Superfund sites, Brownfield sites, LUST sites, other contaminated sites, and landfills. ***Flooding from more intense and frequent storms and extreme storm events could affect the migration and management of contaminants***. Sea-level rise can lead to inundation and salt water intrusion which may impact the performance of the remedies ***and cause the transport of contaminants at sites in coastal areas***. Contaminant migration could also occur after prolonged power loss at cleanup sites with pump and treat systems dependent on grid electricity.
>
> Impacts may be most severe for cleanup sites that are not yet completed; however sites with waste in place following a cleanup and permitted facilities that manage hazardous materials may also be vulnerable. ***Sites with on-site containment or treatment remedies within the 100 or 500 year flood plain of a surface water body and/or within the sea-level rise zone 1.5 meters above high tide are of particular concern in Region III***. Sediment sites with in situ capping remedies are vulnerable to flood regime changes and re-suspension and deposition of contaminated sediment. Flooding from storms and inundation due to sea level rise could jeopardize land revitalization efforts

> including renewable energy generation, greener cleanups, and ecological revitalization projects, as well as other site reuse or redevelopment plans at Brownfield sites and completed Superfund Sites.
>
> Increased ambient temperatures and extreme heat may impact the design and operation of remediation systems. Cleanup sites with waste in place phytoremediation, or a vegetative cap may be vulnerable in areas that experience drought or changing plant hardiness zones. Slowed growth rates during heat waves could impact the success of the remedy or revitalization effort, and excessive vegetation loss could lead to erosion. Coastal, stream, and mountain ridge top habitats are examples of ecosystems in Region 3 that are vulnerable to increases in ambient temperature.

Id., page 17 (bold italics for emphasis).

Last year, the Government Accountability Office published a report recommending that EPA take additional actions to manage risks from climate change. U.S. Government Accountability Office, *Superfund: EPA Should Take Additional Actions to Manage Risks from Climate Change*, GAO-20-73 (2019). The GAO report described Region III's adoption of a policy considering climate change in cleanups of contaminated sites.

To illustrate, the Region III plan notes that increased flooding and sea level rise may increase risks of releases of contaminants:

> Each of the 10 EPA regional offices identified relevant regional climate change effects in their 2014 climate change adaptation implementation plans. [footnote 70]. For example, ***the Region 3 plan states that increased flooding and sea level rise may increase risks of releases of contaminants, salt water intrusion may impact the performance of remedies, and increased temperatures may impact vegetation that prevents erosion***.

Id., pages 36-37.

In addition, the plan notes that "Region 3 has developed a mapping tool on climate change vulnerability that provides site-level assessments of sea level rise, among other potential impacts." *Id.*, page 39.

The GAO report also noted that "[o]fficials from Region 3 told us that they take into account a number of factors, including climate change impacts, if any, when they design and select site remedies."). *Id.*, page 43.

Applying these principles, Region III has considered sea level rise and climate change in the context of the Publicker Industries site on the Delaware River, in southeast Philadelphia. The GAO Report noted that "Region 3 considered newly available information on projected sea level rise in the region to determine if those projections called into question the protectiveness of the existing remedies at the site." *Id.*, page 44.

It is notable that sea level rise was not a concern for the Publicker Industries site only because it is located at a high elevation above sea level (15-19 feet):

> Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
>
> Answer: No other information has come to light that calls into question the protectiveness of the remedy. However, ***due to the proximity of the Publicker site and the Delaware River, EPA looked at the potential impacts from the effects of climate change for this Five-Year Review.*** In a joint report from the EPA and the Delaware River Basin Commission, ***an estimated 21-inch rise in global sea level by 2050 would imply a rise of 2.4 feet in the Delaware estuary***. Also, an estimated 7-foot global rise by 2100 would imply an 8.2-foot rise in the Delaware estuary. [footnote omitted]. ***The Publicker property is located at an elevation of approximately 15-19 feet above sea level***."

See 2014 Five-Year Report for Publicker Industries, page 10 (bold italics for emphasis).

But the oil refinery is closer to sea level, making sea level rise more of a concern. The Publicker Industries site is located at 3223 South Delaware Avenue, Philadelphia, near the Walt Whitman Bridge. *See* EPA, Superfund Site: Publicker Industries Inc. This is about three miles from the oil refinery, and it is located in the same watershed. Just as EPA considered sea level rise in the context of that matter, Evergreen should have considered sea level rise in these reports.

D. <u>The reports do not address climate change when delineating the nature and extent of contamination</u>.

But none of the reports contains any meaningful discussion of the impact of climate change and sea level rise on the remedial investigation.

It would not be a satisfactory response for Evergreen to assert that this is a remediation question to be addressed in the future, rather than a remedial investigation question to be addressed now. That would be a false distinction. In fact, Evergreen has made it a remedial investigation question in its reports wherever it has asserted that pathways of exposure through soil and groundwater are not complete because of on-site permit personal protective equipment (PPE) procedures:

7.6 Potential Migration Pathways and Site Receptors

The following summarizes potential migration pathways and site receptors for AOI 5. AOI 5 is situated within a fenced and secured area to prevent unauthorized Access.

- The potential direct contact pathway to soil greater than two feet is ***deemed incomplete based on PES's on-site permit and PPE procedures which limit exposure to soil encountered in excavations***.

- The potential direct contact pathway to groundwater is ***deemed incomplete based on PES's on-site permit and PPE procedures which limit exposure to groundwater that may be encountered in excavations***.

See 2017 Report (AOI-5), Section 7.6, pages 60-61. Evergreen makes similar assertions in other reports. *See e.g.*, 2016 Report (AOI-1), Section 9.6, pages 9.57-9.58, 2017 Report (AOI-2), Section 7.6, pages 48-49, 2017 Report (AOI-3), Section 7.6, pages 42-43, 2017 Report (AOI-4), Section 9.7, pages 9.55-9.56, Section 7.6, page 42, 2017 Report (AOI-6), Section 9.6, page 37, 2017 Report (AOI-7), Section 9.6, pages 39-40, 2017 Report (AOI-8), Section 10.6, pages 10.75-10.77, 2017 Report Addendum (AOI-9), Section 6.5, page 27, 2011 Report (AOI-10), Section 7.6, pages 28-29. Because the impacts of sea level rise and climate change may affect pathways of exposure, those assertions are flawed.

Evergreen has not explained how on-site permit and PPE procedures will guard against the impacts of climate change -- including sea level rise and storm surge events. The reports are deficient and they need to be revised.

11. Evergreen May Not Fragment the Remedial Investigation Reports by Diverting its Deficiencies Into a Future Fate and Transport Remedial Investigation Report.

Evergreen unfairly attempts to respond to numerous flaws in the reports (including its insufficient characterization of the unconfined aquifer and lower aquifer), by simply promising a future remedial investigation report later this year. *See* 2020 First Amendment to Consent Order and Agreement, page 5 of 77 (setting forth a deadline of December 31, 2021 for a "Fate and Transport Remedial Investigation Report"). This would allow Evergreen to fragment the remedial investigation reports into different pieces, minimizing public scrutiny and delaying its responses to public concerns. It would be fundamentally unfair.

Under Evergreen's approach, the current reports would be approved individually and considered closed, preventing any further comments on them. But later on, the public would be commenting on material that was carved out of these reports and moved into a new report. The objection would then be made that the public may not comment on matters that were previously approved, even though the material is interrelated.

This is flawed for several reasons. The public cannot meaningfully comment on soil and groundwater sampling in the current reports without having a complete analysis of the relationship between the unconfined aquifer and the deep aquifer. Also, it cannot comment on a future fate and transport analysis without considering the underlying soil and groundwater data organized by Evergreen in the current reports.

It is worth noting that the Fate and Transport Remedial Investigation Report promised by Evergreen simply appears to be nothing more than a revised report for AOI-11 that was disapproved in 2013. Nothing in the Department's review of that report compels the conclusion that the remedial investigation reports should be fragmented in the manner proposed by Evergreen. *See* 2011 Comments (AOI-11), Comment 8, 2013 Comments (AOI-11), Comments 11-19, 2013 Memorandum (AOI-11), pages 3-4, 2013 Disapproval Letter (AOI-11). The implication of the Department's disapproval was merely that Sunoco had to submit another remedial investigation report that included an approvable fate and transport analysis. The implication was not that Sunoco should fragment the remedial investigation reports for AOI-11.

In its discussion of site characterization activities in Section II of the Technical Guidance Manual, the Department emphatically recognizes that a fate and transport analysis is a part of a site characterization, and not separate from it:

> The site characterization activities conducted must result in a thorough investigation which meets the requirements of Pa. Code § 250.204. **A complete and accurate site characterization, including fate and transport analysis, and its documentation in the final report is very important, as it is the basis for making remediation decisions and is used later in identifying the appropriate area for demonstrating attainment. Except for sites involving the excavation option for petroleum-**

> **contaminated soil (see 25 Pa. Code § 250.707(b)(1)(iii)), without a proper site characterization, attainment requirements cannot be met and the final report will be disapproved by the Department.**

See DEP, Technical Guidance Manual, Section II.A.4.a, page II-11 (bold in original).

The Department reiterates this point in Section III of the Technical Guidance Manual when it discusses the purpose of a fate and transport analysis:

> **Fate and transport analysis or modeling is a necessary part of site characterization and demonstrating attainment of an Act 2 standard**. However, the Chapter 250 regulations governing Act 2 use the term "fate and transport analysis" as opposed to "fate and transport model." This particular distinction was made because it will not always be necessary to run an analytical or numerical quantitative "fate and transport model" to achieve a standard.
>
> Whether simple or complex, any fate and transport analysis must rely on having and/or obtaining valid data. Reliable field data will be critical in supporting the professional conclusions regarding any predictions of contaminant fate and transport and needs to be considered during the site characterization.
>
> Fate and transport analysis will be used in the Act 2 process to predict contaminant concentrations migrating through the unsaturated zone and the saturated zone, including the impact of soil contamination on groundwater. It will also include an analysis of diffuse groundwater flow into surface water (e.g., a stream) for purposes of determining compliance with surface water quality standards.

See DEP, Technical Guidance Manual, Section III.A, page III-1 (bold in original, underlining added for emphasis). Because "[f]ate and transport analysis or modeling is a necessary part of site characterization," Evergreen may not break out parts of the current remedial investigation reports to address later in a Fate and Transport Remedial Investigation Report.

The proper way to do this is all at once as Sunoco originally attempted to do in 2013 (although it did this unsuccessfully because the report for AOI-11 was deficient).

When Evergreen revises the current reports to address the multiple flaws identified throughout these comments, it should include whatever fate and transport analysis it has been preparing since it submitted its last report over three years ago. Everything should be republished for another public comment period before submission to the Department.

12. <u>Evergreen Fails to Sufficiently Delineate Exceedances of the Soil-to-Groundwater Numeric Value and the Direct Contact Numeric Value for All Constituents of Concern</u>.

Throughout the reports, Evergreen looked for contamination at a distance with a telescope, rather than close-up with a magnifying glass. It conformed its discussion of exceedances to an expectation that it would have to meet less stringent cleanup levels, rather than more stringent cleanup levels. To illustrate, it focused its efforts on delineating lead contamination in surface soils with respect to a direct contact numeric value (1000 mg/kg) and a proposed site-specific standard (initially 1708 mg/kg, and later 2240 mg/kg), while marginalizing and at times even obliterating a discussion of the soil-to-groundwater numeric value (450 mg/kg).

To the extent that data regarding exceedances of the more stringent soil-to-groundwater numeric value are included in the reports, they are buried in dense tables and highlighted as many as three times to reflect three different numeric values being exceeded at the same time. This does not provide a clear delineation of the contamination for the public. The public is entitled to a picture of what the contamination looks like from the perspective of different numeric values.

There is no discussion of whether the soil-to-groundwater numeric value prevails over the direct contact numeric value in setting the Medium-Specific Concentration, which is particularly problematic because the water table is less than ten feet from the surface of the ground in areas of the site, necessitating the use of the soil-to-groundwater numeric value.

Evergreen does not provide an adequate explanation as to why it believes the contamination has been delineated. Often its summary conclusion is based on the assertion that it found a certain number of exceedances of the proposed site-specific standard, which is insufficient.

A statement of policy in Act 2 recognizes the importance of the public understanding how remediation standards are applied at a site:

> ***The public is entitled to understand how remediation standards are applied to a site*** through a plain language description of contamination present on a site, the risk it poses to public health and the environment and any proposed cleanup measure.

See Act 2, §102(9) (bold italics added for emphasis), 35 P.S. §6026.102(9) (same, in unofficial statute). In the case, Evergreen does not sufficiently explain the interplay between the soil-to-groundwater numeric value and the direct contact numeric value.

A. Under the regulations, a Medium-Specific Concentration is defined by the lower of the soil-to-groundwater numeric value or the direct contact numeric value, unless the responsible party makes a soil-to-groundwater pathway equivalency determination.

For surface soils (0-2 feet), the MSC is determined by the lowest of three numbers, one of which is the soil-to-groundwater pathway numeric value:

> (d) ***For the nonresidential standard***, the MSC for regulated substances contained ***in soil throughout the soil column to a depth of 2 feet from the existing ground surface*** is one of the following:
>
> (1) ***The lowest of the following***:
>
> (i) ***The ingestion numeric value as determined by the methodology in § 250.306***, using the appropriate default nonresidential exposure assumptions contained in § 250.306(e).
>
> (ii) ***The inhalation numeric value*** which is the lower of the values for volatilization into the outdoor air and the inhalation of particulates, ***as determined by the methodology in § 250.307***, using the appropriate default nonresidential exposure assumptions contained in § 250.307(d).
>
> (iii) ***The soil-to-groundwater pathway numeric value throughout the entire soil column as determined by the methodology in § 250.308***.

See 25 Pa. Code §250.308(d)(1) (bold italics added for emphasis). The other two numbers are the ingestion numeric value under §250.306 and the inhalation numeric value under 250.307. *See id.* Tables 3A (organics) and 4A (inorganics) in Appendix A list the other values (in the form of the direct contact numeric value) for each contaminant). *See id.*

A responsible party can avoid the soil-to-groundwater numeric value under paragraph (1)(iii), but only if it provides either a demonstration of a soil buffer or an equivalency demonstration:

> (2) ***The lowest of paragraph (1)(i) or (ii) and***, in addition, ***one of the following***:
>
> (i) ***A demonstration of the soil-to-groundwater pathway soil buffer*** as identified in § 250.308(b), if applicable.

> (ii) ***A soil-to-groundwater pathway equivalency demonstration*** as identified in § 250.308(d).

See id., 25 Pa. Code §250.308(d)(2) (bold italics added for emphasis).

The first cross-referenced section requires the identification of a soil buffer that meets a vertical distance value set forth in a Table in the regulations, as well as other requirements:

> (b) ***The soil-to-groundwater pathway soil buffer is the entire area between the bottom of the area of contamination and the groundwater or bedrock*** and ***shall meet the following criteria***:
>
> (1***) The soil depths established in Appendix A, Tables 3B and 4B*** for each regulated substance.
>
> (2) The ***concentration*** of the regulated substance ***cannot exceed the limit related to the PQL or background*** throughout the soil buffer.
>
> (3) No Karst carbonate formation underlies or is within 100 feet of the perimeter of the contaminated soil area.

See id., 25 Pa. Code §250.308(b) (bold italics added for emphasis). This means that the responsible party must look at Table 3B (setting forth soil buffer distances for organics) and Table 4B (setting forth soil buffer distances for inorganics), to compare with the depth of the soil sample.

In other words, assuming the soil-to-groundwater numeric value is the lowest of the three numbers in Section 306(d)(1), a responsible party must guide its soil samples according to the soil-to-groundwater numeric value or according to the PQL or background.

The second cross-referenced section allows the substitution of an equivalency demonstration if the groundwater is below the Medium-Specific Concentration or the background standard prior to remediation:

> (d) For any regulated substance, ***an equivalency demonstration may be substituted*** for the soil-to-groundwater numeric value throughout the site and the soil-to-groundwater pathway soil buffer ***if the groundwater is below the MSC value or the background standard prior to remediation***. This equivalency demonstration shall include the following:
>
> (1) ***Fate and transport analysis*** of the regulated substance from the deepest point of contamination in the soil through unsaturated zone soil ***and shall include the use of soil-to-water partition***

> ***coefficients***. The analysis ***shall demonstrate that the regulated substances will not migrate to bedrock or the groundwater within 30 years at concentrations exceeding the greater of the groundwater MSC or background groundwater*** as the endpoint in soil pore water directly under the site.
>
> (2) In addition to sampling required for attainment of the inhalation or ingestion numeric values for soils up to 15 feet, as applicable, **reporting and monitoring for eight quarters that shows no exceedances of the greater of the groundwater MSCs or of the background standard f**or groundwater beneath the contaminated soil and no indications of an increasing trend of concentration over time that may exceed the standard.

See id., 25 Pa. Code §250.308(d) (bold italics added for emphasis). To do this substitution, the responsible party would have to conduct groundwater modeling (a fate and transport analysis). In the present case, Evergreen has not performed an approvable fate and transport analysis. Therefore, this substitution is not available to Evergreen.

For subsurface soils (2-15 feet), the Medium-Specific Concentration is determined by the lowest of two numbers, one of which is the soil-to-groundwater pathway numeric value:

> (e) ***For the nonresidential standard***, the MSC for regulated substances contained ***in soils at depths greater than 2 feet through 15 feet from the existing ground surface***, is ***one of the following***:
>
> (1) ***The lowest of the following***:
>
> (i) ***The inhalation numeric value which considers volatilization to the outdoor air, as determined by the methodology in § 250.307***, using the appropriate default nonresidential exposure assumptions contained in § 250.307(d), and using a transfer factor (TF) based upon the calculated emission rate from subsurface soil as specified in the method of Jury, et al. 1990. Water Resources Research, Vol. 26, No. 1, pp. 13—20.
>
> (ii) ***The soil-to-groundwater pathway numeric value throughout the entire soil column as determined by the methodology in § 250.308***.

25 Pa. Code §250.308(e)(1) (bold italics added for emphasis). (The analysis is the same as for surface soils, except for the fact that the ingestion numeric value is not considered).

