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REMEDIATION DIVISION, PCB PROGRAM, AND
LEAKING UNDERGROUND STORAGE TANK COORDINATION PROGRAM
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- Documents submitted through the SFT website must include all applicable figures, tables and laboratory data.
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  - For Remediation Filings: **REM_REMID #_SiteAddress_Town_DocumentType_DateofDocument**
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Part I: Primary Recipient*: Remediation Program (* required)

For Remediation documents:	For PCB/LUST documents:
Primary Program*: Voluntary Remediation	UST Facility ID: (if applicable)
Rem ID*: 12390	Spill Case Number: (if known)

Part II: Site Information

Site Name*: Rockville Former MGP
Site Address*: 13 Maple Street
City/Town*: Rockville/Vernon State: CT Zip Code: 06066

Secondary Programs (complete as many as applicable for this document):

Program: Select Secondary Program	Project ID:
Program: Select Secondary Program	Project ID:
Program: Select Secondary Program	Project ID:
Program: Select Secondary Program	Project ID:

Provide Project ID for each secondary program if it is known.
Each program has a unique ID (i.e. Rem ID, Spill Case #, UST Facility ID, etc.)

Part III: Document Information (document type required for appropriate program[s] only)

Remediation*: Ecological Risk Assessment or Sediment Submittal
LUST/PCB*: LUST/PCB Document Type
Date of Document*: 5/31/2023 Version: Final

Part IV: Submitter Information

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Name of company/business this document is being submitted on behalf of: *
The Connecticut Light and Power Company dba Eversource

EVERSOURCE ENERGY

Sustainability & Environmental Affairs
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May 31, 2023

Ms. Traci Iott, Supervising Environmental Analyst
Water Quality Program
Bureau of Water Protection and Land Reuse
Connecticut Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

Reference: **Rockville Former Manufactured Gas Plant Site**
REM ID: 12390
Refined Screening-Level Ecological Risk Assessment

Dear Ms. Iott:

On behalf of The Connecticut Light and Power Company dba Eversource Energy (Eversource), GEI Consultants, Inc., prepared the enclosed Refined Screening-Level Ecological Risk Assessment (RSLERA) which documents a reevaluation of potential risk to ecological receptors at the Rockville former manufactured gas plant (MGP) site located at 13 Maple Street, in the Rockville section of Vernon, Connecticut (Site).

In March 2021, Exponent concluded the need for additional ecological evaluation of potential adverse effects to aquatic and aquatic-dependent biota from surface water and sediment in the Hockanum River, which flows through a portion of the Site. Specifically, concentrations of inorganics in sediment and surface water, as well as polycyclic aromatic hydrocarbons (PAHs) in sediment, were concluded by Exponent to require further evaluation. To address this, GEI implemented a phased approach introducing an "intermediate tier" of ecological risk assessment. This "intermediate tier" consists of a RSLERA with the inclusion of "Step 3a" as detailed in the United States Environmental Protection Agency's (USEPA) ecological risk assessment guidance (USEPA 2001).

Based on GEI's RSLERA findings, no further investigation, evaluation, or action with respect to ecological receptors is warranted regarding Site sediments or surface water in the Hockanum River.

Sincerely,
Eversource Energy Service Company

Andrew (Drew) P. Blicharz, LEP, CHMM
Senior Environmental Specialist – Remediation

Enclosure: Refined Screening-Level Ecological Risk Assessment
Cc: Kevin Neary, CT DEEP
Jeffrey Holden, LEP, GEI Consultants, Inc.



GEI Consultants

Consulting
Engineers and
Scientists

Refined Screening Level

Ecological Risk Assessment

Rockville Former MGP Site
13 Maple Street, Vernon, Rockville, CT 06066

Submitted to:
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BAB/SEM:vjb

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Executive Summary

This Refined Screening-Level Ecological Risk Assessment (RSLERA) was prepared by GEI Consultants, Inc. (GEI) on behalf of The Connecticut Light and Power Company dba Eversource Energy (Eversource) to document a reevaluation of potential risk to ecological receptors at the Rockville former manufactured gas plant (MGP) site located at 13 Maple Street, in the Rockville section of Vernon, Connecticut (Site). A summary of the RSLERA activities is provided below.

A previous ecological investigation conducted by Exponent Ecological and Biological Sciences (Exponent 2021) concluded the need for additional ecological evaluation of potential adverse effects to aquatic and aquatic-dependent biota from surface water and sediment in the Hockanum River, which flows through a portion of the Site. Specifically, concentrations of inorganics in sediment and surface water, as well as polycyclic aromatic hydrocarbons (PAHs) in sediment, were concluded by Exponent to require further evaluation.

To address Exponent's conclusion regarding the need for additional ecological evaluation, GEI implemented a phased approach introducing an "intermediate tier" of ecological risk assessment. This "intermediate tier" consists of a RSLERA with the inclusion of "Step 3a" as detailed in the United States Environmental Protection Agency's (USEPA) ecological risk assessment guidance (USEPA 2001).

Prior to the development of the RSLERA sediment and surface water sampling approach, GEI conducted a detailed review of the 2021 SLERA findings to refine the list of COPECs carried forward for further evaluation in the RSLERA. The review of the historic sediment data collected from 2017 through 2021 included comparison of both Site and background sediment inorganic concentrations to the USEPA Region IVs Freshwater Sediment Screening Values. The results of this screening indicated that only one Site location (SED-06) had inorganic concentrations exceeding the screening values (copper at 2,190 mg/kg; lead at 153 mg/kg). The observed concentration of lead at SED-06 (153 mg/kg) indicated a "slight" exceedance of the conservative USEPA Region IV Freshwater Sediment Screening Value for lead of 128 mg/kg. Sediment sample location SED-06 is located immediately downgradient from background sample location SED-09, which is associated with the municipal storm sewer outfall located at the corner of Maple Street and W. Main Street that discharges stormwater runoff from both roadways and does not receive runoff from the Site. The lead concentration in background sample SED-09 was 267 mg/kg, which is greater than the on-Site, downstream sample at SED-06. Based on this assessment, and the fact lead concentrations in all other on-Site sediments were below the screening value, it was

concluded that the concentrations observed at SED-06 are impacted by discharge from municipal storm sewer located upstream of the Site or other non-Site related sources.

The elevated copper concentration at SED-06 in 2017 was evaluated further by Tighe & Bond in 2018 with an attempt to re-create and delineate the exceedance. Tighe & Bond collected three follow-up samples in the location of 2017's SED-06 location (SED-06A, SED-06B, and SED-06C). The 2018 investigation was not able to replicate the copper concentration observed at SED-06 in 2017. Concentrations from SED-06A (22.1 mg/kg), SED-06B (28.9 mg/kg) and SED-06C (83.7 mg/kg) were all below the USEPA Region IV Freshwater Sediment Screening Values and significantly below the concentration observed in SED-06 in 2017 (2,190 mg/kg).

