



MEMO

TO Ragesh R. Patel
Regional Manager
Environmental Cleanup and Brownfields

FROM Lisa Strobbridge, P.G. *Lisa Strobbridge*
Professional Geologist

THROUGH C. David Brown, P.G.
Professional Geologist Manager

DATE September 27, 2022

RE ECB – Land Recycling Program
Act 2 Technical Memo Summary
Ecological Risk Assessment AOIs 1 through 9
Former Philadelphia Refinery
eFACTS PF No. 780190
Sunoco Inc Phila Ref Sitewide
3144 West Passyunk Avenue
City of Philadelphia
Philadelphia County

Property Owner:

Hilco Redevelopment Partners (aka PES R&M)
99 Summer Street, Suite 1110, Boston, MA 02110

Remediator:

Evergreen Resources Management Operations
2 Righter Parkway, Suite 120
Wilmington, DE 19083

Site Address:

3144 West Passyunk Avenue
Philadelphia, PA 19145

Act 2 Standard(s) Sought: non-residential site-specific standard for soil and groundwater

Property Size: ~1300 acres

Project Site History: Petroleum refining began at the Philadelphia Refinery circa 1870. The facility consisted of two refineries, Point Breeze operated by Atlantic Petroleum Corporation (formerly ARCO) and Girard Point by Chevron (formerly Gulf). Sunoco purchased these two

refineries in 1988 and 1994 and consolidated them into a single facility. In 2012, Sunoco sold the refinery to the Carlyle Group and entered a joint venture to operate it as Philadelphia Energy Solutions (PES). Sunoco, Inc. is now a subsidiary of Energy Transfer Partners, L.P., and Evergreen is a Sunoco affiliate that is responsible for legacy environmental remediation. In 2020, PES was acquired by Hilco Redevelopment Partners (HRP).

The Philadelphia Refinery processed up to 330,000 barrels a day of crude oil. It produced gasoline, diesel, jet fuel, kerosene, home heating oil, and other petroleum liquids. The facility consisted of multiple process units, above-ground storage tanks, pipelines, as well as truck, railcar, and barge transfer equipment. The facility has been divided into eleven areas of interest (AOI 1–11) for purposes of characterizing contamination. The first ten are geographical areas of the facility, and AOI 11 represents the deep groundwater aquifer. From 2012 through 2021 Remedial Investigation Reports have been submitted and approved for AOI-1 through AOI-10 for the site.

DEP and EPA discussed the review of this report and determined that each agency would submit separate written comments.

Ecological Risk Assessment Overview:

- As the title indicates, the Ecological Risk Assessment (ERA) assesses the potential for ecological impacts at Areas of Interest (AOI) 1 through AOI 9 at the former Philadelphia Refinery from historical petroleum operations through 2012.
- Surface water bodies and wetlands are present onsite.
- The Schuylkill River is located immediately adjacent to AOIs 2,5,6,7,8, and 9.
- The Mingo Creek Flood Control Basin is adjacent to AOI 9.
- While most of the site contained impervious services, buildings, refinery structures with foundations, and gravel roads, upland and wetland vegetation are present onsite and were surveyed in 2018.
- Pennsylvania Natural Diversity Inventory (PNDI) searches were performed September 2015, June 2018, and again in 2022.
 - In the 2022 PNDI, the following species of concern were identified by the various agencies:
 - Pennsylvania Game Commission (PGC) – marsh wren and peregrine falcon were identified as special concern species and least bittern was identified as an endangered species.
 - PGC responded that no impact is anticipated for the current remedial actions being performed by Evergreen.
 - Department of Conservation and Natural Resources (DCNR) identified waterhemp ragweed and river bulrush as special concern species and Walter’s Barnyard-grass, multiflowered plantain, and bugleweed as endangered species.
 - DCNR responded that no impact is anticipated for the current remedial actions being performed by Evergreen.