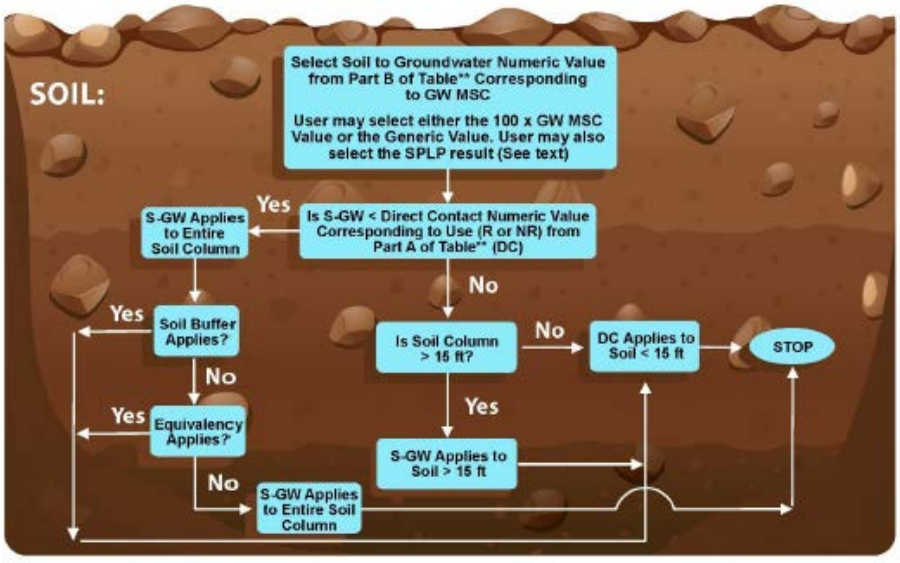
As in the case with surface soils, a responsible party can avoid the soil-to-groundwater numeric value under paragraph (e)(1)(ii), but only if it provides the same demonstrations as discussed above for surface soils:

> (2) ***The value identified in paragraph (1)(i)*** and ***one of the following***:
>
> (i) ***A demonstration of the soil-to-groundwater pathway soil buffer*** as identified in § 250.308(b), if applicable.
>
> (ii) ***A soil-to-groundwater pathway equivalency demonstration*** as identified in § 250.308(d).

25 Pa. Code §250.308(e)(2) (bold italics added for emphasis).

The Technical Guidance Manual confirms this analysis:

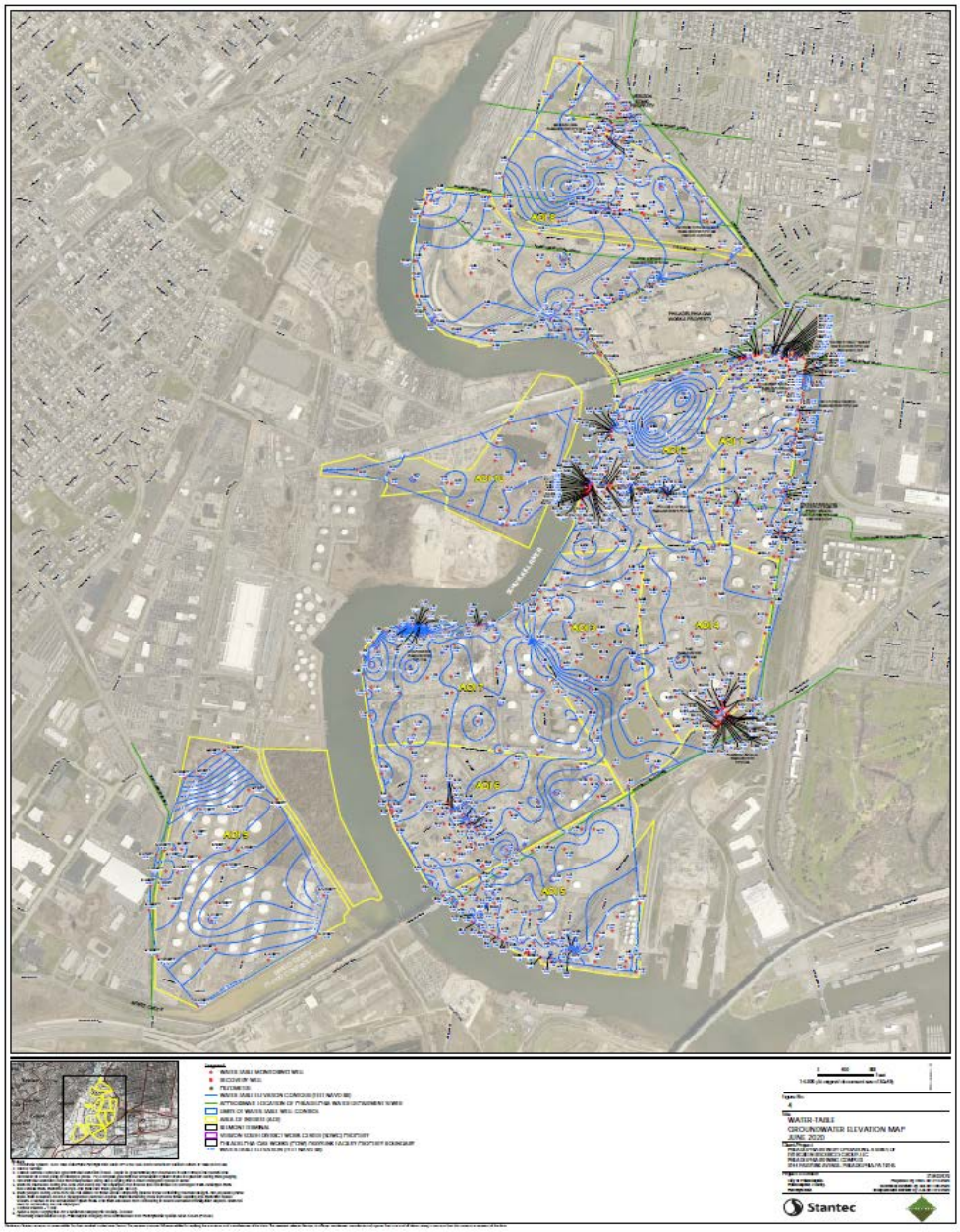
Figure II-11: Decision Tree for Selecting Statewide Health Standard MSCs for Groundwater and Soil



Technical Guidance Manual, page II-52.

B. Because areas of the refinery site have a high water table, Evergreen must compare the soil buffer distance for each Constituent of Concern with the depth of each soil sample, to determine whether the soil-to-groundwater numeric value or the direct contact numeric value defines the Medium-Specific Concentration.

According to a recent groundwater remediation status report, much of the site appears to have a high water table:



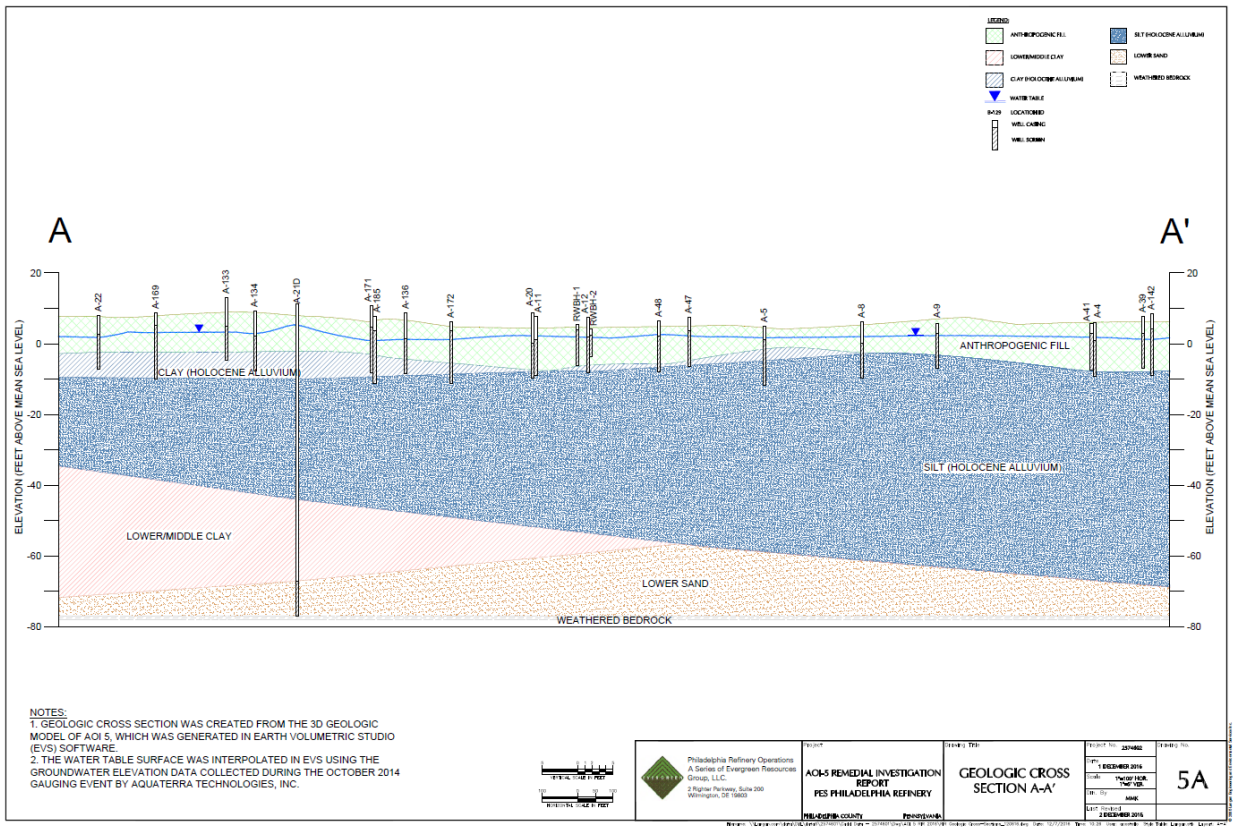
See Semi-Annual Remediation Status Report (June 2020), Figure 4 (Water-Table Groundwater Elevation Map). But the groundwater elevations on this contour map do not literally display the

depth to groundwater from the surface, for two reasons. First, the map is defined by reference to sea level, and not all of the site is located exactly at sea level. Second, not all of the site is exactly flat.

Instead, one must look to other evidence to ascertain the depth to the water table from the surface. Evergreen has provided geologic cross sections for all Areas of Interest. To illustrate with respect to AOI-5, the following Figure from the 2017 report identifies two cross sections -- an A-A' cross section generally running from west to east (in pink), and a B-B' cross section generally running from north to south (in green):

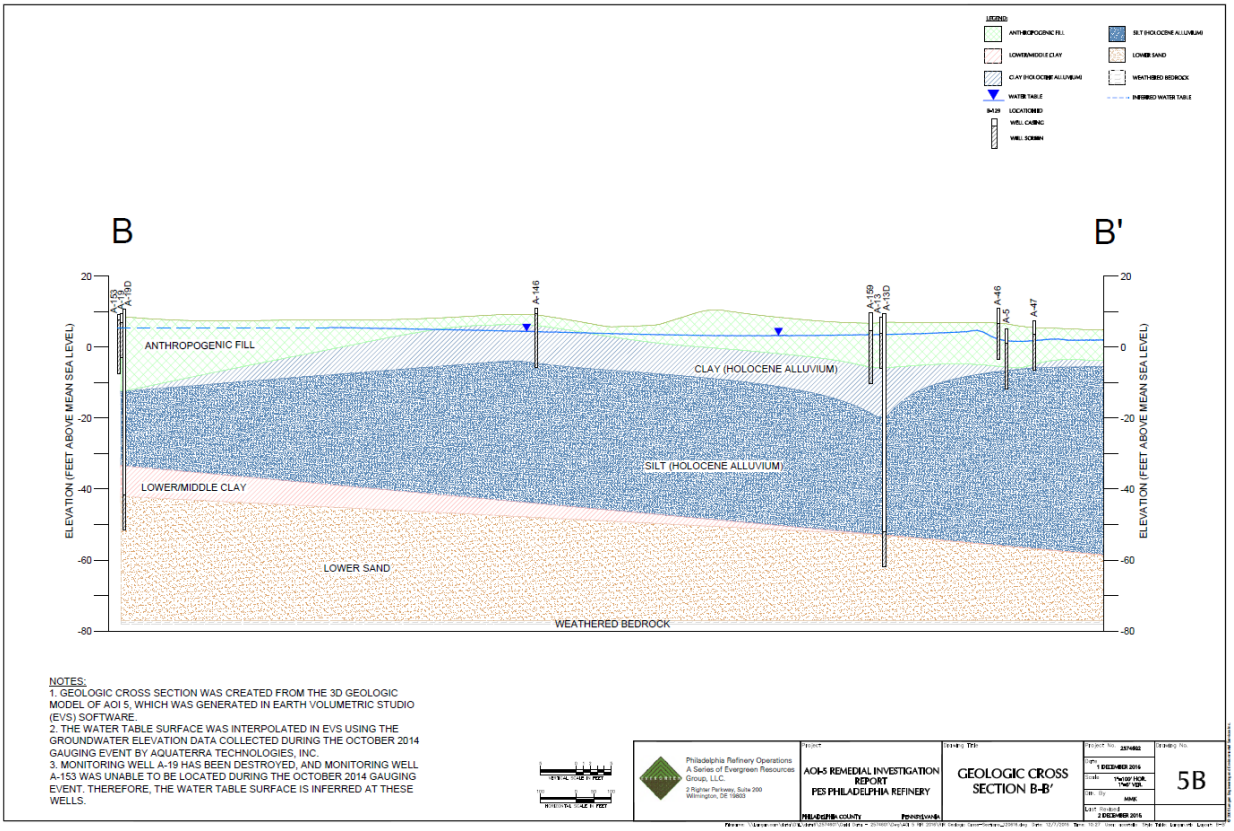
2017 Report (AOI-5), Figure 4 (Geologic Cross Section Location Plan).

The following Figure displays a side view of cross section A-A', looking from the south toward the north. Throughout all of this cross section, the distance between the yellow line at the top (the surface) and the blue line below (the water table) is less than ten feet:



See id., Figure 5A: Geologic Cross Section A-A'.

The other cross section B-B' tells a similar story. The following Figure displays a side view of this cross section, looking from the west toward the east. Throughout all the cross section, the distance between the yellow line at the top (the surface) and the blue line below (the water table) is less than ten feet:



See id., Figure 5B: Geologic Cross Section B-B'.

Despite this graphical evidence, Evergreen did not delineate the contamination in the 2017 report for AOI-5 according to the soil-to-groundwater numeric value. Rather, it delineated it according to the direct contact numeric value and the proposed site-specific value. (See discussion below). Evergreen does not provide a justification for this, and there does not appear to be one.

While Evergreen did use the soil-to-groundwater numeric value as a guide for some soil sampling for AOI-5, it did this for the limited purpose of making a hazardous waste determination under the Toxicity Characteristic Leaching Procedure (TCLP) for the management of hazardous waste under the Resource Conservation and Recovery Act (RCRA). (Once contamination is removed, it becomes waste if it is intended to be disposed). The purpose appears to have been simply to establish some criterion for limiting the amount of waste for consideration as hazardous waste. But Evergreen did not do this for all soil samples. This is insufficient to delineate contamination for these reports under Act 2.

A similar analysis may be performed for the other Areas of Interest. The following chart summarizes the geologic cross sections in the reports, and shows there are certain points where the depth to the water table is less than ten feet from the surface:

Area of Interest	Title	Clean Air Council's Analysis of Evergreen's Geologic Cross Sections
AOI-1 Point Breeze No. 1 Tank Farm	2016 Report (part 1)	Figure 5-1, 5-2 (suggesting water table is less than 10 feet below surface at certain points along cross sections)
AOI-2 Point Breeze Processing Area	2017 Report (part 1) (approved)	Figure 5, 6 (suggesting water table is less than 10 feet below surface at certain points along cross sections)
AOI 3 Point Breeze Impoundment Area	2017 Report (approved)	Figure 5, 6 (suggesting water table is less than 10 feet below surface at certain points along cross sections)
AOI-4 No. 4 Tank Farm	2013 Report (disapproved) 2017 Report (Figures) (disapproved)	Figure 5 (failing to show water table depth in cross section) Figures 2.6, 2.7. 2.8 (failing to show water table depth in cross sections)
AOI-5 Girard Point South Tank Field	2011 Report/Cleanup Plan (disapproved) 2017 Report (approved)	Figure 5 (failing to show water table depth in cross section) Figure 5A, 5B (suggesting water table is less than 10 feet below surface at certain points along cross sections)
AOI-6 Girard Point Chemicals Area	2013 Report (disapproved) 2017 Report (approved)	Figures 5, 6 (failing to show water table depth in cross section) Figure 8 (failing to show water table depth in cross section, apart from Schuylkill River)
AOI-7 Girard Point Fuels Area	2012 Report (disapproved) 2013 Addendum to Report (disapproved)	Figure 5A, 5B, 5C (suggesting water table is less than 10 feet below surface at certain points along cross sections) (not providing a geologic cross-section)

	2017 Report (approved)	Figure 8 (failing to show water table depth in cross section, apart from Schuylkill River)
AOI-8 North Yard	2012 Report 2012 Report (part 2) (approved) 2017 Report 2017 Report (part 2) (approved)	Figures 5a, 5b, 5C (failing to show water table depth in cross sections) Figures 2-6, 2-7, 2-8, 2-9, 2-10 (suggesting water table is less than 10 feet below surface at certain points along cross sections)
AOI-9 Schuylkill River Tank Farm	2015 Report (disapproved) 2017 Report Addendum (approved)	Figure 6A, 6B (suggesting water table is less than 10 feet below surface at certain points along cross sections) Figure 6a, 6b (suggesting water table is less than 10 feet below surface at certain points along cross sections)
AOI-10 West Yard	2011 Report (approved)	Figure 4A, 4B (suggesting water table is less than 10 feet below surface at certain points along cross sections)
AOI-11 Deep Aquifer Beneath Complex	2011 Report (part 1) 2011 Report (part 2) 2013 Report (part 1) 2013 Report (part 2) (disapproved)	Appendix D (Site Wide Geologic Cross Sections) (attaching 20 cross-sections for different Areas of Interest) Appendix C (Geologic Cross Sections) (attaching 23 cross-sections from historical reports) Appendix D (Site Wide Geologic Cross Sections) (attaching 20 cross-sections for different Areas of Interest) Appendix C (Geologic Cross Sections) (attaching 23 cross-sections from historical reports)