Based on the likely relationship for the observed lead exceedance at SED-06 to off-Site sources (e.g., the municipal storm sewer outfall), the inability to replicate the copper exceedance at SED-06, it was determined that inorganics in sediment did not warrant further evaluation at the Site and were not included in the additional sampling efforts to refine the ecological risk assessment.

To further evaluate the potential risk for PAH impacts to the aquatic community, GEI collected additional sediment and surface water data from the sections of the Hockanum River adjacent to and downstream of the Site, as well as from additional upstream (background) locations. In total, seven co-located surface water and sediment samples were collected from the on-site and downstream reach (SW/SD-01 through SW/SD-07), and five upstream/background samples (SW/SD-B01 through SW/SD-B05), including from potentially contributing stormwater outfalls, were collected to quantify background contribution.

Measurement ecological endpoints were established to assess the potential for surface water and sediment PAHs to pose a toxicological risk to benthic invertebrates, fish and semi-aquatic mammals. In addition, a background contribution evaluation was conducted to determine if concentrations of PAHs detected the sections of the Hockanum River adjacent to the Site could be influenced by off-site sources of PAHs.

Based on these RSLERA activities presented, the following key conclusions were drawn:

- Inorganic concentrations present in sediment were not found to pose an unacceptable risk to ecological receptors at the Site. In one instance where a "slight" exceedance of the conservative ecological screening criteria for lead was observed, it was determined that the likely contributing source of the lead exceedance was an upstream municipal storm sewer outfall and not from historic Site-related activities.

- Initial screening of surface water data to ESCs did not show detected concentrations in exceedance of these conservative screening values. Based on the lack of ESC exceedances, the need to further assess potential ecological impacts from surface water was not warranted.
- Exposure estimates of total PAHs calculated for direct contact by benthic invertebrate and fish communities to sediment indicated HQ slightly above 1.0 (HQ = 1.76).
- An additional line of evidence to assess potential Site-related impacts to the benthic invertebrate and fish communities was the evaluation of background or reference location total PAH concentrations on benthic invertebrates. Exposure estimates of background total PAHs concentrations for direct contact by benthic invertebrate and fish communities to sediments presented an HQ (Background HQ = 1.79) consistent with the Site HQ (Site HQ = 1.76).
- Exposure estimates of PAHs calculated for the common raccoon indicated LOAEL HQs less than 1.0 utilizing the most conservative scenario of a 100% AUF.
- A background assessment revealed no statistical difference between Site sediment PAH concentrations and background/reference PAH concentrations.

Based on this information, no further investigation, evaluation or action with respect to ecological receptors is warranted regarding Site sediments or surface water in the Hockanum River.

1. Introduction

1.1 Purpose and Scope

This Refined Screening-Level Ecological Risk Assessment (RSLERA) was prepared by GEI Consultants, Inc. (GEI) on behalf of The Connecticut Light and Power Company dba Eversource Energy (Eversource) and consistent with Connecticut Department of Energy and Environmental Protection (CT DEEP) approach for conducting ecological risk evaluations (CT DEEP 2015). Its purpose is to document a reevaluation of potential risk to ecological receptors at the Rockville former manufactured gas plant (MGP) site located at 13 Maple Street, in the Rockville section of Vernon, Connecticut (Site). A Site Location Map is provided as Figure 1. This RSLERA is a component of the larger Supplemental Phase II/III Environmental Site Assessment (ESA).

A previous ecological investigation conducted by Exponent Ecological and Biological Sciences (Exponent 2021) concluded the need for additional ecological evaluation of potential adverse effects to aquatic and aquatic-dependent biota from surface water and sediment in the Hockanum River, which flows through a portion of the Site. Specifically, concentrations of inorganics in sediment and surface water, as well as polycyclic aromatic hydrocarbons (PAHs) in sediment, were concluded by Exponent to require further evaluation. These conclusions were presented in a 2021 Screening-Level Ecological Risk Assessment (SLERA) submitted to CT DEEP. A copy of the 2021 SLERA is included as Appendix A (Exponent 2021).

To address Exponent's conclusion regarding the need for additional ecological evaluation, GEI has implemented a phased approach introducing an "intermediate tier" of ecological risk assessment. This "intermediate tier" consists of a RSLERA with the inclusion of "Step 3a" as detailed in the United States Environmental Protection Agency's (USEPA) ecological risk assessment guidance (USEPA 2001). The use of a Step 3a RSLERA allows for the ability to make appropriate risk management decisions prior to the need for potentially further ecological investigation and possible preparation of a Baseline Ecological Risk Assessment.

CT DEEP's regulatory approach for conducting ecological risk assessments is to utilize the USEPA's ecological risk assessment framework. Per this directive (CT DEEP 2015), the RSLERA is based on USEPA guidance and considers the following key guidance documents:

- The USEPA Framework for Ecological Risk Assessment (Framework) (USEPA 1992)

- The USEPA Ecological Risk Assessment Guidance for Superfund (ERAGS) (USEPA 1997).
- Guidelines for Ecological Risk Assessment (Guidelines) (USEPA 1998).
- The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments (USEPA 2001).

The RSLERA was prepared as described by USEPA guidance (USEPA 1992, 1997) and includes a site description and habitat characterization, identification of complete exposure pathways, and a screening-level exposure estimate and risk calculation (USEPA 1997).

1.2 Site Setting and Background

The 3.43-acre Site is bounded by a wooded lot, a church, and residential properties to the north, Maple Street to the east, the Hockanum River and West Main Street to the south, and residential properties with frontage on West Street (Route 527) to the west. The Site is currently used as an electrical substation, Eversource's Substation 14W. The substation is enclosed by a locked fence that limits access to authorized personnel only. The Inner Substation Area includes the active electrical substation infrastructure including high voltage power lines, towers, transformers, and electrical control houses. Subsurface electrical power supply ducts and substation grounding grid are located beneath a crushed gravel cover inside the Inner Substation. The remainder of the Site is referred to as the Outer Substation area, which includes all areas outside the Inner Substation. The Outer Substation includes a grassed area surrounding the eastern and northern sides of the Site. A fenced area with a high-pressure gas regulator/control house is located on the western portion of the Outer Substation Area. The Hockanum River runs through the Outer Substation Area and abuts the Inner Substation Area to the south. Wooded and overgrown areas are located on the northern portion of the Site adjacent to the St. Joseph's Church paved parking lot and along the southern portion of the Site between the Hockanum River and West Main Street.

The Site is zoned "NR-10," which is a designation provided to historic district neighborhood parcels. Surrounding land use within a 500-foot radius includes mixed residential, commercial, and industrial land use, schools, and a church.