- The Pennsylvania Fish and Boat Commission (PFBC) identified Atlantic Sturgeon, Hickory Shad, and Shortnose Sturgeon as three endangered species and the Northern Red-Bellied Cooter (also known as Eastern Red-Bellied Turtle) as the threatened species
 - PFBC concurred with the evaluation and results of Northern Red-Bellied Cooter habitat previously submitted to DCNR in October 2018 by Stantec, on behalf of Evergreen. The findings indicated:
 - Four onsite water bodies and the Schuylkill River, and the vegetated areas in proximity to these water bodies, are potential habitat for the Northern Red-bellied Cooter. Impacts to these features should be avoided.
 - The four water bodies present in 2018 that were identified as suitable habitat for Northern Red-bellied Cooter are the Schuylkill River, stormwater basin in AOI 8, Mingo Creek/Basin, and two stormwater basins in AOI 3.
 - A follow-up field survey was conducted in July 2019 in two of the four areas that were identified as potential habitat for the Northern Red-bellied Cooter. Northern Red-bellied Cooters were observed in one of the two waterbodies.
 - PFBC recommended a number of measures to protect suitable habitats from disturbances within 300 feet of all surface water features, and measures that prevent the release of sediment and harmful chemicals into waterways.
 - The United States Fish and Wildlife Service (USFWS) indicated no impacts to federally listed or proposed species is anticipated.
 - It is important to note the supplemental information provided to the agencies stated “This PNDI request is not in relation to the demolition and redevelopment work, but for Evergreen’s storage tank and One Cleanup Plan work.”
 - DEP understands that HRP’s redevelopment plans for the initial redevelopment phases are not yet final.
 - Future PNDIs and associated agency correspondence (from HRP and/or Evergreen) should indicate both current and planned use to ensure current and future protection of the ecological receptors, once redevelopment plans are finalized. A supplemental ecological risk assessment report may be required to account for remedy implementation.
- The Ecological Risk Assessment evaluates risk from site COCs to threatened species, endangered species, and species of concern identified by PNDI.
 - Species evaluated in AOIs 1 through 9 include bird species (marsh wren, peregrine falcon, and least bittern), fish species (Atlantic sturgeon, shortnose sturgeon, and

- hickory shad), reptile species (eastern redbelly turtle) and plant species (waterhemp ragweed, eastern baccharis, Walter's barnyard-grass, multiflowered mudplantain, bugleweed, shrubby camphor-weed, and river bullrush) that were identified in PNDI's conducted in 2018 and 2022.
- The site COC list consists of 21 petroleum compounds – 10 volatile organic compounds (VOCs), 10 semi-volatile organic compounds (SVOCs), and lead. Of these 21 compounds, 10 are identified by PADEP as constituents of potential ecological concern (COPEC) and include benzene, toluene, ethylbenzene, xylenes, benzo(a)pyrene, fluorene, naphthalene, phenanthrene, pyrene, and lead.
 - **Potential ecological receptors** were evaluated including 1) threatened or endangered species, 2) exceptional value wetlands, 3) habitats of concern, and 4) species of concern
 - The habitats and species of concern were evaluated through the PNDI survey and subsequent field surveys of Northern Red-Bellied Cooter and habitat.
 - A botanical survey was conducted at the site in August 2018 and the survey targeted the seven botanical species identified in the 2018 PNDI search as species of special concern (SOSC).
 - It is important to note that between the 2018 and 2022 PNDI surveys, Eastern baccharis was removed as a rare plant species from DCNR's list.
 - The survey included a desktop review to identify potentially vegetated areas, site reconnaissance by qualified personnel to identify vegetated areas that provide suitable habitat for SOSC and a field botanical survey.
 - The field botanical survey was conducted in a grid like approach in vegetated areas that catalogued and photo-documented the plant communities and habitat characteristics, and methodically surveyed the habitat areas for each of the SOSC within the suitable habitat areas.
 - The botanical survey indicated:
 - Waterhemp ragweed, Walter's barnyard-grass, multiflowered mudplantain, bugleweed, shrubby camphor-weed, and river bullrush were not identified as being present onsite at the time of the survey in August 2018
 - Eastern baccharis was identified throughout AOI 3 in significant amounts over a 21 acre area and in AOI 8 in limited numbers.
 - The 2022 PNDI survey continued to identify the presence of SOSCs. Since four years has elapsed since the botanical survey was performed, the botanical survey should be updated to reflect current conditions. Some areas where onsite water bodies exist have been inactive, therefore increasing the potential for colonization of SOSC.
 - Exceptional value wetlands were not identified at the site, and no threatened or endangered plant species were identified during the 2018 botanical survey. The botanical survey did not address the potential for suitable habitat or occurrences of Threatened or Endangered fauna on the property which could affect the designation of Exceptional Value Wetlands and should be evaluated.