The regulations set forth a different buffer depth for a number of contaminants. To illustrate in the case of organics, the soil buffer distance for 1,2,4-trimethylbenzene is 15 feet and the soil buffer distance for 1,3,5-trimethylbenzene is 30 feet:

Table 3—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Soil
B. Soil to Groundwater Numeric Values[1]

REGULATED SUBSTANCE	CASRN	Used Aquifers								Nonuse Aquifers				Soil Buffer Distance (feet)
		TDS ≤ 2500				TDS > 2500								
		Residential		Nonresidential		Residential		Nonresidential		Residential		Nonresidential		
		100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	
TRICHLOROPROPANE, 1,2,3-	96-18-4	4	3.2 E	4	3.2 E	400	320 E	400	320 E	400	320 E	400	320 E	NA
TRICHLOROPROPENE, 1,2,3-	96-19-5	0.063	0.037 E	0.26	0.15 E	6.3	3.7 E	26	15 E	0.063	0.037 E	0.26	0.15 E	NA
TRIETHYLAMINE	121-44-8	1.5	0.36 E	6.2	1.5 E	150	36 E	620	150 E	1.5	0.36 E	6.2	1.5 E	NA
TRIETHYLENE GLYCOL	112-27-6	8,300	1,000 E	10,000	2,900 E	10,000	10,000 C	10,000	10,000 C	8,300	1,000 E	10,000	2,900 E	NA
TRIFLURALIN	1582-09-8	1	1.9 E	1	1.9 E	100	190 E	100	190 E	1	1.9 E	1	1.9 E	30
TRIMETHYLBENZENE, 1,3,4- (TRIMETHYLBENZENE, 1,2,4-)	95-63-6	1.5	8.4 E	6.2	35 E	150	840 E	620	3,500 E	150	840 E	620	3,500 E	15
TRIMETHYLBENZENE, 1,3,5-	108-67-8	42	74 E	120	210 E	4,200	7,400 E	4,900	8,600 E	42	74 E	120	210 E	30
TRINITROGLYCEROL (NITROGLYCERIN)	55-63-0	0.5	0.2 E	0.5	0.2 E	50	20 E	50	20 E	50	20 E	50	20 E	NA
TRINITROTOLUENE, 2,4,6-	118-96-7	0.2	0.023 E	0.2	0.023 E	20	2.3 E	20	2.3 E	0.2	0.023 E	0.2	0.023 E	NA
VINYL ACETATE	108-05-4	42	5 E	180	21 E	4,200	500 E	10,000	2,100 E	42	5 E	180	21 E	NA
VINYL BROMIDE (BROMOETHENE)	593-60-2	0.15	0.073 E	0.78	0.38 E	15	7.3 E	78	38 E	1.5	0.73 E	7.8	3.8 E	NA
VINYL CHLORIDE	75-01-4	0.2	0.027 E	0.2	0.027 E	20	2.7 E	20	2.7 E	2	0.27 E	2	0.27 E	NA
WARFARIN	81-81-2	1.3	3.1 E	3.5	8.4 E	130	310 E	350	840 E	1,300	3,100 E	1,700	4,100 E	30
XYLENES (TOTAL)	1330-20-7	1,000	990 E	1,000	990 E	10,000	10,000 C	10,000	10,000 C	10,000	10,000 C	10,000	10,000 C	NA
ZINEB	12122-67-7	210	33 E	580	92 E	1,000	160 E	1,000	160 E	210	33 E	580	92 E	NA

[1] For other options see Section 250.308
All concentrations in mg/kg
E—Number calculated by the soil to groundwater equation is section 250.308
C—Cap
NA—The soil buffer distance option is not available for this substance
THMs—The values listed for trihalomethanes (THMs) are the total for all THMs combined.
HAAs—The values listed for haloacetic acids (HAAs) are the total for all HAAs combined.

See 25 Pa. Code 250, Appendix A, Table 3B (organic regulated substances).

To illustrate in the case of inorganics (metals), the soil buffer distance for lead is 10 feet:

Table 4—Medium-Specific Concentrations (MSCs) for Inorganic Regulated Substances in Soil
B. Soil to Groundwater Numeric Values[1]

REGULATED SUBSTANCE	CASRN	Used Aquifers								Nonuse Aquifers				Soil Buffer Distance (feet)
		TDS <= 2500				TDS > 2500								
		R		NR		R		NR		R		NR		
		100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	100 X GW MSC	Generic Value	
ALUMINUM	7429-90-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ANTIMONY	7440-36-0	0.6	27	0.6	27	60	2,700	60	2,700	600	27,000	600	27,000	15
ARSENIC	7440-38-2	1	29	1	29	100	2,900	100	2,900	1,000	29,000	1,000	29,000	15
BARIUM AND COMPOUNDS	7440-39-3	200	8,200	200	8,200	20,000	190,000	20,000	190,000	190,000	190,000	190,000	190,000	15
BERYLLIUM	7440-41-7	0.4	320	0.4	320	40	32,000	40	32,000	400	190,000	400	190,000	10
BORON AND COMPOUNDS	7440-42-8	600	1,900	600	1,900	60,000	190,000	60,000	190,000	190,000	190,000	190,000	190,000	30
CADMIUM	7440-43-9	0.5	38	0.5	38	50	3,800	50	3,800	500	38,000	500	38,000	15
CHROMIUM (III)	16065-83-1	10	190,000	10	190,000	1,000	190,000	1,000	190,000	10,000	190,000	10,000	190,000	5
CHROMIUM (VI)	18540-29-9	10	190	10	190	1,000	19,000	1,000	19,000	10,000	190,000	10,000	190,000	15
COBALT	7440-48-4	1	59	4	160	130	5,900	350	16,000	1,300	59,000	3,500	160,000	15
COPPER	7440-50-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CYANIDE, FREE	57-12-5	20	200	20	200	2,000	20,000	2,000	20,000	20,000	190,000	20,000	190,000	20
FLUORIDE	16984-48-8	400	44	400	44	40,000	4,400	40,000	4,400	190,000	44,000	190,000	44,000	NA
IRON	7439-89-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LEAD	7439-92-1	0.5	450	0.5	450	50	45,000	50	45,000	500	190,000	500	190,000	10
LITHIUM	7439-93-2	8	2,500	23	6,900	830	190,000	2,300	190,000	8,300	190,000	23,000	190,000	10
MANGANESE	7439-96-5	30	2,000	30	2,000	3,000	190,000	3,000	190,000	30,000	190,000	30,000	190,000	15
MERCURY	7439-97-6	0.2	10	0.2	10	20	1,000	20	1,000	200	10,000	200	10,000	15
MOLYBDENUM	7439-98-7	4	650	4	650	400	65,000	400	65,000	4,000	190,000	4,000	190,000	15
NICKEL	7440-02-0	10	650	10	650	1,000	65,000	1,000	65,000	10,000	190,000	10,000	190,000	15
PERCHLORATE	7790-98-9	1.5	0.17	1.5	0.17	150	17	150	17	1,500	170	1,500	170	NA
SELENIUM	7782-49-2	5	36	5	36	500	2,600	500	2,600	5,000	26,000	5,000	26,000	20
SILVER	7440-22-4	10	84	10	84	1,000	8,400	1,000	8,400	10,000	84,000	10,000	84,000	20
STRONTIUM	7440-24-6	400	44	400	44	40,000	4,400	40,000	4,400	190,000	44,000	190,000	44,000	NA
THALLIUM	7440-28-0	0.2	14	0.2	14	20	1,400	20	1,400	200	14,000	200	14,000	15
TIN	7440-31-5	2,500	190,000	7,000	190,000	190,000	190,000	190,000	190,000	190,000	190,000	190,000	190,000	10
VANADIUM	7440-62-2	0.29	290	0.82	820	29	29,000	82	82,000	290	190,000	820	190,000	5
ZINC	440-66-6	200	12,000	200	12,000	20,000	190,000	20,000	190,000	190,000	190,000	190,000	190,000	15

[1]For other options see Section 250.308
All concentrations in mg/kg
R—Residential
NR—Non-Residential
NA—Not Applicable

See id., Table 4B (inorganic regulated substances).

Because the geologic cross sections indicate a water table less than ten feet from the surface in areas of the refinery site, Evergreen should have identified the soil buffer distance listed in Table 3B and Table 4B for each contaminant and compared it with the depth of groundwater (namely, the number of feet below the surface at which groundwater is present). Only if Evergreen can satisfy the soil buffer distance test or provide a sufficient equivalency demonstration, can it use the direct contact numeric value to determine the Medium-Specific Concentration.

But Evergreen did not incorporate this analysis into the reports. It should revise the reports to correct this deficiency.

C. <u>Constituents of Concern have soil buffer distances of 5 feet, 10 feet, 15 feet, and 30 feet, potentially causing the soil-to-groundwater numeric value to determine the Medium-Specific Concentration</u>.

In the reports, Evergreen identifies Constituents of Concern for soil sampling and groundwater sampling. *See e.g.*, 2017 Report (AOI-7) (Table 1, "Constituents of Concern"). The following Table (prepared by the Council, not Evergreen) identifies the soil-to-groundwater numeric values and direct contact numeric values referenced by Evergreen.

There are two values that may be used to establish the soil-to-groundwater numeric value. One is based on 100 times the MSC for groundwater. Another is based on generic value

calculations. The one used by Evergreen is highlighted in green. For each Constituent of Concern, the soil-to-groundwater numeric value used by Evergreen is lower than the direct contact numeric value.

In addition, the Table identifies the soil buffer distances corresponding to the Constituents of Concern, and they range from 5 feet (for chrysene) to 30 feet (for naphthalene).

All values in these tables are listed in the regulations as of January 14, 2021, and do not include proposed values in the Department's pending Act 2 rulemaking.

Volatile Organic Compounds (VOCs)
(Prepared by Clean Air Council)

Constituent of Concern	**Nonresidential Surface (0-2ft) soil MSC (mg/kg)**	**Buffer depth (ft)**	**Soil to groundwater 100*GW MSC (mg/kg)**	**Soil to groundwater generic value (mg/kg)**
1,2-Dichloroethane (CAS 107-06-2)	**86 (85)**	NA	**0.5**	0.1
1,2,4-Trimethylbenzene (CAS 95-63-6)	**560 (4700)**	15	6.2(53)	**35 (300)**
1,3,5-Trimethylbenzene (CAS 108-67-8)	**10,000 (4700)**	30	120(53)	**210 (93)**
Benzene (CAS 71-43-2)	**290 (280)**	NA	**0.5**	0.13
Cumene (CAS 98-82-8)	**7700 (7600)**	15	350	**2500**
Ethylbenzene (CAS 100-41-4)	**890 (880)**	NA	**70**	46
Ethylene Dibromide (EDB) (CAS 106-93-4)	**3.7**	NA	**0.005**	0.0012

Methyl Tertiary Butyl Ether (CAS 1634-04-4)	**8600/(8500)**	NA	**2**	0.28
Toluene (CAS 108-88-3)	**10,000**	NA	**100**	44
Xylene (Total) (CAS 1330-20-7)	**8000 (7900)**	NA	**1000**	990

Semivolatile Organic Compounds (VOCs)
(Prepared by Clean Air Council)

Constituent of Concern	Nonresidential Surface soil MSC (mg/kg)	Buffer depth (ft)	Soil to groundwater 100*GW MSC (mg/kg)	Soil to groundwater generic value (mg/kg)
Anthracene (CAS 120-12-7)	**190,000**	10	6.6	**350**
Benzo(a)anthracene (CAS 56-55-3)	**130**	5	0.49(0.39)	**430 (340)**
Benzo(a)pyrene (CAS 50-32-8)	**12 (91)**	5	0.02	**46**
Benzo(b)fluoranthene (CAS 205-99-2)	**76**	5	0.12	**170**
Benzo(g,h,i)perylene (CAS 191-24-2)	**190,000**	5	0.026	**180**
Chrysene (CAS 218-01-9)	**760**	5	0.19	**230**
Fluorene (CAS 86-73-7)	**130,000**	15	190	**3800**
Naphthalene (CAS 91-20-3)	**760/(66)**	30	10	**25**
Phenanthrene (CAS 85-01-8)	**190,000**	10	110	**10,000**
Pyrene (CAS 129-00-0)	**96,000**	10	13	**2200**

For areas where the water table is less than thirty feet from the surface, the Medium-Specific Concentration for the following Constituents of Concern may have to be set by the soil-to-groundwater numeric value:

1. 1,3,5-Trimethylbenzene (soil buffer distance of 30 feet).

For any areas where the water table is less than fifteen feet from the surface, the Medium-Specific Concentration for the following Constituents of Concern may have to be set by the soil-to-groundwater numeric value:

1. 1,2,4-Trimethylbenzene (soil buffer distance of 15 feet),
2. 1,3,5-Trimethylbenzene (soil buffer distance of 30 feet),
3. Cumene (soil buffer distance of 15 feet),
4. Fluorene (soil buffer distance of 15 feet), and
5. Naphthalene (soil buffer distance of 15 feet).

For any areas where the water table is less than ten feet from the surface, the Medium-Specific Concentration for the following Constituents of Concern may have to be set by the soil-to-groundwater numeric value:

1. Anthracene (soil buffer distance of 10 feet),
2. Phenanthrene (soil buffer distance of 10 feet), and
3. Pyrene (soil buffer distance of 10 feet).

For any areas where the water table is less than five feet from the surface, Evergreen should have used the soil-to-groundwater numeric value to determine the Medium-Specific Concentration for the following contaminants:

1. Benzo(a)anthracene (soil buffer distance of 5 feet),
2. Benzo(a)pyrene (soil buffer distance of 5 feet),
3. Benzo(b)fluoranthene (soil buffer distance of 5 feet),
4. Benzo(g,h,i)perylene (soil buffer distance of 5 feet), and
5. Chrysene (soil buffer distance of 5 feet).

But the reports do not include an analysis of soil buffer distances and their role in determining the Medium-Specific Concentration. When it revises the reports, Evergreen should be including a sufficient analysis.

D. Although Evergreen appears to have used the soil-to-groundwater numeric value to determine the Medium-Specific Concentration in some instances, it did not do this as a matter of course.

In the narrative text of the reports, when Evergreen identifies exceedances of the soil-to-groundwater numeric value, it is merely pointed to data tables. Evergreen does not provide an analysis of exceedances of this value or even identify the number of these exceedances in the

narrative text. Rather, it shifts to the direct contact numeric value and the site-specific standard to delineate the contamination.

The following tables illustrate how Evergreen did this:

AOI-1: Point Breeze No. 1 Tank Farm

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2016 Report (part 1) 2016 Report (part 2) (approved)	Table 3-2 (historical, statewide health standards) (identifies only the MSC (apparently determined by the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlights exceedances in orange) Table 3-3 (historical, characterization soil screening levels) (identifies only the direct contact numeric values for surface soils and subsurface soils (although the proposed site-specific standard for lead is substituted), and highlights exceedances in orange)	Section 3.5, page 3.25-3.26 (delineating only with respect to the direct contact numeric value and the proposed site-specific standard) Section 9.3.1, page 9.52 (vague summary does discuss exceedances of the soil-to-groundwater numeric value)

AOI-2: Point Breeze Processing Area

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2017 Report (part 1) 2017 Report (part 2) (approved)	Table 4 (identifies both the soil-to-groundwater numeric value and the direct contact numeric value (although it substitutes the proposed site-specific standard for the direct contact numeric value for lead), and highlights exceedances of each in different ways in the Table)	Section 5.1, page 31 (delineating only exceedances of the direct contact numeric value and the proposed site-specific standard, and not delineating exceedances of the soil-to-groundwater numeric value) Section 11.1, page 53 (asserting in a circular fashion that "[a]ny soils that exhibited exceedances of the soil-to-groundwater MSCs the corresponding soil-to-groundwater pathway will be

		evaluated through analysis and characterization of the groundwater pathway")

AOI 3: Point Breeze Impoundment Area

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2017 Report (part 1) 2017 Report (part 2) (approved)	Table 4 (identifies only the direct contact numeric value (although it substitutes the proposed site-specific standard for the direct contact numeric value for lead), and highlights exceedances of this value in the Table).	Section 3.1, pages 18-19 (delineating only exceedances of the direct contact numeric value and the proposed site-specific standard, and not delineating exceedances of the soil-to-groundwater numeric value) Section 11.0, page 46 (dismissing the soil-to-groundwater pathway and using the confusing term "direct-contact pathway," asserts that "[w]ith regard to the potential direct-contact pathway to subsurface soil within AOI 3 (i.e., greater than 2 feet deep) and the soil-to-groundwater pathway, the direct contact pathway to soil greater than 2 feet beneath the ground surface at the Complex is considered incomplete because of on-site procedures and PPE requirements that protect onsite workers from exposure.")

Table 4 of the 2017 report obliterates any consideration of the soil-to-groundwater numeric value**.**

AOI-4: No. 4 Tank Farm

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2013 Report (disapproved)	Table 4 (identifies both the soil-to-groundwater numeric value and the direct contact numeric value, and	Section 5.2, page 18 (asserting that "1,2,4-TMB, 1,3,5-TMB, benzene, and lead exceeded their respective

	also identifies the MSC (determined by the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlights exceedances of all three in Table).	non-residential MSCs," but not identifying how many soil samples had exceedances, which soil samples had exceedances, what was the numeric value used to determine the exceedances, or what was the extent of the exceedance of the numeric value) Section 12.0, page 35 (asserting that "[c]oncentrations of benzene, 1,2,4-TMB, 1,3,5-TMB, and lead detected in soil samples collected in AOI 4 were above their respective PADEP non-residential soil MSCs"), but not identifying how many soil samples had exceedances, which soil samples had exceedances, what was the numeric value used to determine the exceedances, or what was the extent of the exceedance of the numeric value)
2017 Report (part 1) 2017 Report (part 2) (disapproved)	Table 3-2 (statewide health standards) identifies only the MSC (apparently determined by the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlights exceedances in orange). Table 3-3 (direct contact MSCs) (identifies only the direct contact numeric value for surface soil and subsurface soil (although it substitutes the proposed site-specific standard for lead), and highlights exceedances in orange).	Section 3.6, pages 22-23 (delineating only exceedances of the direct contact numeric value and the proposed site-specific standard, but in passing it mentions several exceedances of the soil-to-groundwater numeric value, while apparently neglecting the exceedance of 494 mg/kg for BH-13-101) Section 13.1, page 13.72 (delineating only exceedances of the direct contact numeric value and the proposed site-specific standard, by asserting that "[c]oncentrations of COCs in all other collected soil samples (including subsurface soil) were below the highest of the SHS, the non-residential direct contact MSC, or the numeric lead SSS.").