Historically, an MGP was located at the Site and operated from 1863 until the 1950s when natural gas was brought to the region. Gas production occurred until the mid-1930s after which the Site appears to have been primarily used for gas storage. A portion of the gas produced was also used to generate electricity at the plant. The MGP manufactured gas from coal using both coal gas and water gas productions methods. The primary by-products of the gasification process were tar, coke, and ammonia liquors that were recycled or sold where possible. Gas purifier wastes were also produced as part of gas manufacturing. Chemicals associated with these by-products include PAHs, volatile organic compounds (VOCs),

sulfides, cyanides, and ammonia. Inorganic chemicals such as metals can be found in higher concentrations in purifier wastes at MGP sites; however, purifier waste deposits have not been encountered during any ESA investigations at the Site.

1.3 Ecological Setting

As discussed in the previous section, a portion of the Hockanum River enters the Site in the southeast corner of the property and runs in a westerly direction along the southern portion of the Site. In addition to the Hockanum River, the remainder of the Site consists almost entirely of developed land used as part of the previously discussed electrical substation. There are two small areas of undeveloped land consisting of narrow tree-lined areas along the southern and northern banks of the Hockanum River. The Site is surrounded by streets and developed land. Based on the current conditions, the Site currently provides fragmented habitat for aquatic life and semi-aquatic wildlife associated with the section of the Hockanum River as it passes through the Site.

As detailed in Exponent's 2021 SLERA, the Hockanum River begins at the outlet of Shenipsit Lake in Rockville and flows through Vernon, Ellington, Manchester, and East Hartford for about 23 miles before terminating at the Connecticut River. The portion of the Hockanum River present at the Site is narrow (approximately 21 to 25 ft wide) and shallow (approximately 0.5 ft in depth in areas with riffles and runs and approximately 3 ft in depth in pooled areas). The Hockanum River has been characterized as a losing river in the vicinity of the Site, which means there is no inflow of groundwater to the river but surface water from the river moves into the surrounding groundwater (Tighe & Bond 2017). The areas surrounding upstream and downstream portions of the Hockanum River have historically been heavily impacted by industrial activities, and the riverbank has been redeveloped as parks and hiking trails. The Hockanum River also receives engineered stormwater discharges from municipal storm sewer systems at multiple points both upstream and downstream of the Site. Most notably, there is a municipal storm sewer outfall discharging to the Hockanum River located in the southeast corner, upstream of the Site that is not associated with current or former operations at the Site. The municipal storm sewer outfall is located at the corner of Maple Street and W. Main Street (Figure 2) and discharges stormwater runoff from both roadways.

The Hockanum River is classified by CT DEEP as a Class B water, meaning that it is designated for use as navigation, recreation, industrial and agricultural water supply. The Hockanum River can support aquatic life, such as benthic invertebrates and fish, amphibians, and a variety of water-dependent birds and mammals.

1.4 Critical Habitat and Species of Special Concern

Based on GEI's review of the CT DEEP Natural Diversity Data Base (NDDB), which was updated in December 2022, the Site is not located within a Natural Diversity Area. The NDDB represents the approximate location of endangered, threatened, and special concern species and significant natural communities in Connecticut. This finding is consistent with previous investigations and a USEPA report (USEPA 1994) that indicated that there were no Federally Endangered Species or Connecticut Species of Concern at the Site. The closest record was more than a mile downstream.

In addition, the NDDB freshwater mussel map shows that the Site is not near any state listed freshwater mussel species. Another species of concern in Connecticut is northern long-eared bat and the Site is not located in an area with known places of hibernation for this bat species.

1.5 Summary of Previous Ecological Assessment Activities

Multiple ecological investigations have been conducted on behalf of property owners in the site vicinity since the early 1990s. Two ecological investigations conducted in 1992 and 1994, and further detailed in Exponent's 2021 SLERA, included the sampling of sediment, surface water and fish tissue for characterization for ecological and human health risk. Since these two initial investigations, extensive sampling of the Hockanum River both within the Site and upstream/downstream of the Site has been conducted by Tighe & Bond (Tighe & Bond 2017) and Exponent (Exponent 2021). In view of the extensive additional sampling conducted since the original investigations, the 1992 and 1994 data were not considered representative of current conditions and were not considered as part of the data set for the 2021 SLERA or for this evaluation.

The following summarizes the major reports and investigations pertinent to ecological assessments at the Site and which are used as part of the RSLERA:

- On November 13, 2017, Tighe & Bond collected sediment samples from six locations in the Hockanum River (SED-01, SED-02, SED-03, SED-04, SED-05, and SED-06). The sediment samples were analyzed for CT extractable total petroleum hydrocarbons (ETPH), metals (antimony, arsenic, barium, beryllium, cadmium, chromium [total], copper, lead mercury, nickel, selenium, silver, thallium, vanadium, and zinc), cyanide (total), polychlorinated biphenyl (PCB) Aroclors, semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs) and total organic carbon (TOC). In addition to six sediment samples, Tighe & Bond also collected surface water samples from four locations (SW-01, SW-02, SW-03, and SW-04) in the Hockanum River that were analyzed for CT ETPH, 15 metals (antimony, arsenic, barium, beryllium,

cadmium, chromium [total], copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc), cyanide (total), SVOCs, and VOCs.

- On August 28, 2018, Tighe & Bond collected sediment samples from six locations (SED-06A, SED-06B, SED-06C, SED-07, SED-08, and SED-09) near the Site. The purpose of the sampling was to further investigate a sediment location where the 2017 sediment sample SED-06 contained an elevated concentration of copper (2,190 mg/kg), as well as to identify possible off-site sources of contamination. Section 4 discusses the potential off-site sources and samples that characterize contributions from these potential sources.
- On October 21, 2020, Tighe & Bond collected sediment samples from five locations (SED-101, SED-102, SED-103, SED-104, and SED-105) upstream of the Site. The upstream locations were selected by Exponent and Tighe & Bond based on visual inspection of the sediment substrate and its similarity to sediment substrates near the Site. The sediment samples were analyzed for CT ETPH, 15 metals (antimony, arsenic, barium, beryllium, cadmium, chromium [total], copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc), PAHs, grain size, and TOC. In addition to this round of sediment sampling, Tighe & Bond collected surface water samples from two locations (SW-100 and SW-101) in the Hockanum River. The surface water stations SW-100 and SW-101 were co-located with upstream sediment samples SED-101 and SED-104, respectively. The surface water samples were analyzed for CT ETPH, 15 total and dissolved metals (antimony, arsenic, barium, beryllium, cadmium, chromium [total], copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc) and PAHs.
- On February 8, 2021, Tighe & Bond collected two additional sediment samples (SED-201 and SED-202) from the Hockanum River. These samples corresponded to locations of former substation outfall pipes noted on historical plans and were sampled to determine if they could have contributed to chemical contamination of the river in those areas. Only sediment samples were collected because the pipe outfalls could not be located. These sediment samples were analyzed for CT ETPH, 15 metals (antimony, arsenic, barium, beryllium, cadmium, chromium [total], copper, lead mercury, nickel, selenium, silver, thallium, vanadium, and zinc), cyanide (total), PCB Aroclors, PAHs, grain size, and TOC.