- An ecological risk assessment for Hickory Shad, Shortnose Sturgeon, and Atlantic Sturgeon was conducted and included monitoring of acoustically-tagged sturgeon from 2018 through 2019 and literature review of shad occurrence in the Schuylkill River.
 - The shad and sturgeon risk assessment also consisted of exposure pathway evaluation for species of concern, identification of constituents of concern (COCs), toxicity assessment, and risk characterization.
 - The identified exposure pathways for shad and sturgeon are Schuylkill River sediments.
 - Bulk sediment samples and one surface water sample were collected from the Schuylkill River in 2017 as part of preparations for dredging. The sample analysis included the COPECs, and sample locations included three locations adjacent to the site. Elutriate testing was also conducted on the sediment samples to evaluate the water quality effects of re-suspending the sediments during dredging.
 - The surface water sample was analyzed for VOCs, SVOCs and lead.
 - Grab or discrete sampling from more than one location from the media of concern is necessary to characterize the point concentration for exposure. Discrete sampling of Schuylkill River sediments, Mingo Creek basin sediments, and other water body sediments is needed.
 - The sediment samples used in the risk assessment do not represent the exposures to the receptors identified in the risk assessment. Sediment samples should be collected at various depths consistent with the fish habitat and from the shoreline consistent with the turtle habitat.
 - The report indicates that VOCs are not expected to be present in high concentrations in the surface water, onsite ponds, and Mingo Creek Flood Control Basin as they rapidly volatilize if present in surface water. This assumption should be verified with analytical data.
 - The toxicity assessment and risk characterization indicated that “it is unlikely that the lead concentrations detected in sediment would be deleterious to the species of concern. Bioaccumulation of lead through food chain transfer is not likely, since fish do not bioaccumulate lead to a significant extent.” “No lead was detected in muscle, liver, or gonad tissues of two adult shortnose sturgeon accidentally killed during sampling in the Delaware River or in the tissues of an adult shortnose sturgeon killed during dredging in the Kennebec River, ME (ERC, 2003). No literature was found on tissue concentrations of lead in hickory shad.”
 - Lead concentrations in the filtered elutriate samples exceeded Biological Technical Assistance Group (BTAG) screening values in 2

- of the 6 samples but were less than Delaware River Basin Commission (DRBC) water quality standards for acute and chronic exposure.
- Alternative screening values were referenced in the ecological risk assessment, including from the Ontario Ministry of the Environment; however, DEP recognizes EPA's BTAG screening tables and soil screening levels. Alternative screening methods can be considered with clear explanation of input parameters, references for assumptions and calculations performed. The description, assumptions, and calculations for the Ontario Ministry of the Environment screening levels were not sufficiently presented to allow for consideration.
 - Lead was detected in the surface water sample.
 - PAHs were detected in the Schuylkill River bulk sediment samples at concentrations that exceeded BTAG freshwater sediment screening values, but the applicability of these benchmarks to fish is unknown.
 - It is unclear if the March 9, 2020 Ecological Risk Assessment (included in this report) for Hickory Shad, Shortnose Sturgeon, and Atlantic Sturgeon in the Schuylkill River Adjacent to the PES Philadelphia Refining Complex Areas of Interest 1 through 9 was shared with PFBC.
 - The 2020 report did not assess the ecological impacts to the Northern Red-Bellied Cooter, and this turtle was recognized as a SOSC in the 2022 PNDI. The PFBC acknowledged the presence of this species and habitat in the 2022 PNDI response and made recommendations to avoid disturbances to the habitat.
 - More detail is needed to justify the exclusion of this species, and what alternatives or surrogates were considered. The report indicates a qualitative assessment of exposures (substantial impacts to exposures to VOCs and lead in sediments and surface water are not expected, turtles can rapidly metabolize PAHs and readily eliminate their metabolites) to this SOSC whereas a quantitative assessment is required.
- **Potential Exposure Pathways** identified include 1) intermittent LNAPL or sheens on Schuylkill River, 2) overland sheet flow transporting surface soil into the Schuylkill River during significant precipitation events, 3) stormwater discharges to the Schuylkill River during significant precipitation events, 4) surface erosion and runoff contributing to migration of surface soil into onsite water bodies, 5) infiltration and leaching of soil impacts to groundwater and subsequent discharge of groundwater to surface water, 6) discharge of groundwater to surface water through preferential pathways such as sewers and other underground utilities, 7) Schuylkill River sediment, and 8) surface water
 - One surface water sample collected from the Schuylkill River was used in the assessment, but surface water samples from other onsite water bodies and Mingo Basin were not collected. The fate and transport model results can be used where appropriate and data can readily be collected from onsite detention ponds/water bodies to allow for quantitative assessment of exposures and subsequent risk.