The 2013 report is extremely confusing because the same listed concentration may be highlighted in bold (with reference to one value), underlining (with reference to another value), or gray (with reference to yet another value) -- or a combination of several methods of highlighting.

The approach of the 2017 report is like the approach for the AOI-1 report.

Spot-checking data reveals the omission of an exceedance in the narrative for the exceedance of 494 mg/kg for BH-13-101.

In addition to checking the data in these reports again, Evergreen should prepare separate maps showing the locations of exceedances -- one for the soil-to-groundwater numeric value, one for the direct contact numeric value, and one for the proposed site-specific standard. This way, the public will have a better context for visualizing and understanding the data and its implications for delineating the extent of the contamination.

AOI-5: Girard Point South Tank Field

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2011 Report/Cleanup Plan (disapproved)	Table 4 (outside Solid Waste Management Unit (SWMU) areas) (identifies both the soil-to-groundwater numeric value and the direct contact numeric value, and highlights exceedances of each) Table 5 (SWMU areas) (identifies both the soil-to-groundwater numeric value and the direct contact numeric value, and highlights exceedances of each)	Section 5.0, pages 20-24, Figure 8 (attempts to delineate for both the soil-to-groundwater numeric value and the direct contact numeric value, for both non-SWMU areas and SWMU areas) Section 13.0, pages 36, 47-48 (attempts to delineate only for a calculated site-specific standard for lead of 1708 mg/kg)
2017 Report (part 1) 2017 Report (part 2) (approved)	Table 4 (identifies only the direct contact numeric value (although it substitutes the proposed site-specific standard for the direct contact numeric value for lead), and highlights exceedances of this value.	Section 5.1, 5.3, pages 19, 38-45, Figure 8 (legend) (attempting to delineate contamination only with respect to the direct contact numeric value and the proposed site-specific standard, and using the soil-to-groundwater numeric value only as a benchmark for limiting soil samples a hazardous waste determination

		through the use of the Toxic Characteristic Leaching Procedure) Section 10.0, pages 64-65 (attempting to delineate contamination only with respect to the direct contact numeric value and the proposed site-specific standard)

Table 4 of the 2011 report is very confusing because the same listed concentration may be highlighted in bold (with reference to the direct contact value), and gray (with reference to both). This buries the significance of the soil-to-groundwater numeric value, which is a concern where the water table is less than ten feet from the surface (the soil buffer distance for lead in Table 4B is 10 feet).

Table 5 of the 2011 report is extremely confusing because the highlighting because the same listed concentration may be highlighted bold (with reference to the direct contact value), or dark gray (with reference to both), and there is also an unrelated light gray shading of the entire rows immediately above and below the row displaying these data. (There is a fourth kind of highlighting where the sides of the rectangular cell are highlighted to denote exceedances of the Toxic Characteristic Leaching Procedure for purposes of determining whether the material constitutes hazardous waste under the Resource Conservation and Recovery Act). The public deserves a clearer presentation of the data regarding exceedances of the soil-to-groundwater numeric value.

In Table 4 of the 2017 report, Evergreen completely obliterated a reference to exceedances of the soil-to-groundwater numeric value. This is a problem because the proposed site-specific value is inappropriate and Evergreen has stated that it would follow any future changes by the Department with respect to the target blood lead level.

Given the concerns about the high water table, Evergreen should revise the report to include a discussion about the number and location of soil samples with exceedances of the soil-to-groundwater numeric value.

AOI-6: Girard Point Chemicals Area

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2013 Report (part 1) 2013 Report	Table 4 (identifies the soil-to-groundwater numeric value and the direct contact numeric	Section 5.1, 5.2, pages 19-22, Figure 10 (legend) (attempting to delineate for both the soil-to-groundwater numeric value and

(part 2) (disapproved)	values, as well as the MSC (apparently determined by the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlights exceedances of all three).	the direct contact numeric value, for both non-SWMU areas and SWMU areas, but not identifying how many soil samples had exceedances, which soil samples had exceedances, what was the numeric value used to determine the exceedances, or what was the extent of the exceedance of the numeric value, forcing the reader to pick them off Figure 10) Section 12.0, page 41 (asserting that "[c]oncentrations of benzene, naphthalene, 1,2,4-TMB, 1,3,5-TMB, benzo(a)pyrene, ethylbenzene, ethylene dibromide, cumene, and lead detected in soil samples collected in AOI 6 were above their respective PADEP non-residential soil MSCs"), but not identifying how many soil samples had exceedances, which soil samples had exceedances, what was the numeric value used to determine the exceedances, or what was the extent of the exceedance of the numeric value)
2017 Report (part 1) 2017 Report (part 2) (approved)	Table 3a (current data) (identifies the soil-to-groundwater numeric value and the MSC (apparently determined by the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlights exceedances of all three). Table 4a (historical data) (identifies the direct contact numeric value and the SHS (apparently determined by the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlights exceedances of each with multiple superscripts, in addition to bold, underlining, and orange).	Section 3.5, page 22 (attempting to delineate contamination only with respect to the direct contact numeric value and the proposed site-specific standard) Section 3.6, pages 22-23 (referencing some exceedances of the soil-to-groundwater numeric value in additional soil sampling, but not discussing the implications of the exceedances and whether additional sampling should have been performed) Section 13.1, page 42 (attempting to delineate contamination only with respect to the direct contact numeric value and the proposed site-specific standard)

Table 4 of the 2013 report is extremely confusing because the same listed concentration may be highlighted in bold (with respect to one value), underlining (with respect to another value), and gray (with respect to yet another value). This is like the 2014 report for AOI-4

Table 4a of the 2017 report is very confusing because one has to read the superscript notes at the bottom of the spreadsheet to find out which value is being exceeded. The data relating to exceedances of the soil-to-groundwater numeric value should be broken out so that they may be understood.

AOI-7: Girard Point Fuels Area

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2012 Report (disapproved)	Table 4 (identifies only the soil-to-groundwater numeric value, and highlights exceedances)	Section 5.1, 5.2, pages 23-26, Figure 8 (legend) (attempting to delineate for the soil-to-groundwater numeric value, for both non-SWMU areas and SWMU areas) Section 12.0, page 45 (stating that "[c]oncentrations of benzene, naphthalene, 1,2,4-TMB, and lead detected in surface soil samples collected in AOI 7 were above their respective PADEP non-residential soil MSCs, but does not ___, and dismisses this under the rationale that "all but one location (BH-10-26 for lead) were below the calculated site-specific standards")
2013 Addendum to Report (disapproved)	Table 3 (identifies the soil-to-groundwater numeric value, the direct contact numeric value, and the MSC (apparently determined by the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlights exceedances of all three).	Section 4.1, 4.2, pages 6-10, Figure 3 (legend) (attempting to identify exceedances of the soil-to-groundwater numeric value, for both non-SWMU areas and SWMU areas) Section 7.0, page 13 (stating that "[c]oncentrations of lead were detected in shallow soil samples above the non-residential soil MSC, and concentrations of 1,3,5-TMB, lead and

		benzene were detected in deep soils above the non-residential soil MSC," but not explaining why this is sufficient to delineate the contamination)
2017 Report (part 1) 2017 Report (part 2) (approved)	Table 3a (current data) (identifies the direct contact numeric value and the MSC (apparently determined by the lower of the soil-to-groundwater numeric value or the direct contact numeric value, but substitutes the proposed site-specific standard for the MSC for lead), and highlights exceedances of each). Table 4a (historical data) (identifies the direct contact numeric value and the SHS (apparently defining it as the lower of the soil-to-groundwater numeric value or the direct contact numeric value, but substituting the proposed site-specific standard for the direct contact numeric value for lead), and highlighting exceedances of each in orange, bold, and italics in the Table).	Section 3.6, page 25 (attempting to delineate contamination only with respect to the direct contact numeric value and the proposed site-specific standard) Section 3.7, page 26 (referencing some exceedances of the soil-to-groundwater numeric value in additional soil sampling, but not discussing the implications of the exceedances and whether additional sampling should have been performed) Section 13.1, page 45 (attempting to delineate contamination only with respect to the direct contact numeric value and the proposed site-specific standard)

Table 3 of the 2013 Addendum is extremely confusing because a listed concentration may be highlighted in bold (with respect to one value), underlining (with respect to another value), and gray (with respect to yet another value). This is like the 2014 report for AOI-4

Table 3a of the 2017 report is misleading because the proposed site-specific standard is the only value for lead that is listed, meaning that one reviewing this would know nothing about exceedances of the soil-to-groundwater numeric value or the direct contact numeric value for lead.

Table 4a of the 2017 report is confusing; while it identifies exceedances of the soil-to-groundwater numeric value, it suffers from too much highlighting by reference to multiple values, making it very difficult to evaluate the exceedances in terms of the multiple values.

AOI-8: North Yard

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2012 Report (part 1) 2012 Report (part 2) (approved)	Table 4 (non-SWMU) (identifies only the MSC (apparently defining it as the soil-to-groundwater numeric value) and highlights exceedances in gray) Table 5 (SWMU 2) (identifies only the MSC (apparently defining it solely by the soil-to-groundwater numeric value) and highlights exceedances in gray)	Section 5.1, 5.2, pages 24-25, Figure 8 (legend) (attempting to delineate for the soil-to-groundwater numeric value, for both non-SWMU areas and SWMU areas), but not identifying how many soil samples had exceedances, which soil samples had exceedances, what was the numeric value used to determine the exceedances, or what was the extent of the exceedance of the numeric value, forcing the reader to pick them off Figure 8) Section 12.0, page 55 (stating that "[c]oncentrations of benzene, naphthalene, benzo(a)pyrene and lead detected in shallow soil samples collected in AOI 8 were above their respective non-residential soil MSCs; however they were below the calculated site-specific standards," but not explaining why this is sufficient to delineate the contamination)
2017 Report (part 1) 2017 Report (part 2) (approved)	Table 3-2 (identifies only the SHS (apparently defining it as the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlighting exceedances are highlighted in orange and bold and underlining) Table 3-3 (same data) (identifies only the direct contract numeric value for surface soils and subsurface soils (but characterizes the proposed site-specific standard as the direct contract	Section 3.5, pages 3.27-3.28 (attempting to delineate contamination only with respect to the direct contact numeric value and the proposed site-specific standard) Section 13.1, page 13.80 (attempting to delineate contamination only with respect to the direct contact numeric value and the proposed site-specific standard)

	numeric value for lead), and highlights exceedances in orange.	

Table 3-3 of the 2017 obliterates any characterization of exceedances of the direct contact numeric value where those exceedances are less than the proposed site-specific standard.

AOI-9: Schuylkill River Tank Farm

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2015 Report (part 1) 2015 Report (part 2) (disapproved)	Table 4a (PA inspection) (identifies only the MSC (apparently defining it as the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlights exceedances in purple) Table 5 (identifies the Surface Soil MSC (apparently defining it as the lower of the soil-to-groundwater numeric value) and the Direct Contact MSC (another term for the direct contact numeric value), and highlights one in bold and underlining and the other in gray.	Section 5.2, pages 31-32, Section 5.4, pages 34-35, Figure 11 (legend) (implying an attempt to delineate for the soil-to-groundwater numeric value, but not identifying how many soil samples had exceedances, which soil samples had exceedances, what was the numeric value used to determine the exceedances, or what was the extent of the exceedance of the numeric value, forcing the reader to pick them off Figure 11, which actually only identifies exceedances of the direct contact numeric value and the proposed site-specific standard, and not exceedances of the soil-to-groundwater numeric value) Section 11.0, page 49 (stating that "[t]hirteen surface soil locations exhibited lead concentrations above the SSS or benzo(a)pyrene concentrations above the non-residential soil direct contact MSC," but not explaining why this is sufficient to delineate the contamination)
2017 Report Addendum (part 1)	Table 4 (identifies only the direct contact numeric value (substituting the proposed site-specific standard for the direct contact numeric value	Section 4.1, pages 16-17, Figure 16 (legend) (attempting to delineate contamination only with respect to the direct contact numeric value and the

2017 Report Addendum (part 2) (approved)	for lead), and highlights exceedances of this value).	proposed site-specific standard) Section 7.0, page 28 (attempting to delineate contamination only with respect to the direct contact numeric value and the proposed site-specific standard) Section 7.0, page 28 (stating that "[o]ne surface soil location exhibited a lead concentration above the SSS for lead. This exceedance has been delineated." Section 7.0, page 28 (stating that [o]ne surface soil location exhibited a benzo(b)flouranthene concentration above the PADEP non-residential surface soil direct contact MSC. This exceedance has been delineated.")

Evergreen's failure to identify exceedances on Figure 11 demonstrates why it should revise all these reports. What guided the entire investigation was a concern for establishing a less stringent standard (the direct contact numeric value or the proposed site-specific standard), rather than the more stringent soil-to-groundwater numeric value. If the latter numeric value had been used, Evergreen would have been able to characterize the contamination more precisely.

Instead, it established an approach that biased the investigation toward higher exceedances of the direct contact numeric value or the proposed site-specific standard, to the neglect of lower exceedances of the soil-to-groundwater numeric value. That latter approach would have presented a more detailed picture. We cannot see that picture because Figure 11 is flawed and missing data.

Table 5 of the 2015 report is extremely confusing, as it blurs terms (the MSC and the site-specific standard), its uses terms that have legal distinctions without making that distinction clear (Surface Soil MSC and Direct Contact MSC) and obliterating characterization of the soil-to-groundwater numeric value, at least with respect to lead. A site-specific standard is not an MSC. *Cf.* 25 Pa. Code 250, subchapter C (Statewide Health Standards) with 25 Pa. Code 250, subchapter D (Site-Specific Standard).

Table 4 of the 2017 report addendum obliterates any characterization of exceedances of the soil-to-groundwater numeric value where the exceedances are less than the proposed site-specific standard.

The 2017 Addendum does not even attempt to delineate exceedances of the soil-to-groundwater numeric value or the direct contact numeric value -- and there are 55 exceedances of the direct contact numeric value.

AOI-10: West Yard

Title	Analysis of Evergreen's Tables	Analysis of Evergreen's Textual Narrative
2011 Report (approved)	Table 4 (areas outside SWMU) (identifies the direct contact numeric value and the MSC (apparently defining it as the lower of the soil-to-groundwater numeric value or the direct contact numeric value), and highlights exceedances of both of each in gray) Tables 5-9 (similar)	Section 4.1, 4.2, pages 17-18, Figure 7 (legend), Figure 8 (legend) (attempting to delineate for the soil-to-groundwater numeric value, for both Corrective Action Management Unit (CAMU) areas and non-CAMU areas, but not identifying how many soil samples had exceedances, which soil samples had exceedances, what was the numeric value used to determine the exceedances, or what was the extent of the exceedance of the numeric value, forcing the reader to pick them off Figure 7 and Figure 8) Section 11.0, pages 36-37 (attempting to delineate contamination only with respect to proposed site-specific standards)

E. Evergreen fails to establish a soil buffer equivalency determination as required by the regulations, instead offering a "qualitative assessment" that defers its work to a future Fate and Transport Remedial Investigation Report, underscoring the interdependence of these reports and fragmenting the public comment process.

For all Areas of Interest, Evergreen uses the direct contact numeric value to delineate soil exceedances (for both surface soil and subsurface soil), rather than the soil-to groundwater numeric value. Evergreen offers no alternative equivalency determination to meet the requirements for an "an equivalency demonstration" in Section 250.308(d) of the regulations:

> (d) For any regulated substance, ***an equivalency demonstration may be substituted*** for the soil-to-groundwater numeric value throughout the site and the soil-to-groundwater pathway soil

> buffer ***if the groundwater is below the MSC value or the background standard prior to remediation***. This equivalency demonstration shall include the following:
>
> (1) ***Fate and transport analysis*** of the regulated substance ***from the deepest point of contamination in the soil through unsaturated zone soil*** and shall include the ***use of soil-to-water partition coefficients***. The analysis shall demonstrate that ***the regulated substances will not migrate to bedrock or the groundwater within 30 years*** at ***concentrations exceeding the greater of the groundwater MSC or background in groundwater*** as the ***endpoint in soil pore water directly under the site***.
>
> (2) In addition to sampling required for attainment of the inhalation or ingestion numeric values for soils up to 15 feet, as applicable, reporting and monitoring for eight quarters that shows no exceedances of the greater of the groundwater MSCs or of the background standard for groundwater beneath the contaminated soil and no indications of an increasing trend of concentration over time that may exceed the standard.

Section 250.308(d) (bold italics added for emphasis).

By its own admission, Evergreen avoids these quantitative requirements and instead offers its own "qualitative assessment." Evergreen does not even ask the Department to accept a qualitative assessment in place of the quantitative assessment required by the regulations. Evergreen may not avoid the requirements of the regulations in this manner.

Any vague assertions by Evergreen about aboveground activities cited to support a "pathway elimination" argument are insufficient to meet the requirements of Section 250.308(d) with contamination underneath the surface of the ground.

AOI-1: Point Breeze No. 1 Tank Farm

The report uses the direct contact numeric value for soil to screen exceedances, and asserts that:

> ***The SHS value is usually driven by the soil-to-groundwater MSC, and the soil-to-groundwater pathway will be addressed in the groundwater investigation presented in this RIR (Section 4) and through subsequent remedial measures which will be further described in future Act 2 deliverables. In order to further evaluate the risk posed by the concentrations of COCs which were detected above their respective SHS, the next step in the screening process is to compare all of the soil analytical***

> ***results to the nonresidential direct contact MSCs***. Soil sample locations that will require further pathway evaluation or require a remedial measure in order to attain a standard under Act 2 were identified through comparison to the non-residential direct contact MSCs.