1.6 Conclusions of 2021 SLERA

Data collected as discussed in Section 1.2 was utilized by Exponent to prepare the 2021 SLERA (Appendix A). The findings of the SLERA indicated potential adverse effects to aquatic and aquatic-dependent biota for the portion of the Hockanum River within and adjacent to the Site. Contaminants of potential ecological concern (COPEC) were identified to be PAHs and various metals based on screening-level comparisons to standard,

conservative ecological screening criteria for surface water and sediment. Exponent also identified upstream (background) concentrations of PAHs in sediment and metals in surface water that could contribute to the potential impacts to the sediment and surface water observed. Therefore, Exponent (2021) recommended the need for additional ecological evaluation of sediment and surface water.

Based on Exponent's SLERA conclusion, GEI has prepared this RSLERA to refine the findings of the 2021 SLERA. To conduct this refinement, GEI collected additional sediment and surface water data as detailed in Section 2. These data, as well as the previous evaluated data from the 2021 SLERA, were used to assess and identify potential for risk in the RSLERA, including risk to benthic invertebrates, aquatic life (including fish) and wildlife (i.e., semi-aquatic terrestrial receptors). It should be noted that due to the transient nature of surface water through the Site, historic surface water data, was not utilized as part of this RSLERA as it is not indicative of current site conditions.

2. 2022 Sediment & Surface Water Sampling

To support the development of a comprehensive RSLERA, GEI collected additional sediment and surface water data from the sections of the Hockanum River adjacent to and downstream of the Site, as well as from additional upstream (background) locations. In total, seven co-located surface water and sediment samples were collected from the on-site and downstream reach (SW/SD-01 through SW/SD-07), and five upstream/background samples (SW/SD-B01 through SW/SD-B05), including from potentially contributing stormwater outfalls, were collected to quantify background contribution.

2.1 Refinement of 2021 Inorganic Sediment Data

Prior to the development of the RSLERA sediment and surface water sampling approach, GEI conducted a detailed review of the 2021 SLERA findings to refine the list of COPECs carried forward for further evaluation in the RSLERA.

GEI's review of the historic sediment data collected from 2017 through 2021 included comparison of both Site and background sediment inorganic concentrations to the USEPA Region IVs Freshwater Sediment Screening Values. The results of this screening indicated that only one Site location (SED-06) had inorganic concentrations exceeding the screening values (copper at 2,190 mg/kg; lead at 153 mg/kg).

The observed concentration of lead at SED-06 (153 mg/kg) indicated a "slight" exceedance of the conservative USEPA Region IV Freshwater Sediment Screening Value for lead of 128 mg/kg. Sediment sample location SED-06 is located immediately downgradient from background sample location SED-09, which is associated with the municipal storm sewer outfall located at the corner of Maple Street and W. Main Street that discharges stormwater runoff from both roadways and does not receive runoff from the Site. The lead concentration in background sample SED-09 was 267 mg/kg, which is greater than the on-Site, downstream sample at SED-06. Based on this assessment, and the fact lead concentrations in all other on-Site sediments were below the screening value, it was concluded that the concentrations observed at SED-06 are impacted by discharge from municipal storm sewer located upstream of the Site or other non-Site related sources.

The elevated copper concentration at SED-06 in 2017 was evaluated further by Tighe & Bond in 2018 with an attempt to re-create and delineate the exceedance. Tighe & Bond collected three follow-up samples in the location of 2017's SED-06 location (SED-06A, SED-06B, and SED-06C). The 2018 investigation was not able to replicate the copper concentration observed at SED-06 in 2017. Concentrations from SED-06A (22.1 mg/kg), SED-06B (28.9 mg/kg) and SED-06C (83.7 mg/kg) were all below the USEPA Region IV

Freshwater Sediment Screening Values and significantly below the concentration observed in SED-06 in 2017 (2,190 mg/kg).

Based on the likely relationship for the observed lead exceedance at SED-06 to off-Site sources (e.g., the municipal storm sewer outfall), the inability to replicate the copper exceedance at SED-06, it was determined that inorganics in sediment did not warrant further evaluation at the Site and were not included in the additional sampling efforts to refine the ecological risk assessment.

2.2 2022 Surface Water Sampling Locations and Methodology

Twelve surface water samples were collected in the following areas to evaluate potential Site impacts and background contributions:

- Seven samples adjacent and immediately downstream of the Site to assess potential migration of COPECs from the Site to the Hockanum River (SW-01 through SW-07);
- One sample downstream of the upstream municipal stormwater outfall located in the southeast corner of the Site to assess potential COPEC contributions related to the storm sewer discharge from the outfall to the stretch of Hockanum River adjacent to the Site (SW-B01); and
- Four samples upstream of the Site to assess background conditions in the Hockanum River (SW-B02 through SW-B05).

The 2022 surface water sample locations are shown on Figures 2 and 3. The surface water samples were collected on December 5 and 6, 2022 during low-flow conditions via manual sampling methods as proposed in GEI's 2022 Supplemental Phase II/III Environmental Site Assessment Work Plan (GEI 2022). Surface water samples were analyzed by Phoenix Environmental Laboratories, Inc., a Connecticut certified laboratory, for total and dissolved metals and hardness.

2.3 2022 Sediment Sampling Locations and Methodology

Twelve sediment samples were co-located with the surface water samples identified in Section 2.2 in the following areas to evaluate potential Site impacts and background contributions:

- Seven samples adjacent and immediately downstream of the Site to assess potential migration of COPECs from the Site to the Hockanum River (SD-01 through SD-07).
- One sample downstream of the municipal stormwater outfall located in the southeast corner of the Site to assess potential COPEC contributions related to the storm sewer

discharge from the outfall to the stretch of Hockanum River adjacent to the Site (SD-B01).

- Four samples upstream of the Site to assess background conditions in the Hockanum River (SD-B02 through SD-B05).

The sediment sample locations are shown on Figures 4 and 5. The sediment samples were collected on December 5 and 6, 2022 from biologically active zone (i.e., the surface sediment to 6 inches) via a grab sample device as proposed in GEI's 2022 Supplemental Phase II/III Environmental Site Assessment Work Plan (GEI 2022). Sediment samples were analyzed by Phoenix Environmental Laboratories, Inc., a Connecticut certified laboratory, for PAHs and TOC.