- Sediment samples from onsite water bodies or Mingo Basin were not collected or evaluated in the assessment. This data can readily be collected to allow for quantitative assessment of exposures and subsequent risk.
- Sediment samples from the Schuylkill River shoreline were not collected or evaluated in the assessment. This data can readily be collected to allow for quantitative assessment of exposures and subsequent risk.
- The report indicates that for the purposes of this evaluation, it is assumed that the Evergreen COPECs are present in surface water and sediment of the onsite ponds, the Mingo Creek Flood Control Basin, and the Schuylkill River adjacent to the facility.
- **Potential Routes of Exposure** were qualitatively evaluated for the Marsh Wren, Peregrine Falcon, Least Bittern, Atlantic Sturgeon, Shortnose Sturgeon, Hickory Shad, and Northern Red-Bellied Cooter and include dermal adsorption of COPECs in surface water from the Schuylkill River and/or Mingo Basin, and ingestion of insects, fish, and/or birds that have accumulated COPECs from surface water and sediment in the Schuylkill River and/or Mingo Basin, and ingestion of COPECs in surface water from onsite ponds, Mingo Basin, and/or the Schuylkill River.
- **Risk Characterization** was performed qualitatively and not quantitatively.
 - Statements such as “VOCs are not expected to be present in high concentrations in the surface water in the onsite ponds or the Mingo Creek Flood Control Basin as they rapidly volatilize if present in surface water” and “The solubility of PAHs in surface water is low; therefore, PAH concentrations in surface water in the onsite ponds and Mingo Creek Flood Control Basin are expected to be low if present” do not adequately address the risk characterization for ecological receptor protection.
 - The risk characterization stated that fate and transport modeling results for each COPEC were below ecological screening values, but the projected concentrations at each surface water body were not identified.
 - The fate and transport model did not evaluate all the site COCs or COPECs.
 - Considerations for route of exposures for each species also needs to be conducted and quantified.
 - Considerations for risk for all COPECs for each species also needs to be conducted and quantified.

Public Comments:

- On August 29, 2022, DEP received Evergreen’s Response to public comments for Ecological Risk Assessment Areas of Interest 1 through 9.
 - Evergreen reported receipt of public comments from Clean Air Council (CAC), Delaware Riverkeeper Network (DRN), and one community member.
 - DEP received, reviewed, and took into consideration the received public comments as part of the review.
 - DEP reviewed the responses to public comments. Some of the comments from CAC and DRN regarding quantitative risk characterization for SOPC were consistent with noted report deficiencies.

DEP Final Action: The Ecological Risk Assessment: Areas of Interest 1 through 9 is recommended for technical deficiency due to:

1. The botanical survey did not address the potential for suitable habitat or occurrences of Threatened or Endangered fauna at the site, which could affect the designation of Exceptional Value Wetlands. Evaluation of Exceptional Value Wetlands is required by 25 Pa. Code Section 250.311(a)(2) as referenced by Section 250.402(c).
2. The ecological risk assessment did not adequately evaluate ecological receptors as required by 25 Pa. Code Sections 250.402(c), 250.404(a), and 250.602(a). The sediment samples used in the risk assessment do not adequately represent the exposures to the receptors identified in the risk assessment. Sediment samples collected from appropriate locations for fish and turtle habitats from onsite water bodies should be included in this risk assessment. In addition, grab or discrete sampling from more than one location from the media of concern is necessary to characterize the point concentration for exposure. Discrete sampling of Schuylkill River sediments, Mingo Creek basin sediments, and other water body sediments is needed.
3. The data and risk calculations are not presented clearly or accurately as required by 25 Pa. Code Sections 250.402(c), 250.404(a), 250.602(a), and 250.604(b). There were multiple references to modeling of VOC, PAH, and lead concentrations in the report but there were no results or tables to substantiate this claim. In addition, there are general statements in the report regarding volatilization of VOCs reducing probability of concentrations in surface water or lead concentrations in sediments that are unlikely to result in impact to species of concern. These assumptions need to be evaluated through data collection and risk characterization.
4. A toxicity assessment and description of toxicity factors was not included as required by 25 Pa. Code Sections 250.402(c) and 250.602(a). The report includes a qualitative toxicity assessment instead of a quantitative assessment.
5. Screening procedures used were inconsistent with guidelines outlined in DEP's Technical Guidance Manual and requirements in 25 Pa. Code Sections 250.402(a), 250.404(a), and 250.602(a)). Screening should be performed using either the highest reporting limit or the highest detected concentration, whichever is higher. Alternative screening values were referenced in the ecological risk assessment, including from the Ontario Ministry of the Environment; however DEP recognizes EPA's BTAG screening tables and soil screening levels. Alternative screening methods can be considered with clear explanation of input parameters, references for assumptions and calculations performed. The description, assumptions, and calculations for the Ontario Ministry of the Environment screening levels were not sufficiently presented to allow for consideration.

6. All potential exposure pathways need to be identified for identified ecological receptors as required by 25 Pa. Code Section 250.404(a). More detail is needed to justify why the dermal pathway for the red bellied turtle was insignificant and further explanation is needed for why select routes of exposure may screen out from further quantitative evaluation.
7. The Ecological Risk Assessment relies on the groundwater fate and transport model to estimate exposure concentrations; however not all COPECs were included in the fate and transport model (25 Pa. Code Sections 250.402(a), 250.404(a), 250.602(a), and 250.604(b)). In addition, the fate and transport model did not project concentrations to all water bodies onsite, so a combination of modeling and direct sampling of surface water bodies is needed.
8. The Ecological Risk Assessment did not calculate a concentration level of constituents of potential ecological concern at which the environment is protected, as required by 25 Pa. Code Sections 250.409 and 250.606. A qualitative assessment was described in the report, but the risk characterization should be quantified for each COPEC, or class of COPECs where appropriate, and for each route of exposure for each species of concern.
9. The uncertainty in this report was not discussed thoroughly and lacks detailed site-specific sources of uncertainty as required by 25 Pa. Code Section 250.602(f).

In addition to the above referenced deficiencies, the following clarifications are requested:

- It is unclear if the March 9, 2020 Ecological Risk Assessment for Hickory Shad, Shortnose Sturgeon, and Atlantic Sturgeon in the Schuylkill River Adjacent to the PES Philadelphia Refining Complex Areas of Interest 1 through 9 was shared with PFBC.
- Clarification is needed to understand how Evergreen plans to address ecological risk assessment obligations required by 25 Pa. Code Sections 250.402(c) and (d), 250.404(b) and 250.409(1) for future site conditions. DEP understands that HRP's redevelopment plans for the initial redevelopment phases are not final; for example, the future status of the onsite water bodies is unknown. DEP expects that future Act 2 submittals will address risks to ecological receptors posed by remedial activities. Evaluation of new conditions might be addressed in site cleanup plans or might require submittal of supplemental risk assessment reports.
- A discussion of routes of exposure for species of concern was included in the report. References supporting the basis for the routes of exposure are requested to support that all routes of exposure have been evaluated.

The technical deficiencies and comments were reviewed with Evergreen and Stantec on September 21, 2022 and DEP communicated during the call that this technical memo would be provided following the issuance of the decision letter.

DEP Contact: Lisa Strobridge, P.G. **Phone:** 484-250-5796

Site Contact: Tiffani Doerr, P.G., Evergreen **Phone:** 302-477-1305

Site Consultant: Jennifer Menges, Stantec **Phone:** 610-840-2540

EPA Contact: Kevin Bilash, USEPA Region III **Phone:** 215-814-2796