See 2016 Report (part 1), Section 1.6.1, page 1.7 (bold italics added for emphasis). But there is no discussion of "equivalency" as required by the Section 250.308(d) of the regulations. *See id*.

Contrary to the suggestion in the quotation, Section 4 does not contain a discussion of the "soil-to-groundwater pathway." *See id.*, Section 4.0, pages 4.27-4.29. Moreover, the fate and transport section of the report concerns groundwater only, and does not include a discussion of the soil-to-groundwater pathway. *See id.*, Section 10.0, pages 10.59-10.71 ("Qualitative Fate and Transport Assessment").

AOI-2: Point Breeze Processing Area

The report uses the direct contact numeric value and the proposed site-specific standard for lead to screen exceedances in surface soil. *See* 2017 Report (part 1), page 6. It uses the direct contact numeric value to screen exceedances in subsurface soil. *See id.*

It does not delineate exceedances of the soil-to-groundwater numeric value under the rationale that they will be evaluated through analysis and characterization of the groundwater pathway:

> Soil sample exceedances of the PADEP non-residential soil-to-groundwater MSCs are ***not displayed in Figure 11 as these exceedances will be evaluated through analysis and characterization of the groundwater pathway***.

See id., page 30 (bold italics added for emphasis).

However, Sunoco does not provide a discussion of this analysis and characterization. Rather, it simply assumed that its evaluation of groundwater data would suffice:

> No fate and transport modeling was completed for the soil analytical results ***since the soil-to-groundwater pathway is evaluated through groundwater data***. Potential exposure pathways for AOI 2 are discussed in more detail in Section 9.

See id., Section 6.1, page 40 (bold italics added for emphasis). That is insufficient because Section 9 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 9, pages 51-52 ("Exposure Assessment"). The fate and transport evaluation for groundwater does not provide this analysis. *See id.*, Section 6.2, page 40-41.

AOI 3: Point Breeze Impoundment Area

The report uses the direct contact numeric value and the proposed site-specific standard for lead to screen exceedances in surface soil. *See* 2017 Report (part 1), Section 1.4, page 6. It uses the direct contact numeric value to screen exceedances in subsurface soil. *See id.*

In addition, it stated

> ***No fate and transport modeling was completed for the soil analytical results since the soil-to-groundwater pathway is evaluated through groundwater data***. Potential exposure pathways for AOI 3 are discussed in more detail in Section 9.

See id., Section 6.1, page 35 (bold italics added for emphasis). *Accord*, Section 7.5, page 40. That is insufficient because Section 9 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 9, pages 44-45 ("Exposure Assessment"). The fate and transport evaluation for groundwater does not provide this analysis, either. *See id.*, Section 6.2, page 35-36.

AOI-4: No. 4 Tank Farm

The report states that non-residential direct contact MSC were used to screen exceedances for both surface and subsurface soil. *See* 2013 Report (part 1) (disapproved), page 5. Using circular reasoning, Sunoco stated that it did not have to perform a fate and transport analysis for the soil-to-groundwater pathway because it assumed there was no pathway of exposure other than direct contact:

> No fate and transport modeling was completed for the soil analytical results ***since the only potential exposure pathway to shallow soil is by direct contact***. PES's permit procedures and personal protective equipment (PPE) requirements eliminate the potential direct contact exposure pathway to subsurface soil. Potential exposure pathways for AOI 4 are discussed in detail in Section 9.0.

See id., Section 7.1, page 23 (bold italics added for emphasis). That is insufficient because Section 9 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 9, page 30 ("Human Health Exposure Assessment/Risk Assessment"). The fate and transport evaluation for groundwater does not provide this analysis, either. *See id.*, Section 7.2, page 23-24.

In the 2017 report, Evergreen again avoids the quantitative requirements of Section 250.308(d), Evergreen instead offers its own "qualitative assessment":

> ***A soil to groundwater model to evaluate the soil to groundwater pathway was not developed for the qualitative fate and transport assessment presented in this RIR***. Rather, a qualitative-level assessment of groundwater data has been completed (Section 10).

See 2017 Report, Section 9.5, page 9.52 (bold italics added for emphasis). That is insufficient because Section 10 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 10, pages 10.57-10.69 ("Fate and Transport Assessment").

AOI-5: Girard Point South Tank Field

The report uses the direct contact numeric value and the proposed site-specific standard for lead to screen exceedances in surface soil. *See* 2011 Report/Cleanup Plan (part 1) (disapproved), page 6. It uses the direct contact numeric value to screen exceedances in subsurface soil. *See id.*

> ***No fate and transport modeling was completed for the soil analytical results since the soil-to-groundwater pathway is evaluated through groundwater data***. Potential exposure pathways for AOI 5 are discussed in more detail in Section 9.

See id., Section 6.1, page 55 (bold italics added for emphasis). That is insufficient because Section 9 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 9, page 30 ("'Exposure Assessment' "). The fate and transport evaluation for groundwater does not provide this analysis, either. *See id.*, Section 6.2, page 55-56.

Avoiding the quantitative requirements of Section 250.308(d), Evergreen instead offers t simply use its groundwater data:

> ***No fate and transport modeling was completed for the soil analytical results since the soil-to-groundwater pathway is evaluated through groundwater data***. Potential exposure pathways for AOI 5 are discussed in more detail in Section 9.

2017 Report, Section 6.1, page 55 (bold italics added for emphasis). That is insufficient because Section 9 does not provide an analysis of how this meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 9.0, pages 62-63.

AOI-6: Girard Point Chemicals Area

Avoiding the quantitative requirements of Section 250.308(d), Evergreen instead offers t simply use its groundwater data:

> ***No fate and transport modeling was completed for the soil analytical results since the only potential exposure pathway to shallow soil is by direct contact***. PES's permit procedures and personal protective equipment (PPE) requirements eliminate the potential direct contact exposure pathway to subsurface soil. Potential exposure pathways for AOI 6 are discussed in detail in Section 9.0.

2013 Report, Section 7.1, page 25 (bold italics added for emphasis). That is insufficient because Section 9.0 does not provide an analysis of how this meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 9.0, pages 35-40.

As in AOI-1, the report states that:

> ***The SHS value is usually driven by the soil-to-groundwater MSC, and the soil-to-groundwater pathway will be addressed in the groundwater investigation presented in this report***. In order to further evaluate the risk posed by the concentrations of COCs which were detected above their respective SHS, the next step is to compare all of the soil analytical results to the non-residential direct contact MSCs. Soil sample locations that will require further pathway evaluation or require a remedial measure in order to attain a standard under Act 2 were identified through comparison to the non-residential direct contact MSCs.

See 2017 Report (part 1), Section 1.5.1, page 6 (bold italics added for emphasis). It did not perform a delineation to the lowest value (the soil-to-groundwater numeric value," but to the highest of the several values:

> Delineation was performed to the highest of the Act 2 non-residential SHS, the non-residential direct contact MSC, and the numeric SSS (for lead).

See id., page 17.

Avoiding the quantitative requirements of Section 250.308(d), Evergreen instead offers its own "qualitative assessment":

> ***A soil to groundwater model to evaluate the soil to groundwater pathway was not developed for the qualitative fate and transport***

> ***assessment presented in this RIR.*** Rather, a qualitative-level assessment of groundwater data was warranted at this stage of the investigation.

See id., Section 9.5, page 36 (bold italics added for emphasis). That is insufficient because Section 10 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 10, pages 37-41 ("Qualitative Fate and Transport Assessment").

AOI-7: Girard Point Fuels Area

Avoiding the quantitative requirements of Section 250.308(d), Evergreen instead offers t simply use its groundwater data:

> ***No fate and transport modeling was completed for the soil analytical results since the only potential exposure pathway to shallow soil is by direct contact***. The soil-to- groundwater pathway is evaluated through evaluation of groundwater data. Potential exposure pathways for AOI 7 are discussed in detail in Section 9.0.

2012 Report, Section 7.1, page 28 (bold italics added for emphasis). That is insufficient because Section 9.0 does not provide an analysis of how this meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 9.0, pages 39-44.

As in AOI-1 and AOI-6, the report states that;

> ***The SHS value is usually driven by the soil-to-groundwater MSC, and the soil-to-groundwater pathway will be addressed in the groundwater investigation presented in this report.*** In order to further evaluate the risk posed by the concentrations of COCs which were detected above their respective SHS, the next step is to compare all of the soil analytical results to the non-residential direct contact MSCs. Soil sample locations that will require further pathway evaluation or require a remedial measure in order to attain a standard under Act 2 were identified through comparison to the non-residential direct contact MSCs.

See 2017 Report (part 1), Section 1.5.1, page 6 (bold italics added for emphasis). It also stated that "Delineation was completed to the non-residential direct contact MSC and the numeric SSS (for lead)." *See id.*, Section 3, page 16.

Avoiding the quantitative requirements of Section 250.308(d), Evergreen instead offers its own "qualitative assessment":

> ***A soil to groundwater model to evaluate the soil to groundwater pathway was not developed for the qualitative fate and transport***

> ***assessment presented in this RIR.*** Rather, a qualitative-level assessment of groundwater data was warranted at this stage of the investigation.

See id., Section 9.5, page 38 (bold italics added for emphasis). That is insufficient because Section 10 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 10, pages 40-44 ("Qualitative Fate and Transport Assessment").

AOI-8: North Yard

Avoiding the quantitative requirements of Section 250.308(d), Evergreen instead offers t simply use its groundwater data:

> ***No fate and transport modeling was completed for the soil analytical results since the soil-to-groundwater pathway is evaluated through groundwater data***. Potential exposure pathways for AOI 8 are discussed in more detail in Sections 9.0 and 10.0 below.

2012 Report, Section 7.1, page 32 (bold italics added for emphasis). That is insufficient because Section 9.0 and 10.0 provide no analysis of how this meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 9.0 and Section 10.0, pages 49-54.

Similar to AOI 1, it is stated:

> ***The SHS value is usually driven by the soil-to-groundwater MSC, and the soil-to-groundwater pathway will be addressed in the groundwater investigation presented in this RIR (Section 4) and through subsequent remedial measures which will be further described in future Act 2 deliverables***. To further evaluate the risk posed by the concentrations of COCs which were detected above their respective SHS, the next step in the screening process is to compare all of the soil analytical results to the non-residential direct contact MSCs. Soil sample locations that will require further pathway evaluation or require a remedial measure in order to attain a standard under Act 2 were identified through comparison to the non-residential direct contact MSCs.

See 2017 Report (part 1), Section 1.6.1, page 1.9 (bold italics added for emphasis). Accordingly, exceedances in soil samples were determined by the direct contact MSC.

Contrary to the suggestion in the quotation above, Section 4 does not contain any discussion of a "soil-to-groundwater pathway." *See id.*, Section 4, pages 4.29-4.32.

The report states that

> ***A soil to groundwater model to evaluate the soil to groundwater pathway was not developed for the qualitative fate and transport assessment presented in this RIR***. Rather, a qualitative-level assessment of groundwater data has been completed (Section 9).

See id., Section 10.5, page 10.73 (bold italics added for emphasis). That is insufficient because Section 9 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 9, pages 9.55-9.67 ("Fate and Transport Assessment").

AOI-9: Schuylkill River Tank Farm

Evergreen makes the following statement:

> ***No fate and transport modeling was completed for the soil analytical results since the soil-to-groundwater pathway is evaluated through groundwater data***. Potential exposure pathways for AOI 9 are discussed in more detail in Section 9 below.

2015 Report, Section 6.1, page 42. That is insufficient because Section 9 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section Section 9.0, page 48.

The report uses the direct contact numeric value and the proposed site-specific standard for lead to screen exceedances in surface soil. *See* 2017 Report Addendum (part 1), Section 1.1, page 2. It uses the direct contact numeric value to screen exceedances in subsurface soil. *See id.*

Again, Evergreen simply assumed that its evaluation of groundwater data would suffice to meet the requirements of Section 250.308(d) of the regulations:

> ***No fate and transport modeling was completed for the soil analytical results since the soil-to-groundwater pathway is evaluated through groundwater data***. Potential exposure pathways for AOI 9 are discussed in more detail in Section 6 below.

See id., Section 5.1 page 21 (bold italics added for emphasis). *Accord*, Section 6.4, page 25. However, no analysis related to 250.308(d) is provided.

Contrary to the suggestion in the quotation above, Section 6 does not contain any discussion of a "soil-to-groundwater pathway." *See id.*, Section 6.0, pages 22-27 ("Conceptual

Site Model"). Evergreen simply repeats the circular assertion above. *See id.*, Section 6.4, page 25 ("No fate and transport modeling was completed for the soil analytical results. The soil-to-groundwater pathway is evaluated through groundwater data.").

AOI-10: West Yard

Using circular reasoning, Sunoco stated that it did not have to perform a fate and transport analysis for the soil-to-groundwater pathway because it assumed there was no pathway of exposure other than direct contact:

> ***No fate and transport modeling was completed for the soil analytical results since the only potential exposure pathway to soil is by direct contact to shallow soil***. The soil-to-groundwater pathway is evaluated through groundwater data. Potential exposure pathways for AOI 10 are discussed in more detail in Section 8.0.

See 2011 Report, Section 6.1 page 21 (bold italics added for emphasis). *Accord*, Section 7.5, pages 27-28 (Fate and Transport of COCs). That is insufficient because Section 8.0 provides no analysis of how it meets the requirements of Section 250.308(d) of the regulations. *See id.*, Section 8.0, pages 29-33 ("Human Health Exposure Assessment/Risk Assessment").

13. The Department Should Disapprove Evergreen's Proposed Site-Specific Standard of 2240 mg/kg for Lead in Surface Soils.

Evergreen's proposed site-specific standard of 2240 mg/kg for lead in surface soil is flawed for several reasons. First, in its use of the Adult Lead Model, Evergreen inappropriately assumed a target blood lead level of 10 ug/dL in a fetus, rather than the target blood lead level of 5 ug/dL that the Centers for Disease Control and Prevention have been using since 2012 for case management for children exposed to lead. Changing this value alone would result in a standard of no more than 1050 mg/kg, rather than 2240 mg/kg.

In addition, the high water table in areas of the site complicates the notion that Evergreen could even develop a site-specific standard greater than the soil-to-groundwater numeric value. *See* Comment #7, above. Because the Adult Lead Model merely involves the multiplication of variables relating to exposure to lead in surface soils, it is insufficient as a risk assessment for the soil-to-groundwater pathway of exposure.

The Department should disapprove the proposal.

A. Evergreen inappropriately assumed a target blood lead level of 10 ug/dL in a fetus, rather than the target blood lead level of 5 ug/dL used by the Centers for Disease Control and Prevention for case management for children since 2012.

In 2015, Evergreen proposed a site-specific standard of 2240 mg/kg for lead in surface soil. 2015 Human Health Risk Assessment (Lead). The Department approved this proposal. 2015 Memo (lead), 2015 Approval Letter (lead). In its report, Evergreen assumed a target blood lead level of 10 ug/dL in a fetus:

Table 1
Calculation of a Site-Specific Standard for Lead
Philadelphia Refinery, Belmont Terminal and Marcus Hook Industrial Complex
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
$PbB_{fetal,\ 0.95}$	95th percentile PbB in fetus	ug/dL	10
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	–	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	–	1.8
PbB_0	Baseline PbB	ug/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	–	0.12
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days/yr	219
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days/yr	365
	Site Specific Standard (SSS) for Lead	**ppm**	**2,240**

Notes:
ug/dL = micrograms per deciliter
ug/day = micrograms per day
g/day = grams per day
days/yr = days per year

2015 Human Health Risk Assessment (Lead), Table 1.

Last year, the Council submitted comments on a proposed Act 2 rulemaking that would have increased the direct contact numeric value from 1000 ppm to 2500 ppm. *See* Attachments 4-8 -- Clean Air Council Comments on Proposed Act 2 Rulemaking dated April 30, 2020. Just like Evergreen's proposal, that proposal was based on a target blood lead level of 10 µg/dL for a fetus. *See* Attachment 4 -- Clean Air Council Comments, pages 4-6. The value of 10 ug/dL was based on a "level of concern" value set by the Centers for Disease Control in 1991 -- nearly thirty years ago. *See id.*, pages 2, 8, 23.

In 2012, the Centers for Disease Control lowered the number to 5 µg/dL, and since then it has used this number as a "reference value" for case management for pregnant women and children up to 5 years old. *Id.*, pages 8-9. The Pennsylvania Department of Public Health, the Allegheny County Health Department, and the City of Philadelphia have also been using 5 µg/dL for case management. *Id.*, pages 10-13.

At its presentation to the Clean Standards Scientific Advisory Board (CSSAB) last month, the Department stated that it now intends to use the 5 ug/dL target blood lead level in the calculation of a direct contact numeric value, rather than the 10 ug/dL target blood lead level. Rounding to two significant figures, the Department intends to finalize a direct contact numeric value of 1100 mg/kg, rather than the proposed value of 2500 mg/kg. *See* DEP, Overview of Chapter 250 Draft-Final Rulemaking (December 16, 2020), pages 6-9; *see also* DEP, Draft Appendix A, Table 4A (December 16, 2020).

The fact that the Department has now embraced a target blood lead level of 5 ug/dL (rather than 10 ug/dL) underscores the error made in Evergreen's proposed site-specific standard.

The lowering of target blood lead level to 5 ug/dL would result in a proposed site-specific standard of no more than 1050 mg/kg. (While the Department intends to round up this figure to 1100 mg/kg for the proposed direct contact numeric value, rounding up would be inappropriate for a proposed site-specific standard. Evergreen did not round down its proposed standard of 2240 mg/kg to 2200 mg/kg).

B. Because the Adult Lead Model is a soil ingestion model, it is insufficient as a risk assessment for the soil-to-groundwater pathway of exposure.

Given the limitations of the Adult Lead Model, the failure of Evergreen to delineate soil contamination according to the soil-to-groundwater pathway, and the failure of Evergreen to characterize the relationship between the unconfined aquifer (water table) and the deep aquifer, it is questionable whether a site-specific standard higher than the soil-to-groundwater pathway would even be appropriate. *See* Comments #7, 12, above.

The inputs into the Adult Lead Model do not take into consideration the pathway of exposure through groundwater. It is a model based on the soil ingestion pathway. *See* Attachment 4 -- Clean Air Council Comments on Proposed Act 2 Rulemaking, page 16.