2.4 2022 Surface Water Sampling Results

Surface water analytical results from the 2022 sampling event are presented in Table 1 and the laboratory data packages are included as Appendix B. Surface water analytical results were compared to the CT DEEP Water Quality Standards – Aquatic Life Criteria. For metals (either total or dissolved) that did not have a CT DEEP criterion, USEPA Region IV Ecological Surface Water Screening Values were used as a surrogate screening criterion where available. It should be noted that due to the transient nature of surface water through the Site, historic surface water data (data collected prior to 2022) was not utilized as part of this RSLERA as it is not indicative of current site conditions.

All detected total and dissolved metals (including all on-site, upstream and downstream samples) results were below their respective surface water ecological screening criteria (ESCs).

2.5 2022 Sediment Sampling Results

Sediment analytical results, both historic and from the 2022 sampling event, are presented in Table 2 and the laboratory data packages are included as Appendix B. Sediment analytical results were compared to the USEPA Region IV Freshwater Sediment Screening Values.

Exceedances of the sediment ESCs were observed in sediment samples collected at the Site in 2017 and 2022. In addition, as discussed further in Section 4, exceedances of the same ESCs were also observed in the 2017, 2018, 2020 and 2022 background study sediment samples, with the largest exceedances for all PAHs occurring in either Site or background locations coming from background study sample SD-01.

2.6 Surface Water and Sediment Screening Conclusions

Initial surface water and sediment sampling occurring from 2017 through 2020 discussed in detail in the 2021 SLERA indicated exceedances of metals and PAH ESCs in surface water and sediment. Due to these results, GEI conducted supplemental surface water and sediment sampling in 2022 as detailed in the previous sections.

ESC exceedances were observed for one or more PAH (including cumulative total PAH concentrations) in all sediment samples, both on Site and in background locations. However, at least a portion of PAHs found in Site sediments could be attributable to background conditions as PAH exceedances were also present in the background sediment dataset. In accordance with the USEPA ERA Framework, further ecological risk assessment with respect to PAHs will be addressed through the evaluation of potential impacts to benthic invertebrates and semi-aquatic receptors (Section 3). In addition, due to the elevated presence of PAHs in background samples, a statistical background analysis will also be conducted to assess potential contribution of off-site sources to the elevated PAHs concentrations present in the Site sediment samples (Section 4).

The current round of surface water sampling conducted in 2022, and which is representative of current surface water conditions in the section of the Hockanum River adjacent to the Site, did not show detected concentrations in exceedance of the surface water ESCs. In addition, detected concentrations in Site surface water samples are similar to concentrations detected in the background dataset. Based on the lack of ESC exceedances, further assessment of potential ecological impacts from surface water is not warranted.

3. Refined Screening Level Risk Assessment (Step 3A)

3.1 Ecological Conceptual Site Model

An Ecological Conceptual Site Model (CSM) describes the predicted relationships between ecological receptors and stressors to which they may be exposed. It also describes the primary, secondary, and tertiary exposure pathways or co-occurrences among exposure pathways, ecological effects, and ecological receptors (USEPA, 1998). The CSM for this RSLERA is described below. This CSM summarizes how COPECs may be transported through the different matrices of the Site and result in exposure to ecological receptors. This section highlights the key transport pathways for COPECs at this Site.

3.1.1 Exposure Pathways

The primary aquatic pathway of concern for the Site is the potential sorption of COPECs to the sediment of the Hockanum River, thereby directly exposing biota that use or live in these sensitive areas. Sediment grains tend to adsorb and/or degrade COPECs in the water. Whether the COPECs sorb to the sediment or remain in the water column depends on the chemical characteristics. COPECs with a high organic carbon partition coefficient (K_{oc}) have a greater affinity for sediment, especially sediment in depositional areas of a water body, which tend to have more organic carbon. These constituents will tend to bind to the sediment surfaces. COPECs that are partitioned in this phase have the potential to impact species of limited mobility (i.e., benthic invertebrates) that may inhabit the micropores between sediment grains, directly contacting the contaminant.

Sorbed COPECs could migrate downstream of the Site from processes such as erosion, scouring or other physical disturbance. A portion of the COPECs may be dissolved in the water and move with the flow in the Hockanum River. These dissolved COPECs could potentially be ingested by biota living in the Hockanum River. Note that Site surface water samples were all below ESC, indicating this pathway is currently insignificant, but may have served as a source to sediment in the past.

In addition to the direct exposure by contact and ingestion, indirect exposure can occur when a COPEC found in the sediment is assimilated by a species (e.g., prey/food item) at one trophic level, bioaccumulated by that trophic level, and transferred to a higher trophic level species through consumption. The likely prey/food item would include invertebrates and fish, which potentially serve as a food source for higher trophic level aquatic species as well as semi-aquatic piscivorous mammal species in the area.

3.1.2 Wildlife Receptors of Interest

Based on the primary mechanisms of exposure to COPECs in the Hockanum River (sediment and prey), the receptors of interest (ROIs) are benthic invertebrates, fish, and semi-aquatic carnivorous/omnivorous mammals.

A surrogate species, the common raccoon (*Procyon lotor*), was identified as a representative species to evaluate exposure to mammalian receptors based on feeding guild. Surrogate species for benthic invertebrates and fish were not selected as these receptors were evaluated on a community rather than individual level as detailed in this RSLERA. While it can be common to include an assessment of avian species, such inclusion is dependent on habitat conditions that are present at the Site. Based on the size, substrate and prey/food source composition, the Hockanum River near the Site represents limited forage potential for species such as ducks and other waterfowl. Piscivorous avian species (e.g., kingfishers) would more likely be tertiary consumers with minimal direct contact with sediment. These species also have extremely large home ranges and would have limited foraging time at the Site. Finally, due to the limited potential for bioaccumulation of PAHs, avian receptors not in consistent direct contact with sediment while foraging are not expected to be negatively impacted by PAH concentrations present in the Site sediments. As a result, a surrogate avian species was not included in the RSLERA.

3.2 Assessment and Measurement Endpoints

The following subsections discuss the identification of endpoints that will be utilized to evaluate the ecological effects associated with the potential exposure of ecological receptors to COPECs.

3.2.1 Assessment Endpoints

Assessment endpoints are statements of the characteristics or attributes of the environment that are to be protected. The following assessment endpoints were developed based on the four selection criteria described in the USEPA *Environmental Risk Assessment Guidance for Superfund* (ERAGS, USEPA, 1997).

Assessment Endpoint #1: Evaluate the potential for adverse changes in the survival, reproduction, and growth of benthic invertebrate and fish populations on a community level resulting from potential exposure to COPECs in Hockanum River sediments.

Assessment Endpoint #2: Evaluate the potential for adverse changes in the survival, reproduction, and growth of populations of semi-aquatic mammal species potentially utilizing the Site resulting from exposures to COPECs in sediments and prey (fish and benthic invertebrates).

The RSLERA will evaluate the ecological risks in the Hockanum River relative to these endpoints.