Under state law, a responsible party may propose a site-specific standard in place of a soil-to-groundwater numeric value or a direct contact numeric value. *See* Section 301(a)(3) of Act 2 of 1995. But any proposed standard must comply with the Act 2 regulations.

The regulations require a site-specific risk assessment. For a toxic chemical such as lead, they require a reduction of risk to a quantitative range of risk:

> (b) The site-specific standard ***shall be a protective level that eliminates or reduces any risk to human health*** in accordance with the following:
>
> (1) ***For known or suspected carcinogens***, soil and groundwater cleanup standards ***shall be established at exposures which represent an excess upperbound lifetime risk of between 1 in 10,000 and 1 in 1 million***. The cumulative excess risk to exposed populations, including sensitive subgroups, may not be greater than 1 in 10,000.

….

25 Pa. Code 250.402(b) (bold italics added for emphasis).

It is premature for Evergreen to propose a site-specific standard for lead in surface soil for a number of reasons. The Adult Lead Model does not address exposure through the soil-to-groundwater pathway. Evergreen has not properly delineated contamination according to the soil-to-groundwater numeric value. There is a high water table in areas of the site. Evergreen has failed to sufficiently characterize the relationship between the unconfined aquifer (water table) and the deep aquifer.

14. Evergreen's Flawed Site-Specific Standard Results in an Insufficient Delineation of Lead Contamination in Surface Soils.

In its reports, Evergreen has provided a distorted delineation of lead contamination in surface soils. It framed its discussion in terms of a proposed site-specific standard of 2240 mg/kg that is artificially lenient and erroneous. In terms of quantitative data, the reports would have been very different if the delineation had been based on the soil-to-groundwater numeric value (450 mg/kg) or even the direct contact numeric value (1000 mg/kg).

The anticipation of a lenient standard of 2240 mg/kg would naturally have affected decisions in the field regarding the number and locations of soil samples to be taken. The Department's guidance document underscores what common sense would suggest -- that with a less stringent standard in mind, fewer samples would be necessary:

> ***Soils must be characterized horizontally and vertically to concentrations below the selected numeric standards***, or to where it can be demonstrated that the pathway elimination measure is adequate to protect human health and the environment. This ensures that all soils containing regulated substances at or above the selected numeric standards have been adequately characterized to support a fate and transport analysis which shows where the contamination is currently located and those areas to which it is moving. ***The remediator determines the concentration level for characterization beyond the minimal level stated above***. The remediator must state what factors were used in determining the level used to define the site boundaries.

See Technical Guidance Manual, Section II.A.4.b.i, page II-12 (bold italics added for emphasis).

With respect to the quantitative data, the following table identifies the increase in the number of exceedances that would result if the soil-to-groundwater numeric value (450 mg/kg) or the direct contact numeric value (1000 mg/kg) were to be used to delineate the contamination, instead of the proposed site-specific standard (2240 mg/kg):

Area of Interest	Title	Exceedances Under Different Numeric Values
AOI-1 Point Breeze No. 1 Tank Farm	2016 Report, Table 3-2	16 exceedances of soil-to-groundwater numeric value (450 mg/kg) 7 exceedances of direct contact numeric value (1000 mg/kg) 4 exceedances of proposed site-specific standard

		(2240 mg/kg)
AOI-2 Point Breeze Processing Area	2017 Report, Table 4 (approved)	18 exceedances of soil-to-groundwater numeric value (450 mg/kg) 9 exceedances of direct contact numeric value (1000 mg/kg) 4 exceedances of proposed site-specific standard (2240 mg/kg)
AOI 3 Point Breeze Impoundment Area	2017 Report, Table 4 (approved)	15 exceedances of soil-to-groundwater numeric value (450 mg/kg) 6 exceedances of direct contact numeric value (1000 mg/kg) 5 exceedances of proposed site-specific standard (2240 mg/kg)
AOI-4 No. 4 Tank Farm	2013 Report, Table 3-2 (disapproved) 2017 Report (disapproved)	13 exceedances of soil-to-groundwater numeric value (450 mg/kg) 10 exceedances of direct contact numeric value (1000 mg/kg) 6 exceedances of proposed site-specific standard (2240 mg/kg)
AOI-5 Girard Point South Tank Field	2011 Report/Cleanup Plan, Table 4 (outside SWMU areas) Table 5 (SWMU areas) (disapproved)	3 exceedances of soil-to-groundwater numeric value (450 mg/kg) 1 exceedance of direct contact numeric value (1000 mg/kg) 1 exceedance of proposed site-specific standard (2240 mg/kg) 25 exceedances of soil-to-groundwater numeric value (450 mg/kg) (3 outside SWMU areas) 14 exceedances of direct contact numeric value (1000 mg/kg) (1 outside SWMU areas) 4 exceedances of proposed site-specific standard

		(2240 mg/kg) (1 outside SWMU areas)
	2017 Report, Table 4 (approved)	80 exceedances of soil-to-groundwater numeric value (450 mg/kg) 57 exceedances of direct contact numeric value (1000 mg/kg) 11 exceedances of proposed site-specific standard (2240 mg/kg)
AOI-6 Girard Point Chemicals Area	2013 Report, Table 4 (disapproved)	21 exceedances of soil-to-groundwater numeric value (450 mg/kg) 8 exceedances of direct contact numeric value (1000 mg/kg) 2 exceedances of proposed site-specific standard (2240 mg/kg)
	2017 Report, Table 3a (Recent Data) (approved)	12 exceedances of soil-to-groundwater numeric value (450 mg/kg) 5 exceedances of direct contact numeric value (1000 mg/kg) 4 exceedances of proposed site-specific standard (2240 mg/kg)
	Table 4a (Historical Data)	50 exceedances of soil-to-groundwater numeric value (450 mg/kg) 23 exceedances of direct contact numeric value (1000 mg/kg) 6 exceedances of proposed site-specific standard (2240 mg/kg)
AOI-7 Girard Point Fuels Area	2012 Report , Table 4 (disapproved)	11 exceedances of soil-to-groundwater numeric value (450 mg/kg) 3 exceedances of direct contact numeric value (1000 mg/kg)

		0 exceedances of proposed site-specific standard (2240 mg/kg)
	2013 Addendum to Report, Table 1 (disapproved)	21 exceedances of soil-to-groundwater numeric value (450 mg/kg) 5 exceedances of direct contact numeric value (1000 mg/kg) 0 exceedances of proposed site-specific standard (2240 mg/kg)
	2017 Report, Table 3a (approved)	6 exceedances of soil-to-groundwater numeric value (450 mg/kg) 0 exceedances of direct contact numeric value (1000 mg/kg) 0 exceedances of proposed site-specific standard (2240 mg/kg)
	Table 4a (Historical Data)	29 exceedances of soil-to-groundwater numeric value (450 mg/kg) 6 exceedances of direct contact numeric value (1000 mg/kg) 0 exceedances of proposed site-specific standard (2240 mg/kg)
AOI-8 North Yard	2012 Report, Table 4 (approved)	11 exceedances of soil-to-groundwater numeric value (450 mg/kg) 4 exceedances of direct contact numeric value (1000 mg/kg) 0 exceedances of proposed site-specific standard (2240 mg/kg)
	2017 Report, Table 3-2 (approved)	36 exceedances of soil-to-groundwater numeric value (450 mg/kg) 19 exceedances of direct contact numeric value (1000 mg/kg)

		7 exceedances of proposed site-specific standard (2240 mg/kg)
AOI-9 Schuylkill River Tank Farm	2015 Report, Table 5 (disapproved)	87 exceedances of soil-to-groundwater numeric value (450 mg/kg) 55 exceedances of direct contact numeric value (1000 mg/kg) 11 exceedances of proposed site-specific standard (2240 mg/kg)
	2017 Report Addendum (approved)	6 exceedances of soil-to-groundwater numeric value (450 mg/kg) 3 exceedances of direct contact numeric value (1000 mg/kg) 1 exceedance of proposed site-specific standard (2240 mg/kg)
AOI-10 West Yard	2011 Report, Table 4 (outside CAMU) (approved)	12 exceedances of soil-to-groundwater numeric value (450 mg/kg) 6 exceedances of direct contact numeric value (1000 mg/kg) 3 exceedances of proposed site-specific standard (2240 mg/kg)
	Table 5 (CAMU delineation samples)	5 exceedances of soil-to-groundwater numeric value (450 mg/kg) 2 exceedances of direct contact numeric value (1000 mg/kg) 0 exceedances of proposed site-specific standard (2240 mg/kg)
	Table 6 (CAMU area)	1 exceedance of soil-to-groundwater numeric value (450 mg/kg) 0 exceedances of direct contact numeric value (1000 mg/kg)

		0 exceedances of proposed site-specific standard (2240 mg/kg)

The disparity in the number of exceedances is most striking for the two Areas of Interest with the most lead contamination (AOI-5 and AOI-9). Therefore, it is a concern that Evergreen did not even attempt to compare the soil sample results with the soil-to-groundwater numeric value (450 mg/kg) or the direct contact numeric value (1000 mg/kg) in some reports for these areas. In a report for AOI-5, it simply lists 2240 mg/kg as the "PADEP Non-Residential Surface Soil Direct Contact MSC." *See* 2017 Report (AOI-5), Table 4, pdf pages 86-127. In a report for AOI-9, it lists 2240 mg/kg as both the "PADEP Non-residential Surface Soil MSC" and the "PADEP Non-residential Soil Direct Contact MSC." 2015 Report, Table 5, pdf pages 70-106.

As a matter of law, it is an error to identify 2240 mg/kg as the "PADEP Non-residential Surface Soil MSC" and the "PADEP Non-residential Soil Direct Contact MSC." An MSC is not a site-specific standard and a site-specific standard is not an MSC. *Cf.* 25 Pa. Code Subchapter D (Site-Specific Standard) with 25 Pa. Code § 250.305 (MSCs for soil).

Evergreen should have shown the work, but it did not. The Council had to identify these exceedances itself.

Evergreen's errors are also important on a qualitative level. By ruling out certain samples under the assumption that an artificially lenient standard would apply, Evergreen would have blocked off lines of investigation. Data on exceedances helps to inform one's judgment regarding additional sampling.

Finally, Evergreen does not provide an analysis that synthesizes the data in a meaningful and helpful way. There is no discussion in the conclusions of the reports about why it took the samples in the locations it did and stopped where it did. Rather, it points to data in tables and asserts in a conclusory fashion that it has delineated the contamination. This is not sufficient.

15. <u>Evergreen Fails to Include Per- and Polyfluoroalkyl Substances (PFAS) as a Constituent of Concern, Despite a History of Catastrophic Fires at the Refinery</u>.

Per- and Polyfluoroalkyl Substances (PFAS) are persistent, bioaccumulative, and harmful chemicals. Historically, some of them have been used in foam for firefighting at refineries. Evergreen does not identify PFAS as a Constituent of Concern in any of its reports. Given a history of catastrophic fires at the facility prior to the sale in 2012, Evergreen should prepare a work plan and revise its remedial investigation to include PFAS contaminants in the soil and groundwater.

A. <u>The Department has acknowledged the harmful health effects of PFAS by proposing to establish Medium-Specific Concentrations for Perfluorooctanoic Acid (PFOA), Perfluorooctane Sulfonate (PFOS) and Perfluorobutane Sulfonate (PFBS)</u>.

PFAS are a group of man-made chemicals that includes PFOA, PFOS, PFBS, and many other chemicals. EPA, Basic Information on PFAS ("What is the difference between PFOA, PFOS and GenX and other replacement PFAS?"). According to EPA, "[s]tudies indicate that PFOA and PFOS can cause reproductive and developmental, liver and kidney, and immunological effects in laboratory animals." *Id.* ("Are there health effects from PFAS?"). In 2016, EPA issued drinking water health advisories for PFOA and PFOS. *See* EPA, Fact Sheet: PFOA & PFOS Drinking Water Health Advisories (November 2016).

EPA notes that PFAS is associated with firefighting at refineries:

> Drinking water can be a source of exposure in communities where these chemicals have contaminated water supplies. ***Such contamination is typically localized and associated with a specific facility, for example***,
>
> - an industrial facility where PFAS were produced or used to manufacture other products, or
> - ***an oil refinery, airfield or other location at which PFAS were used for firefighting***.

EPA, Basic Information on PFAS ("How are people exposed to PFAS?") (bold italics added for emphasis). Historically, PFAS are associated with fire-fighting foams. *Id.* ("What is the difference between PFOA, PFOS and GenX and other replacement PFAS?").

Last year, the Department proposed to add Medium-Specific Concentrations for PFOA, PFOS, and PFBS. *See* 50 Pa. B. 1011 (February 15, 2020), paragraph 1. It is anticipated that the Department will finalize this proposal. *See* DEP, Overview of Chapter 250 Proposed Rulemaking (July 30, 2020), pages 22-24 (summarizing public comments in presentation to Cleanup Standards Scientific Advisory Board); *see also* DEP, Draft Appendix A, Table 1 (December 16, 2020) (including MSCs for PFOs, PFOA, and PFBS in latest proposed draft).

B. Given the provision of foam for firefighting at the refinery before 2012, there is a concern for the presence of PFAS in the soil and groundwater.

There is a history of explosions and fires at the Philadelphia refinery. The following table summarizes this history:

Year	**Incident**	**Facility**
1931	explosion	Atlantic Refining plant at Point Breeze
1960	fire	Girard Point Refinery, then owned by Gulf
1970	explosion	Arco plant
1975	fire	Gulf refinery
1975	fire	Arco refinery
1977	explosion and fire	Arco plant
1988	explosion	Point Breeze, then operated by John Deuss' Atlantic Refining & Marketing Corp
1998	small fire	Girard Point

Source: Mariah Rush, Philadelphia Inquirer, *In Philly, a history of oil refinery fires going back decades* (Updated: June 21, 2019).

The 1975 fire was the worst. It was an 11-alarm fire that overwhelmed the facility and resulted in the deaths of eight firefighters. A video of the massive fire is available at 6ABC Action News, *Looking back at 1975 Philly refinery fire that killed 8 firefighters* (00:35-1:07). The owner of the refinery was fined $37,000. New York Times, *Gulf Fined $37,000 for Violations At South Philadelphia Refinery* (July 7, 1977).

PFAS is a concern at the refinery site because foam was provided to the firefighters to fight that fire:

> But more than 500 firemen fought all night to avert a catastrophe.
> ***They spread a blanket of foam to smother the flames***.

See Elmer Smith, Philadelphia Inquirer, *30 Yrs. Later, Memories of a Refinery Inferno* (August 17, 2005) (republication) (bold italics added for emphasis). The oil foam overwhelmed the sewer system, resulting in the flashing of the material and contributing to the death of several firefighters:

> During this catastrophe, firefighters successfully suppressed flames emanating from tank 231, roughly where the current stack is now visible north of the Platt Bridge. During the course of their operations, ***a massive quantity of oily foam began to overwhelm the refinery's sewage system and accumulate in tank dikes and along the major thoroughfares where most of the fire apparatuses were assembled***. Just before 5PM, ***this material flashed, capturing men and machines amid white hot sheets of flame***. Four entire firetrucks and their crews melted before the department's officers.

Christopher R. Dougherty, *A Petaled Rose Of Hell: Refineries, Fire Risk, And The New Geography Of Oil In Philadelphia's Tidewater* (December 10, 2013) (bold italics added for emphasis).

This is one example of foam being provided to firefighters to fight fires at the refinery. There may be others. Because foam was used in firefighting, there is a concern that it contained PFAS, and that these chemicals are now contaminants in the soil and groundwater.

C. Evergreen should revise the reports to include PFAS as Constituents of Concern in the soil and groundwater, and it should prepare a work plan for submission to the Department.

In its reports prior to the sale in 2012, Evergreen did not identify PFAS as a Constituent of Concern. *See e.g.*, 2004 Current Conditions Report, Table 5a and Table 5b (Constituents of Concern for Soil and Groundwater), pdf pages 120-121; *see also* Interim Activities Work Plan (2011), Table 2 (Constituents of Concern for Soil and Groundwater), pdf pages 16-17. Nor did Evergreen do this in reports after 2012. *See e.g.*, 2017 Report (AOI-7), Table 1 (Constituents of Concern), pdf page 76.

Evergreen should amend its list of Constituents of Concern to include the PFAS group, including PFOA, PFOS, and PFBS.

In addition, Evergreen should develop a work plan for a remedial investigation of PFAS in the soil and groundwater. In doing so, Evergreen should work with the City of Philadelphia fire department to gather records regarding historical fires, to identify the locations of the property where PFAS contamination is more likely to be located.

Thank you for your consideration of the Council's comments.

Sincerely,

_____

Joseph Otis Minott, Esq.
Executive Director and Chief Counsel

Christopher D. Ahlers, Esq.
Staff Attorney

Nily Dan, Ph.D (Chemical Engineering)
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DOERR, TIFFANI L

From: noreply@phillyrefinerycleanup.info
Sent: Friday, July 29, 2022 12:55 PM
To: DOERR, TIFFANI L
Subject: New submission from Comment Submission Form

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David Farrington

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Report or Topic

Sitewide Fate & Transport RIR

Comment

This letter provides comments on the Act 2 Sitewide Fate & Transport Remedial Investigation Report ("RIR"), Parts 1 and 2 pertaining to the Philadelphia Energy Solutions Refining & Marketing ("PES") site located at 3144 Passyunk Avenue, Philadelphia, PA (the "Site") prepared for Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC ("Evergreen"). The Fate & Transport Report is comprised of the following four specific documents:

1. Sitewide Fate & Transport RIR, Part 1 - Groundwater Flow Model_06-30-2022
2. Sitewide Fate & Transport RIR, Part 2 Section I - Contaminant Fate and Transport Assessment_06-30-2022
3. Sitewide Fate & Transport RIR, Part 2 Section II - Contaminant Fate and Transport Assessment_06-30-2022
4. Sitewide Fate & Transport RIR, Part 2 Section III - Contaminant Fate and Transport Assessment_06-30-2022.

These comments are being provided within the 30-day public comment period that began on June 30, 2022. We appreciate the opportunity to comment on the Site's Fate & Transport Report. A discussion supporting each comment is also included in this letter.

Comment No. 1

The Fate & Transport Report is inadequate because it does not address all site contaminants. The Fate & Transport Report does not evaluate the fate and transport of PFAS even though Evergreen has reported the presence of PFAS in both the shallow aquifer and lower aquifer. Evergreen has reported PFOA at 2,800 ppt, PFNA at 3,100 ppt, and PFOS at 3,300 ppt in well B-173 in the shallow aquifer, and PFOA at 580 ppt in S-110DSRTF, PFNA at 370 ppt in A-19D, and PFOS at 280 ppt in S-389D in the lower aquifer. These levels are several orders of magnitude above current and proposed cleanup standards and EPA's Health Advisory Levels. PFAS will behave very differently in the environment than the five "Indicator Parameters" associated with petroleum hydrocarbon contamination that were evaluated by the Evergreen fate and transport model (benzene, MTBE, Benzo(a)pyrene, naphthalene, and lead). The stated primary objective of the Fate & Transport Report is to complete the remedial investigation process under Act 2 for remediation liability of historic groundwater contamination at the facility. This objective has not been achieved since a significant source of historic groundwater contamination, PFAS contamination, has not been evaluated. Evergreen should be required to update the Fate & Transport Report to evaluate the fate and transport of PFAS, in particular, to evaluate if PFAS contamination in the lower aquifer has migrated to New Jersey and may be impacting public water supply wells in New Jersey, and to evaluate if PFAS in the shallow aquifer may be impacting surface waters and ecological receptors.

Comment No. 2

The Fate & Transport Report is inadequate because it does not address the documented flow of groundwater in the lower aquifer from the PES Site under the Delaware River to New Jersey. It is well documented that the lower aquifer beneath the PES Site, the Potomac-Raritan-Magothy aquifer system ("PRM"), flows from PES beneath the Delaware River into Gloucester and Camden Counties in New Jersey as described in a report prepared by the U.S. Geologic Survey ("USGS") in cooperation with U.S. EPA. At the time of the USGS report, the PRM was an important sole-source ground-water supply in Camden and Gloucester Counties of New Jersey and was designated as a sole-source aquifer by the U.S. EPA because there were few or no alternative drinking water sources in the area.

Evergreen should be required to update the Fate & Transport Report to evaluate the current and previous fate and transport of PFAS in the lower aquifer to New Jersey.

Comment No. 3

The Fate & Transport Report is inadequate because it does not address all relevant time periods and conditions for the release of Site contaminants. The Groundwater Flow Model and Fate & Transport Model prepared by Evergreen provides predictive estimates of the future transport direction based on select contaminant concentration data from 2014 –2022, and groundwater withdrawal data provided in 2012 and 2013 to generate predictive flow simulations and contaminant migration for the next 30 years. The models and the conclusions from the models focus primarily on conditions from the past 10 years and are not representative of fate and transport conditions for contaminants present during the 1970s, 1980s, and early 1990s, when groundwater pumping influences near and around the PES Site were significantly greater and pumping from New Jersey was at its peak. In addition, during the period studied by Evergreen, the Site was operating groundwater extraction and treatment systems that provided some level of hydraulic control. During the 1970s, 1980s and early 1990s, there was no hydraulic control at the site to mitigate the flow of contaminated groundwater towards New Jersey. Evergreen should be required to update the Fate & Transport Report to evaluate the fate and transport of contaminants released in the 1970s, 1980s and 1990s, particularly PFAS, when the level of pumping in New Jersey was much higher.

Discussion

Comment No. 1 Discussion

The Fate & Transport Report does not evaluate the fate and transport of PFAS even though Evergreen has reported the presence of PFAS in both the shallow aquifer (PFOA at 2,800 ppt, PFNA at 3,100 ppt, and PFOS at 3,300 ppt in well B-173) and lower aquifer (PFOA at 580 ppt in S-110DSRTF, PFNA at 370 ppt in A-19D, and PFOS at 280 ppt in S-389D). The Evergreen Fate & Transport Report states that the groundwater transport model was simulated to evaluate the potential migration of the indicator parameters in groundwater. However, the five constituents studied are not indicator parameters for the non-petroleum contamination at the PES Site. PFAS would not degrade in the groundwater near the PES Site like the petroleum indicators, but rather would migrate along the groundwater flow path in effect at the time. The PES Site has been a significant potential source of PFAS in groundwater since the 1970s or earlier. Between 1960 and 1975, the refinery was the scene of ten extra-alarm fires. In 1975, the Point Breeze refinery, which was operated by ARCO at the time, experienced a nine-alarm fire for which 200 firefighters responded. On January 24, 1977, there was an explosion that sparked a fire that lasted four hours and involved 250 firefighters, and another explosion on January 11, 1988. Firefighting foam was reportedly used at each of these events. A major fire at the Girard Point refinery in August 1975, then operated by Gulf Oil, was brought under control with the application of a large volume of foam from National Foam. , In addition, firefighting training areas have been located in multiple areas on the PES Site, and the application of firefighting foam as part of fire training activities, presumably between the 1970s and the 2000s. The extensive use of AFFF at the PES site was documented in the Evergreen Desktop Review and Sampling Plan submitted to PADEP. The Evergreen Desktop Review documents that the PES site had multiple fire training areas and multiple, significant incidents involving the application of AFFF from at least 1975. The summary of the history of AFFF use and releases at the Site from the Evergreen Desktop Review is attached to this letter as Exhibit 1.

Sampling by Evergreen of the shallow and lower aquifers demonstrates the presence of PFAS at levels that are orders of magnitude higher than relevant clean-up standards and health advisories (See Table 1 below). The level of PFAS in groundwater beneath the PES Site in the 1970s and 1980s, when many of the incidents involving AFFF occurred, would have been significantly higher than the levels found today. Notably, the highest levels of PFNA and PFOS detected in the lower aquifer were in downgradient boundary locations (wells A-19D and S-389D), indicating that these contaminants have migrated off-site.

Table 1.

PFAS LEVEL IN SHALLOW GW (ppt) LEVEL IN DEEP GW (ppt) PA SHS MSC (ppt) PA PROPOSED MCL (ppt) NJ MCL (ppt) EPA INTERIM HAL (ppt) EPA RSL Tapwater (ppt)
PFOA 2800 580 70 14 14 0.004 60
PFOS 3,300 280 70 18 13 0.02 40
PFNA 3,100 370 N/A N/A 13 N/A 59

Because PFAS are emerging contaminants, they have a relatively short track record for migration studies in groundwater. One group of researchers who have evaluated this issue concluded that when compared to petroleum-related groundwater contaminants, the median PFAS plume might be significantly longer than BTEX and MTBE plumes. Therefore, the modeling of hydrocarbon compounds under recent pumping and flow conditions is not considered to be representative of the migration potential for PFAS during the relevant time period, i.e., 1970s and 1980s, when large volumes of AFFF were released to the environment. Evergreen should be required to update the Fate & Transport Report to evaluate the fate and transport of PFAS, in particular, to evaluate if PFAS contamination in the lower aquifer has migrated to New Jersey public water supply wells, and if PFAS in the shallow aquifer may be impacting surface waters and ecological receptors.

Comment No. 2 Discussion

It is well documented that the lower aquifer beneath the PES Site, the Potomac-Raritan-Magothy aquifer system (“PRM”), flows from PES beneath the Delaware River into Gloucester County New Jersey, as depicted in Figure 1 below from a report prepared by the U.S. Geological Survey (“USGS”) in cooperation with U.S. EPA. Groundwater modeling of the PRM aquifer system by the USGS shows groundwater flow from the PES Site beneath the Delaware River and into New Jersey with radial flow to the south, southeast, and east. In

its PFAS Lower Aquifer Sampling Results Report, Evergreen identifies wells A-19D and S-389D as downgradient boundary locations. Well A-19D has the highest PFNA concentration and well S-389D has the highest PFOS level, indicating these contaminants have migrated off-site. Notwithstanding the known flow pattern of the lower PRM from PES to New Jersey, and the known high levels of PFAS in the lower PRM at the PES site, Evergreen did not model the transport of PFAS in the lower PRM under the Delaware River.

Figure 1

Water table maps of the PRM aquifer units prepared by the USGS show flow directions from the PES refinery complex into New Jersey, in particular towards Westville, Bellmawr, Brooklawn and National Park wells completed in the lower PRM aquifer. Work by the USGS has established that contaminated water (elevated iron, sulfate and manganese) beneath the PES refinery complex was drawn down into the lower PRM aquifer by historical pumping at the Navy Yard, and then beneath the Delaware River and into New Jersey. , Westville, Bellmawr, Brooklawn, and National Park all have wells in the lower PRM with treatment for high iron and are located on the edge of the iron plume originating in Pennsylvania; all also have wells that contain PFAS. Based on the USGS mapping of the iron plume extending from Pennsylvania to New Jersey water supply wells, contaminants like PFAS in groundwater would be expected to follow the same flow path.

Other PES reports acknowledge that the contamination in the lower aquifer at the PES site can adversely impact drinking water in New Jersey. The PES RIR Report Review states, “[b]enzene, MTBE, and lead were found above standards in the lower aquifer under AOI-1. Groundwater contaminants, especially benzene and MTBE, could migrate off site and affect the water supply for New Jersey.” This report was written before the PFAS sampling was conducted and found elevated PFAS in the lower aquifer at the Site. The Site RIR for AOI-1 states, “The PRM aquifer system is utilized for water supply in New Jersey. The aquifers of that system, chiefly the lower sand unit, can receive recharge via vertical leakage through confining units and direct recharge from younger deposits along their subcrop area in the south Philadelphia area. Groundwater COCs, such as benzene and MTBE, present in the lower aquifer beneath AOI-1 have the potential to migrate offsite.” The RIR for AOI-1 further acknowledges the high hydraulic conductivity rates measured in the lower sand unit proximal to the PES facility and across the Delaware River in New Jersey, and that “Selected geologic units of the PRM are utilized for water supply in New Jersey.” As a result, in order to protect drinking water supplies in New Jersey, Evergreen should be required to update the Fate & Transport Report to evaluate the fate and transport of PFAS in the lower aquifer to evaluate if PFAS releases from the Site have or may impact supply wells in New Jersey.

Comment No. 3 Discussion

The Evergreen fate and transport model is based on input concentration data from 2014 to 2022. The Evergreen model is also based on groundwater withdrawal data provided in 2012 and 2013. As a result, the groundwater model used allows for performing simulations under conditions that have existed during the most recent 7-year period based on groundwater withdrawal data considered representative of that period. However, significant releases of PFAS occurred prior to 2014 and the groundwater withdrawal data from the 1970s, 1980s and early 1990s was very different from 2012-2013. As a result, the model used by Evergreen does not accurately predict the fate and transport conditions for PFAS released during the 1970s, 1980s, and early 1990s. As noted earlier, the highest levels of PFNA and PFOS found in the lower aquifer were in the downgradient boundary wells suggesting that the PFAS releases have already substantially migrated off-site.

Significant PFAS releases occurred during the 1970s, 1980s, and early 1990s when groundwater pumping influences near and around the PES Site were significantly greater and pumping from New Jersey was at its peak. During this period, heavy pumping in New Jersey maintained downward vertical head gradients in the PRM aquifer system in south Philadelphia. This facilitated the flow of groundwater from Philadelphia to New Jersey under the Delaware River, making Philadelphia a recharge area for the PRM aquifer system in parts of Camden and Gloucester Counties, where the lower aquifer is not in direct hydraulic connection with the Delaware River. As shown in Figure 2 below and as demonstrated by the studies by the New Jersey Geological Survey (“NJGS”), groundwater withdrawals from the Philadelphia Naval Ship Yard (“PNSY”) were discontinued in the mid-1960s, and the groundwater withdrawals from the PRM aquifer system in New Jersey began to increase sharply beginning about 1951. Groundwater-withdrawal data from 1978 to 1997 for southern New Jersey counties indicated that withdrawals peaked, then began to decline in 1981 in the middle aquifer, in 1983 in the lower aquifer, and in 1989 in the upper aquifer. In 1994, NJDEP designated the PRM aquifer systems in parts of Gloucester and Camden Counties as a Water Supply Critical Area, reduced water-supply allocations from the PRM, and developed surface water supplies. As a result, the conditions that existed at the time PFAS were released at the PES Site were very different from the conditions modeled by Evergreen. During the 1970s and 1980s there was a strong gradient in the lower PRM towards New Jersey.

Figure 2

By way of example, in 2003, the USGS concluded, “Organic compounds from industrial waste sources in south Philadelphia have the potential to effect the quality of ground water withdrawn from the lower aquifer of the PRM in adjacent areas of New Jersey where the lower aquifer is not in direct hydraulic connection with the Delaware River.” “The outcrop area of the PRM in Philadelphia became a recharge area for the lower aquifer of the PRM in parts of New Jersey.”

In addition, the Evergreen fate and transport model is based on Site conditions when the Site was operating groundwater extraction and treatment systems that provided some level of localized hydraulic control. During the 1970s, 1980s and early 1990s, there were no known groundwater pumping and treatment systems at the site to mitigate the flow of contaminated groundwater towards New Jersey.

As a result, the Fate & Transport Report did not model the relevant time period or conditions to assess the most significant offsite migration from PFAS releases. Evergreen should be required to update the Fate & Transport Report to evaluate the fate and transport of

PFAS released in the 1970s, 1980s and 1990s, when the level of pumping in New Jersey was much higher and the flow of groundwater from Philadelphia to New Jersey under the Delaware River was well documented.

Thank you for your consideration of these comments.

Sincerely,

David B. Farrington, P.G.
Principal Geologist

From: Shani Ferguson
To: Philly Refinery Cleanup; lstrobridg@pa.gov; cdbrown@pa.gov; LeighAnne.Rainford@phila.gov
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date: Thursday, July 28, 2022 9:18:37 PM

To Whom It May Concern:

I am writing as a nearby resident of the subject site to ask you to PLEASE disapprove Evergreen Resources Group, LLC's latest Act 2 submission to the Pennsylvania Department of Environmental Protection (DEP), the sitewide fate and transport remedial investigation report (RIR).

Pennsylvania's Act 2 of 1995 defines the "fate and transport" as describing the "the degradation of a chemical over time and where chemicals are likely to move given their physical and other properties and the environmental medium they are moving through."

The most obvious concern regarding Evergreen's current RIR submission is the absence of a discussion of the effects of increased precipitation events caused by climate change and the related increased flooding caused by the combination of increased sea level rise with more frequent and severe storms that result in increased precipitation and flooding. Evergreen's report accounted for the effects of sea level rise on the tidal Schuylkill River, but did not mention the contribution of increased precipitation and more frequent storms resulting from climate change.

To compound this problem, the site's current owners, Hilco Redevelopment Partners are proposing to pave the vast majority of the 1,400 acre site, which would significantly increase the risk of flooding at this site which already contains large portions of heavily contaminated areas in the 100 and 500-year floodplains. Hilco is also proposing to raise the site out of these floodplains, which will increase flooding in the tidal Schuylkill River and the surrounding community, potentially dispersing dangerous pollutants like the known carcinogen benzene and lead, which is known to reduce brain function and damage other organs like kidneys.

In its consideration of climate change, Evergreen mistakenly concludes that, "because the groundwater gradient is not anticipated to change substantively, groundwater fluxes of contaminants are similarly assumed to remain consistent over time in the absence of substantial anthropogenic changes to the system." The entire intention of incorporating climate change-related projections into this RIR is to anticipate changes in groundwater movement, particularly in the context of planned development. Evergreen should not assume "the absence of substantial anthropogenic changes to the system" given the current and future impacts of human-made climate change to the City and the network of public sewer lines under the site, which are already damaged.

While the combination of sea level rise, increased precipitation events and large increases in impervious surface could itself contribute to changes in the groundwater gradient, this change could be further exacerbated by the several leaking sewers at the site, known to be pathways of groundwater contamination. Evergreen repeatedly mentions the several public sewer lines under the site that are known to leak and Evergreen projects that the leaking sewers will affect groundwater movement at the site. Evergreen also states several times that the sewers act as pathways to transport pollutants at the site, specifically benzene. These sewers connect the

surrounding community to the Schuylkill River and could potentially flood during a storm event, dispersing pollutants to the surrounding community. Evergreen also describes that groundwater movement converges around the Shunk, Maiden Lane, 26th Street and Pollock Street/Packer Avenue Sewers, all of which are known to leak and transport groundwater pollution around the site. The combination of converging groundwater around leaking sewers at heavily contaminated areas of the site could result in a pollution incident if the sewer system overflows. The 26th Street and Pollock Street/Packer Avenue Sewers are known to transmit pollutants offsite and the Shunk Street sewer system exists at a convergence of groundwater and elevated benzene levels. In Evergreen's own words, "the most significant groundwater benzene impacts in the water table are in the northeast corner of Belmont Terminal generally on the north side of the Shunk Street sewer."

DEP should require Evergreen to model sewer overflows during large and frequent precipitation events with consideration of sea level rise and increased impervious surface at and around the site. These precipitation events could affect the groundwater gradient at the site and should be modeled as a part of this RIR. It is also premature to make assumptions about the condition of the several public sewers that run under the site before it is redeveloped by Hilco. The proposed redevelopment, cleanup, and any proposed stormwater management efforts may further damage the sewer system at the site.

An additional concern is the public water infrastructure on the West side of the Schuylkill River that is intended to prevent Area of Interest (AOI) 9 from flooding - the Mingo Basin. Another concern is Evergreen's complete disregard of the impacts that future development at the site will have on the migration of contaminated groundwater. Evergreen both assumes that the Philadelphia Water Department (PWD) will continue to operate the Mingo Basin water pump for the next 30 years while assuming that there will be no use changes at AOI 9, the Schuylkill River Tank Farm (SRTF). Hilco, the current owner of the SRTF has not stated a future use of the property. However, the Schuylkill River Development Corporation (SRDC) just announced a $2.5 million grant from Pennsylvania's Redevelopment Assistance Capital Program for a river trail that would eventually cross the riverside border of AOI 9. This new waterline construction project within the footprint of AOI 9 could affect pollution exposures and groundwater movement at the site.