3.2.2 Measurement Endpoints

Because the above assessment endpoints generally cannot be measured directly, measurement endpoints have been identified. There are two types of measurement endpoints, or lines of evidence, which were used to assess the status and potential changes in the attributes of the environment. The lines of evidence included:

- Determination of the potential for ecological effects by the comparison of COPEC concentrations to media-specific ecotoxicological benchmarks derived from the literature, when available; and
- Estimation of the potential for ecological effects on higher trophic level organisms (raccoon) from COPECs based on dietary exposure.

3.2.2.1 Measurement Endpoint for Assessment Endpoint #1 (Benthic Invertebrate and Fish Populations)

When evaluating potential risk to the benthic invertebrate community from PAH exposure in sediments, the "consensus-based" freshwater sediment quality effects concentrations most commonly referenced are the threshold effects concentrations (TEC) and probable effects concentrations (PEC) presented in MacDonald et al. 2000. These values are widely accepted throughout the risk assessment community for use in ecological sediment evaluations, and generally correspond to sediment concentrations above which effects are likely to be observed. The TEC corresponds to the concentration below which no adverse effects on growth, reproduction, or survival have been observed. The PEC corresponds to the concentration above which adverse effects on growth, reproduction or survival are likely to occur. Both the published TECs and PECs are derived from empirical studies of wildlife effects from chemical stressors. TECs are lower-bound levels at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects (e.g., on growth, reproduction, survival) between the exposed population and its appropriate control population. These values tend to be heavily conservative, and in many cases, underestimate the actual threshold concentration at which no adverse effect is observed. PECs on the other hand are the lowest level of a stressor evaluated in a toxicity test or biological field survey that has a statistically significant adverse effect on the exposed organisms compared with unexposed organisms in a control or reference site (USEPA 1997). PECs are lower-bound threshold effect levels and are used to provide a more realistic evaluation of the potential for adverse ecological effects to wildlife populations from exposure to COPECs. For this reason, the PEC will be the value utilized to evaluate the most likely scenario for assessment of ecological risk in the Step 3a process.

It should be assumed that benchmarks developed for benthic invertebrates would be more conservative than benchmarks developed for fish communities due to many factors, including the more sessile (immobile) nature of benthic invertebrates and consistent, direct contact with sediments. Utilizing these benchmarks to evaluate the potential for ecological impacts to fish communities may overestimate the magnitude of potential impacts. In addition, surface water from the Hockanum River was found to be below the conservative ESC which would indicate any potential toxicological effects to the fish community would be sediment driven and accounted for by the benthic invertebrate evaluation.

3.2.2.2 Measurement Endpoint for Assessment Endpoint #2 (Semi-Aquatic Mammals)

The potential impact to higher trophic level organisms was evaluated through a dietary exposure model based on body burden concentrations of COPECs in sediment and estimated concentrations in prey, compared to associated toxicity reference values (TRVs) from scientific literature (as presented in Table 3). Exposure concentrations for the raccoon were estimated using food chain models and dose calculations described later in the RSLERA.

Measured concentrations of COPECs in the sediment may not produce direct ecotoxicological effects. However, if the constituents are bioavailable and bioaccumulative, they may have the potential for producing effects at higher trophic levels. This may result in indirect impacts to more wide-ranging species, to species that are especially sensitive to COPECs, or to species that have special status because of population levels or habitat requirements. For that reason, dietary exposure was employed to assess the potential exposure of piscivorous species to COPECs in sediments from the Hockanum River. Using empirical data, the potential for ecological risks to these ROIs feeding at the Site was calculated through an average daily dose (ADD) then compared to COPEC-specific TRVs.

3.3 Exposure Assessment

The exposure assessment connects problem formulation with risk characterization through examination of the exposure of a measurement receptor to a COPEC, and the ecological effects resulting from that exposure. Exposure estimates emphasize contact and uptake into species, while effects estimates frequently entail extrapolation from test species to the species of interest. Exposure is the contact of a receptor with a COPEC (e.g., ingestion). Exposures of ecological receptors to COPECs released from affected properties are evaluated through consideration of exposure pathways.

Exposure was determined using reasonably conservative assumptions to minimize the potential for overlooking ecological risks. Applicable exposure variables (e.g., food ingestion rates and body weight) were determined using published sources as referenced in Table 4.

3.3.1 Exposure Point Concentrations

The analytical results for sediment COPECs discussed in Section 2 were used to calculate the Exposure Point Concentrations (EPCs) which are used in this RSLERA. The EPCs for ecological receptors in sediment were developed based on calculation of the 95% Upper Confidence Limit (UCL) of each COPEC calculated using the USEPA's ProUCL 5.0 software. The statistical output from the ProUCL software is presented in Appendix C. For sediment, separate EPCs were calculated for both the Site data set and the background/reference data set.

For receptors, the toxic effects triggered by exposure to many PAHs are termed "narcosis" (USEPA 2003). The similarity in mode of action indicates that for many organic compounds the toxicity is additive, and a total toxicity can be calculated as the sum of the individual toxicities. For PAHs, toxicities are usually expressed as the total exposure to all individual PAH compounds. This is the basis for the USEPA sediment quality guidelines (USEPA 2003). There are also times when it is valuable to assess PAHs cumulatively based on their respective molecular weights. This is mainly because in the exposure assessment process, toxicity associated with exposure to PAHs is typically considered to be additive for low molecular weight (LMW), as well as high molecular weight (HMW) PAHs (USEPA 2007). To that end, the RSLERA will evaluate PAHs as total PAHs, low molecular weight (LMW) PAHs and high molecular weight (HMW) PAHs where possible instead of on an individual basis. This method is further supported by the fact that PAHs almost always occur in the environment as mixtures and, as such, the piecemeal elimination of components that constitute the mixture should be avoided. Therefore, the screening-out of individual PAHs based on individual PAH ESCs or benchmarks is not appropriate where same-media values for total HWM, LMW or total PAHs criteria exist, as is the case for sediments.

3.3.2 Direct Contact Exposure

The direct contact exposure evaluation includes the comparison of EPC of detected COPECs to direct contact PECs for the analysis of risks to benthic macroinvertebrate and fish communities as discussed in Section 3.4. Table 5 summarizes the comparison of the selected sediment, benthic invertebrate PECs to calculated EPCs for total PAHs (as total HMW and LMW PAH PECs are not available from this source). For presentation purposes, TEC comparisons are also included in Table 5 but are not typically used to make a risk management decision due to the extremely conservative nature of the values as previously discussed in Section 3.2.2.1.

3.3.3 Food Chain Modeling Methodology

This section summarizes the methodologies used to estimate the potential exposures to the surrogate wildlife receptor (raccoon). The exposure to COPECs in sediment and prey was

calculated through an average daily dose (ADD), which is the amount of COPEC that an individual organism may be exposed to daily through direct or indirect exposure pathways within the Site area. The ADD is calculated using: 1) exposure media-specific concentrations; 2) estimated or measured EPCs for prey; and 3) receptor-specific exposure parameters.