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Most sincerely,
Shani Ferguson
748 S 18th St
Philadelphia, PA 19146

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date: Tuesday, August 2, 2022 10:34:02 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

From: MARLENE ADKINS <dkdka27@msn.com>
Sent: Friday, July 29, 2022 1:21 PM
To: Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>; lstrobridg@pa.gov; cdbrown@pa.gov; LeighAnne.Rainford@Phila.gov
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

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The most obvious concern regarding Evergreen's current RIR submission is the absence of a discussion of the effects of increased precipitation events caused by climate change and the related increased flooding caused by the combination of increased sea level rise with more frequent and severe storms that result in increased precipitation and flooding. Evergreen's report accounted for the effects of sea level rise on the tidal Schuylkill River, but did not mention the contribution of increased precipitation and more frequent storms resulting from climate change.

To compound this problem, the site's current owners, Hilco Redevelopment Partners are proposing to pave the vast majority of the 1,400-acre site, which would significantly increase

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Marlene Adkins
Triumph to those who don't Resign

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date: Tuesday, August 2, 2022 10:33:47 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

The Power of Commitment

Connect

From: Nancy Ballard <nballard@dca.net>
Sent: Friday, July 29, 2022 12:18 PM
To: Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>
Subject: Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

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Annette N. Ballard

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date: Tuesday, August 2, 2022 10:33:29 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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M 647-233-6948 **E** emily.cameron@ghd.com

The Power of Commitment

Connect

From: Turtlebug <play@turtlebug.org>
Sent: Friday, July 29, 2022 6:45 AM
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

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Johnny Buckley
215.687.1212
Play@turtlebug.org
Turtlebug.org
Change.org/fortheloveofturtlebug
Instagram.com/play.turtlebug
https://youtu.be/rQBSru7Ner4

From:	Philly Refinery Cleanup
To:	DOERR, TIFFANI L
Subject:	FW: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date:	Tuesday, August 2, 2022 10:35:36 AM
Attachments:	image001.png image002.png image003.png image004.png image005.png

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Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

From: Kenneth Daly <kenneth_daly_149@comcast.net>
Sent: Saturday, July 30, 2022 4:31 PM
To: Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

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Given the lack of lead testing along the shoreline and the vague estimations of groundwater pumping at the site, Evergreen’s “Simulated Lead Distribution Over 30 Years” for the water table at AOI 9 (Figure 4.23e) is unacceptable and should be disapproved by DEP. Evergreen claims that the lead plume at the site will be completely pumped into the Schuylkill River within 10 years.This argument is misplaced because discharging lead into the river will add lead to the sediments along the river, which has already been shown to have elevated concentrations of lead.

Please require Evergreen to adequately address groundwater contamination and movement at the site given these concerns.

Sincerely,

Kenneth W. Daly

2200 Benjamin Franklin Parkway Apt S1411

Philadelphia PA 19130

From:	Philly Refinery Cleanup
To:	DOERR, TIFFANI L
Subject:	FW: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date:	Tuesday, August 2, 2022 10:34:16 AM
Attachments:	image001.png image002.png image003.png image004.png image005.png

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Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

GHD
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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

From: Boris Dirnbach <bdirnbac@gmail.com>
Sent: Friday, July 29, 2022 2:39 PM
To: Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>; lstrobridg@pa.gov; cdbrown@pa.gov; LeighAnne.Rainford@phila.gov
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

Please disapprove Evergreen Resources Group, LLC's latest Act 2 submission to the Pennsylvania Department of Environmental Protection (DEP), the sitewide fate and transport remedial investigation report (RIR). Pennsylvania's Act 2 of 1995 defines the "fate and transport" as describing the "the degradation of a chemical over time and where chemicals are likely to move given their physical and other properties and the environmental medium they are moving through."

The most obvious concern regarding Evergreen's current RIR submission is the absence of a discussion of the effects of increased precipitation events caused by climate change and the related increased flooding caused by the combination of increased sea level rise with more frequent and severe storms that result in increased precipitation and flooding. Evergreen's report accounted for the effects of sea level rise on the tidal Schuylkill River, but did not mention the contribution of increased precipitation and more frequent storms resulting from climate change.

To compound this problem, the site's current owners, Hilco Redevelopment Partners are proposing to pave the vast majority of the 1,400 acre site, which would significantly increase

the risk of flooding at this site which already contains large portions of heavily contaminated areas in the 100 and 500-year floodplains. Hilco is also proposing to raise the site out of these floodplains, which will increase flooding in the tidal Schuylkill River and the surrounding community, potentially dispersing dangerous pollutants like the known carcinogen benzene and lead, which is known to reduce brain function and damage other organs like kidneys.

In its consideration of climate change, Evergreen mistakenly concludes that, "because the groundwater gradient is not anticipated to change substantively, groundwater fluxes of contaminants are similarly assumed to remain consistent over time in the absence of substantial anthropogenic changes to the system." The entire intention of incorporating climate change-related projections into this RIR is to anticipate changes in groundwater movement, particularly in the context of planned development. Evergreen should not assume "the absence of substantial anthropogenic changes to the system" given the current and future impacts of human-made climate change to the City and the network of public sewer lines under the site, which are already damaged.

While the combination of sea level rise, increased precipitation events and large increases in impervious surface could itself contribute to changes in the groundwater gradient, this change could be further exacerbated by the several leaking sewers at the site, known to be pathways of groundwater contamination. Evergreen repeatedly mentions the several public sewer lines under the site that are known to leak and Evergreen projects that the leaking sewers will affect groundwater movement at the site. Evergreen also states several times that the sewers act as pathways to transport pollutants at the site, specifically benzene. These sewers connect the surrounding community to the Schuylkill River and could potentially flood during a storm event, dispersing pollutants to the surrounding community. Evergreen also describes that groundwater movement converges around the Shunk, Maiden Lane, 26th Street and Pollock Street/Packer Avenue Sewers, all of which are known to leak and transport groundwater pollution around the site. The combination of converging groundwater around leaking sewers at heavily contaminated areas of the site could result in a pollution incident if the sewer system overflows. The 26th Street and Pollock Street/Packer Avenue Sewers are known to transmit pollutants offsite and the Shunk Street sewer system exists at a convergence of groundwater and elevated benzene levels. In Evergreen's own words, "the most significant groundwater benzene impacts in the water table are in the northeast corner of Belmont Terminal generally on the north side of the Shunk Street sewer."

DEP should require Evergreen to model sewer overflows during large and frequent precipitation events with consideration of sea level rise and increased impervious surface at and around the site. These precipitation events could affect the groundwater gradient at the site and should be modeled as a part of this RIR. It is also premature to make assumptions about the condition of the several public sewers that run under the site before it is redeveloped by Hilco. The proposed redevelopment, cleanup, and any proposed stormwater management efforts may further damage the sewer system at the site.

An additional concern is the public water infrastructure on the West side of the Schuylkill River that is intended to prevent Area of Interest (AOI) 9 from flooding - the Mingo Basin. Another concern is Evergreen's complete disregard of the impacts that future development at the site will have on the migration of contaminated groundwater. Evergreen both assumes that the Philadelphia Water Department (PWD) will continue to operate the Mingo Basin water pump for the next 30 years while assuming that there will be no use changes at AOI 9, the Schuylkill River Tank Farm (SRTF). Hilco, the current owner of the SRTF has not stated a future use of the property. However, the Schuylkill River Development Corporation (SRDC)

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Please require Evergreen to adequately address groundwater contamination and movement at the site given these concerns.

I await your decision.

Sincerely,

Boris Dirnbach

Philadelphia PA

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Evergreen Resources Latest Act 2 Submisson Fails
Date: Tuesday, August 2, 2022 10:34:48 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

From: Meg <megreenfield1@gmail.com>
Sent: Friday, July 29, 2022 5:42 PM
To: Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>; lstrobridg@pa.gov; cdbrown@pa.gov; LeighAnne.Rainford@Phila.gov
Subject: Evergreen Resources Latest Act 2 Submisson Fails

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Please require Evergreen to adequately address groundwater contamination and movement at the site given these concerns.

Marjorie Greenfield
A very concerned resident of Philadelphia

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Comment on Sitewide Fate & Transport Remedial Investigation Report
Date: Tuesday, August 2, 2022 10:34:13 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com


The Power of Commitment

Connect

From: Mary Ann <chilipott@msn.com>
Sent: Friday, July 29, 2022 2:26 PM
To: Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>
Subject: Comment on Sitewide Fate & Transport Remedial Investigation Report

Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

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The most obvious concern regarding Evergreen's current RIR submission is the absence of a discussion of the effects of increased precipitation events caused by climate change and the related increased flooding caused by the combination of increased sea level rise with more frequent and severe storms that result in increased precipitation and flooding. Evergreen's report accounted for the effects of sea level rise on the tidal Schuylkill River, but did not mention the contribution of increased precipitation and more frequent storms resulting from climate change.

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Please require Evergreen to adequately address groundwater contamination and movement at the site given these concerns.

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date: Tuesday, August 2, 2022 10:34:34 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

From: Tammy Murphy <tammy@psrpa.org>
Sent: Friday, July 29, 2022 3:45 PM
To: LeighAnne.Rainford@phila.gov; Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>; cdbrown@pa.gov; lstrobridg@pa.gov
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

Please disapprove Evergreen Resources Group, LLC's latest Act 2 submission to the Pennsylvania Department of Environmental Protection (DEP), the sitewide fate and transport remedial investigation report (RIR).

Evergreen Resources Group, LLC, a subsidiary of Sunoco LLC, has not adequately documented the potential for dangerous pollutants to travel at the site, which could potentially increase human exposure and damage wildlife and ecology. Evergreen is required by Pennsylvania's Act 2 of 1995 to report the fate and transport of the legacy of chemicals such as benzene, which is a known carcinogen, and lead, which can damage brain function and harm other vital organs like kidneys as community members face continued exposure.

The Sitewide Fate and Transport Remedial Investigation Report (RIR) lacks adequate testing on the West side of the Schuylkill River at the Schuylkill River Tank Farm. Regarding the East side of the river, the Sitewide Fate and Transport Remedial Investigation Report (RIR) does not address how the city's sewer system will function with increased sea level rise and storms with a sewer system running under the refinery property that is known as a pathway of pollutants, and known to leak. A more in-depth analysis of that system, and the potential for sewer overflow is missing from the Sitewide Fate and Transport Remedial Investigation Report (RIR).

Thank you.

Sincerely,

Barbara Brandom, MD
Concerned Health Professionals of Pennsylvania

Tammy Murphy, M.A., LL.M.
Physicians for Social Responsibility - Pennsylvania

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date: Tuesday, August 2, 2022 10:35:10 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

From: Brandon Robilotti <b.robilotti@gmail.com>
Sent: Saturday, July 30, 2022 3:59 PM
To: Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>; cdbrown@pa.gov; lstrobridg@pa.gov; LeighAnne.Rainford@phila.gov
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

Dear Committed Public Servants,

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Thank you sincerely,

Brandon Robilotti, Concerned Citizen

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date: Tuesday, August 2, 2022 10:34:43 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

From: Madeline Shikomba <northofwashingtonavecoalition@gmail.com>
Sent: Friday, July 29, 2022 4:54 PM
To: Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

Subject:

Please disapprove Evergreen Resources Group, LLC's latest Act 2 submission to the Pennsylvania Department of Environmental Protection (DEP), the sitewide fate and transport remedial investigation report (RIR). Pennsylvania's Act 2 of 1995 defines the "fate and transport" as describing the "the degradation of a chemical over time and where chemicals are likely to move given their physical and other properties and the environmental medium they are moving through."

The most obvious concern regarding Evergreen's current RIR submission is the absence of a discussion of the effects of increased precipitation events caused by climate change and the related increased flooding caused by the combination of increased sea level rise with more frequent and severe storms that result in increased precipitation and flooding. Evergreen's report accounted for the effects of sea level rise on the tidal Schuylkill River, but did not mention the contribution of increased precipitation and more frequent storms resulting from climate change.

To compound this problem, the site's current owners, Hilco Redevelopment Partners are

proposing to pave the vast majority of the 1,400 acre site, which would significantly increase the risk of flooding at this site which already contains large portions of heavily contaminated areas in the 100 and 500-year floodplains. Hilco is also proposing to raise the site out of these floodplains, which will increase flooding in the tidal Schuylkill River and the surrounding community, potentially dispersing dangerous pollutants like the known carcinogen benzene and lead, which is known to reduce brain function and damage other organs like kidneys.

In its consideration of climate change, Evergreen mistakenly concludes that, “because the groundwater gradient is not anticipated to change substantively, groundwater fluxes of contaminants are similarly assumed to remain consistent over time in the absence of substantial anthropogenic changes to the system.” The entire intention of incorporating climate change-related projections into this RIR is to anticipate changes in groundwater movement, particularly in the context of planned development. Evergreen should not assume “the absence of substantial anthropogenic changes to the system” given the current and future impacts of human-made climate change to the City and the network of public sewer lines under the site, which are already damaged.

While the combination of sea level rise, increased precipitation events and large increases in impervious surface could itself contribute to changes in the groundwater gradient, this change could be further exacerbated by the several leaking sewers at the site, known to be pathways of groundwater contamination. Evergreen repeatedly mentions the several public sewer lines under the site that are known to leak and Evergreen projects that the leaking sewers will affect groundwater movement at the site. Evergreen also states several times that the sewers act as pathways to transport pollutants at the site, specifically benzene. These sewers connect the surrounding community to the Schuylkill River and could potentially flood during a storm event, dispersing pollutants to the surrounding community. Evergreen also describes that groundwater movement converges around the Shunk, Maiden Lane, 26th Street and Pollock Street/Packer Avenue Sewers, all of which are known to leak and transport groundwater pollution around the site. The combination of converging groundwater around leaking sewers at heavily contaminated areas of the site could result in a pollution incident if the sewer system overflows. The 26th Street and Pollock Street/Packer Avenue Sewers are known to transmit pollutants offsite and the Shunk Street sewer system exists at a convergence of groundwater and elevated benzene levels. In Evergreen’s own words, “the most significant groundwater benzene impacts in the water table are in the northeast corner of Belmont Terminal generally on the north side of the Shunk Street sewer.”

DEP should require Evergreen to model sewer overflows during large and frequent precipitation events with consideration of sea level rise and increased impervious surface at and around the site. These precipitation events could affect the groundwater gradient at the site and should be modeled as a part of this RIR. It is also premature to make assumptions about the condition of the several public sewers that run under the site before it is redeveloped by Hilco. The proposed redevelopment, cleanup, and any proposed stormwater management efforts may further damage the sewer system at the site.

An additional concern is the public water infrastructure on the West side of the Schuylkill River that is intended to prevent Area of Interest (AOI) 9 from flooding - the Mingo Basin. Another concern is Evergreen’s complete disregard of the impacts that future development at the site will have on the migration of contaminated groundwater. Evergreen both assumes that the Philadelphia Water Department (PWD) will continue to operate the Mingo Basin water pump for the next 30 years while assuming that there will be no use changes at AOI 9, the Schuylkill River Tank Farm (SRTF). Hilco, the current owner of the SRTF has not stated a

future use of the property. However, the Schuylkill River Development Corporation (SRDC) just announced a $2.5 million grant from Pennsylvania's Redevelopment Assistance Capital Program for a river trail that would eventually cross the riverside border of AOI 9. This new waterline construction project within the footprint of AOI 9 could affect pollution exposures and groundwater movement at the site.

Evergreen has not assessed the sturdiness of the shoreline and mistakenly claims that "along the facility, much of the Schuylkill River shoreline has been hardened with sheet pilings and bulkheads to stabilize the channel, provide shipping access, and mitigate the potential for erosion and flooding." Evergreen has clearly not confirmed the integrity of these materials along the shoreline.

Evergreen also continues to provide vague estimates of the water pumping done at the Mingo Basin. Evergreen's current assessment of water pumping at this facility, "approximately 1 to 3 MGD", is simply too broad. This figure in conjunction with Evergreen's lack of assessment of the impact of impervious surface and precipitation events in its climate change projections could lead to a misestimation of the movement of groundwater at the site.

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Please require Evergreen to adequately address groundwater contamination and movement at the site given these concerns.

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Comment fro POWER Interfaith Climate Justice and Jobs team
Date: Tuesday, August 2, 2022 10:35:39 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

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Stakeholder Engagement Specialist

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The Power of Commitment

Connect

From: Moon Smith <moonesmith@gmail.com>
Sent: Sunday, July 31, 2022 6:36 PM
To: Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>
Subject: Comment fro POWER Interfaith Climate Justice and Jobs team

Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

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POWER Interfaith Climate Justice and Jobs Team

From: Philly Refinery Cleanup
To: DOERR, TIFFANI L
Subject: FW: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date: Tuesday, August 2, 2022 10:35:33 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png

Thank you,

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Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

From: President PFB <president@philadelphiafreedomband.com>
Sent: Saturday, July 30, 2022 2:59 PM
To: LeighAnne.Rainford@phila.gov; cdbrown@pa.gov; lstrobridg@pa.gov; Philly Refinery Cleanup <phillyrefinerycleanup@ghd.com>
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

I am a resident of Grays Ferry.

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Thanks,

David Szczepanik

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_____

David Szczepanik, OTR/L
he/him
484-364-1251
President, Philadelphia Freedom Band
president@philadelphiafreedomband.com
philaband.org

_____

From:	Philly Refinery Cleanup
To:	DOERR, TIFFANI L
Subject:	FW: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)
Date:	Tuesday, August 2, 2022 10:33:44 AM
Attachments:	image001.png image002.png image003.png image004.png image005.png

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Thank you,

EMILY CAMERON
Stakeholder Engagement Specialist

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184 Front Street East suite 302, Toronto, Ontario, M5A 4N3
M 647-233-6948 **E** emily.cameron@ghd.com

From: Sarah Thompson <sathomp17@gmail.com>
Sent: Friday, July 29, 2022 7:01 AM
To: lstrobridg@pa.gov
Subject: Comment on Sitewide Fate and Transport Remedial Investigation Report (RIR)

To whom it concerns,

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Regards,

Sarah Thompson

DOERR, TIFFANI L

From: noreply@phillyrefinerycleanup.info
Sent: Friday, July 15, 2022 8:09 PM
To: DOERR, TIFFANI L
Subject: New submission from Comment Submission Form

Name
Vivian Wise
Email
vmx@verizon.net
Address
5825 Theodore St Philadelphia, Pennsylvania 19143 United States Map It
Report or Topic
General Comment
Comment
Should be a park