The total ADD is typically the sum of ADDs for each of the pathways (food, water, and sediment), adjusted for the seasonal duration of exposure at the Site. For this RLSERA, data for PAHs in surface water were not collected during the 2022 sampling event as historic investigations of surface water did not indicate that they were at concentrations that would pose a potential ecological risk. I t can be assumed, based on the review of historic investigations, that surface water is not a viable source of PAHs for semi-aquatic mammals. Therefore, the formula for calculating the ADDs in this RSLERA is as follows:

$$\mathbf{ADD = (Dose_{food} + Dose_{sediment}) \times SUF}$$

where:

- ADD = Average daily dose of COPEC (mg/kg BW/day)
- $Dose_{food}$ = Dose of COPEC in food (mg/kg BW/day)
- $Dose_{sediment}$ = Dose of COPEC in sediment (mg/kg BW/day)
- SUF = Seasonal Use Factor (unitless)

The individual terms of the equation are calculated as:

$$\mathbf{Dose_x = IR_x \times C_x \times AUF}$$

where:

- $Dose_x$ = Dose of the particular medium in mg/kg BW/day
- IR_x = Ingestion rate of medium in mg/kg BW/day (wet weight)
- C_x = Concentration of COPEC in particular medium in mg/kg or mg/L
- AUF = Area Use Factor (unitless)

ADDs for the raccoon were developed based on procedures and factors obtained from several references as listed in Table 4, including variables such as AUF and SUF, which estimate the percentages of Site area utilized and time of year spent within the Site area, respectively. As presented in Table 4, the typically expected home range for the common raccoon is 568 acres which is significantly larger than the area of the Site (3.43 acres). The method for determining the AUF is to divide the site acreage by the expected home range of the ROI. For the common raccoon, this produces an AUF of 0.6% (which translates to the common

raccoon only utilizing the Site for foraging less than 1% of the time). As a conservative assessment for this RSLERA, a AUF for the raccoon was assumed to be 100% which is much higher than the anticipated AUF for a raccoon relative to the size of the Site.

ADDs were calculated using the EPCs of total LMW PAHs, HMW PAHs and total PAH identified in the sediment. Potential ecological impacts to the raccoon were assessed by comparing the calculated exposures (ADDs) to wildlife benchmarks identified from the literature (Table 3). The wildlife benchmarks are TRVs that were derived from available toxicological data.

For the RSLERA, two TRVs were derived for each COPEC. One was based on the no-observed-adverse-effect-level (NOAEL) and the other was based on the lowest-observed-adverse-effect level (LOAEL). The NOAEL corresponds to the highest dose at which no adverse effects on growth, reproduction, or survival have been observed. The LOAEL corresponds to the lowest dose at which adverse effects on growth, reproduction or survival have been observed. Wildlife TRVs are derived from empirical studies of wildlife effects from chemical stressors. NOAELs are lower-bound levels at which there are no statistically or biologically significant increases in the frequency or severity of adverse effects (e.g., on growth, reproduction, survival) between the exposed population and its appropriate control population. These values tend to be conservative, and in many cases, underestimate the actual threshold dose at which no adverse effect is observed. LOAELs are the lowest level of a stressor evaluated in a toxicity test or biological field survey that has a statistically significant adverse effect on the exposed organisms compared with unexposed organisms in a control or reference site (USEPA 1997). LOAELs are lower-bound threshold effect levels and are used to provide a more realistic evaluation of the potential for adverse ecological effects to wildlife populations from exposure to COPECs.

A common practice used in ERAs in the past was to modify the TRVs according to body mass differences between the test organisms and the Site-specific receptors being evaluated (e.g., scale to metabolic rate raised to the 0.67 or 0.75 power). Rhomberg and Wolff (1998) reviewed the mammalian toxicity database and Sample and Arenal (1999) reviewed both the avian and mammalian toxicity databases. These authors' comprehensive reviews concluded that body size scaling of toxicity values was not well-supported. Consequently, no scaling of wildlife TRVs was conducted in this RSLERA.

3.4 Risk Characterization

Risk characterization combines potential Site-related exposures to COPECs and the potential for ecotoxicological effects, to estimate the likelihood of ecological risk. The risk characterization was conducted utilizing EPCs to evaluate potential effects for each assessment endpoint.

Risk characterization of the potential for impacts to benthic invertebrates and fish communities was evaluated by the mathematical comparison of COPEC EPCs to a PEC and TEC. Risk characterization of the potential for impacts to the raccoon was conducted by dividing the ADD by the TRV for the development of a hazard quotient (HQ) as detailed in the following equation:

$$\text{HQ} = \frac{\text{Media-Specific COPEC Concentration or Total Estimate of Exposure}}{\text{Ecotoxicological Benchmark (in comparable units)}}$$

If the HQ was less than or equal to 1.0, then it was concluded that the potential for impacts to ecological receptors is absent or minimal. If the HQ was greater than 1.0, then it was concluded that a potential for impacts to ecological receptors exists. Some authors suggest that HQs should not be used as a definitive statement of the presence or absence of an ecological risk. Instead, it is argued that the HQ serves as an indicator of order-of-magnitude possibilities for impacts to a receptor. Therefore, the literature suggests that HQs between one and ten indicate only a slight possibility of an ecological risk, while an HQ in excess of ten can indicate a more likely chance that an ecological impact will occur (Edmisten-Watkin and Stelljes, 1993). Based on this assessment, it is cautioned that an HQ greater than 1.0 is not confirmation that an ecological impact is occurring, it is only an indication of the potential for a risk and the need to examine other lines of evidence. The magnitude of the exceedance over 1.0 may be related to the magnitude of the potential for risk. The level of conservatism in the benchmark, however, must be taken into consideration. Comparison of chemical data to strongly conservative benchmarks may be overprotective of the resource and exaggerate the potential for an ecological risk.

3.4.1 Evaluation of Potential Ecological Risk to Benthic Invertebrate Communities

Potential risk to the benthic invertebrate community was assessed via the direct contact exposure route as discussed in Section 3.3.2. Results for this assessment are presented in Table 5 and were generated by comparing the total PAH EPC to the total PAH PEC presented in MacDonald et al. 2000. This PEC value is widely accepted throughout the risk assessment community for use in ecological sediment evaluations, and generally corresponds to sediment concentrations above which effects are likely to be observed. It should be noted that MacDonald et al. 2000 does not present a value for PAHs based on molecular weight, only total PAHs. When the Site EPC for total PAHs (40.1 mg/kg) was compared to the total PAH PEC presented in MacDonald et al. 2000 (22.8 mg/kg), an HQ of 1.76 was calculated which indicates a slight potential for ecological risk to benthic invertebrates. As discussed in Section 3.4, it is cautioned that an HQ greater than 1.0 is not confirmation that an ecological impact is occurring, it is only an indication of the potential for a risk and the need to examine other lines of evidence.

An additional line of evidence to assess potential Site-related impacts to the benthic invertebrate community was the evaluation of background or reference location total PAH concentrations on benthic invertebrates. As presented in Table 5, when the background EPC for total PAHs (40.9 mg/kg) was compared to the total PAH PEC presented in MacDonald et al. 2000 (22.8 mg/kg), an HQ of 1.79 was calculated, which is essentially the same as the Site HQ. In this regard, the Site conditions are essentially indistinguishable from upstream/ background conditions from an ecological risk perspective.

Based on two lines of evidence 1) the minor exceedance of the Site HQ for total PAHs (1.76) and 2) the conclusion that Site-related impacts are not driving an unacceptable risk to benthic invertebrates compared to background or reference locations in the surrounding area which are unrelated to the Site, it can be logically concluded that the potential for Site related total PAH impacts to not pose an unacceptable risk to the benthic invertebrate community and do not require further evaluation. Further discussion of the background assessment conducted as part of this RSLERA is presented in Section 4.

3.4.2 Evaluation of Potential Ecological Risk to Fish Communities

It should be assumed that sediment benchmarks developed for benthic invertebrates would be more conservative than sediment benchmarks developed for fish communities due to many factors, including the more sessile nature on benthic invertebrates and consistent, direct contact with sediments. Utilizing these benchmarks to evaluate the potential for ecological impacts to fish communities would at worst overestimate the magnitude of potential impacts.

As discussed in Section 3.4.1, it was determined that the total PAH concentrations do not pose a statistically significant ecological risk to benthic invertebrates as a result of Site-related impacts. As such, it may also be deemed that that total PAHs in sediment do not pose a statistically significant ecological risk to fish communities at the Site. In addition, as discussed in Section 2.5, a screening of both total and dissolved metals in surface water presented no exceedances of the conservative initial screening criteria, and therefore, it can be concluded that metals in surface water would not pose an unacceptable risk to the fish community due to Site related impacts.

3.4.3 Evaluation of Potential Ecological Risk to the Raccoon

Potential risks to the selected semi-aquatic mammalian receptor, the common raccoon, was assessed via the food chain modeling methodology discussed in Section 3.3.2. Results for this assessment are presented in Table 6 and were generated by comparing the total HMW PAH, total LMW PAH and total PAH EPCs to the selected LOAEL TRVs presented in Table 3. The selected TRVs are widely accepted throughout the risk assessment community for use in ecological sediment evaluations, and generally corresponds to sediment

concentrations above which effects are likely to be observed. Below is a summary of the calculated HQs for the various COPEC classes:

Analyte	Site EPC (mg/kg)	Raccoon HQs Based on LOAEL
Total HMW-PAHs	31.7	0.62
Total LMW-PAHs	8.7	0.002
Total PAHs	40.1	0.06

As presented, all calculated HQs for the raccoon are below 1.0. Based on these results, it can be assumed that the PAH COPECs do not pose a statistically significant ecological risk and will not be evaluated further for impacts to piscivorous mammals. It should also be noted that these HQs were calculated utilizing a highly conservative AUF of 100% which would be highly unlikely based on the size of the Site compared to the researched home range of the common raccoon (presented in Table 3).

3.5 Adjustment for Bioavailability & Equilibrium Partitioning

The toxicity of many organic constituents, including PAHs, is considered to be correlated with the dissolved contaminant concentration present in sediment pore water rather than the total contaminant concentration found in sediment. This is because a fraction of the total contaminant concentration is tightly bound to sediment particles and not readily bioavailable (DiToro & McGrath 2000; USEPA 2009). Therefore, toxicity estimates based on interstitial or pore water concentrations provide a more accurate measure of the potential for adverse effect from exposure to sediment-associated organic contaminants. For organic compounds in sediment, the key influencing factor for solid- and liquid-phase portioning is the presence of organic carbon (USEPA 2003).

Typically, bioavailability assessments of PAHs are conducted to calculate sample-specific equilibrium partitioning sediment benchmark toxic units (ESBTUs) for PAHs based on measured TOC concentrations in sediment samples. The equilibrium partitioning methodology uses TOC concentrations in Site sediment to predict the fraction of a contaminant that is dissolved in pore water and therefore, bioavailable to benthic invertebrates and other sediment-dwelling aquatic organisms. When higher concentrations of TOC are present in sediment, a smaller fraction of the contaminant will be dissolved in sediment pore water because the contaminant will sorb to the organic carbon and will therefore be less toxic to sediment-dwelling aquatic organisms.

A review of TOC concentrations from both onsite and background/reference locations indicated relatively low TOC concentrations which typically equate to less binding of the PAHs to the solid-phase portioning (and thus greater portioning into the pore water). Based

on the findings of the RSLERA, as well as the low TOC concentrations observed, it was not deemed beneficial to conduct a bioavailability/equilibrium portioning assessment at this time.

Analyte	P-Value of t-Test
HWM PAHs	0.22
LMW PAHs	0.40
Total PAHs	0.26

Review of the ProUCL background analysis outputs (which are included as Appendix D) indicated that, for all three data sets (HMW, LMW and total PAHs), Site sediment data was equal to or less than the background sediment data, which indicates that there is no significant increase in sediment impacts due to Site-related COPECs.

4. Background Assessment

The Hockanum River is a recipient of discharges and runoff from multiple urban, industrial, and historical sources. To evaluate the potential for background sediments upstream of the Site to contain COPECs at concentrations that could be influencing chemical concentrations downstream via sediment transport and deposition to the Site, a background contribution analysis was conducted.

To assist in this analysis, background sediment samples collected over the various investigations from 2017 through 2022 were assessed and compared to sediments samples collected from the Site over the same period of time. The following table presents a breakdown of the two data sets and the various locations are shown on Figures 4 and 5.

Site Sediment Locations		Background Sediment Locations	
SED-02	SD-01	SED-01	SED-104
SED-03	SD-02	SED-07	SED-105
SED-04	SD-03	SED-08	SD-B01
SED-05	SD-04	SED-09	SD-B02
SED-06	SD-05	SED-101	SD-B03
SED-201	SD-06	SED-102	SD-B04
SED-202	SD-07	SED-103	SD-B05

The concentrations of PAHs in background and sediment from the Site were compared statistically to determine if PAH concentrations detected in onsite samples are significantly higher than background. Total HMW PAHs, total LMW PAHs and total PAH concentrations from Site and background sediments were assessed via inferential statistics calculated using a two-sample hypothesis t test (α=0.05) available in ProUCL v. 5.2 (Singh and Maichle 2015). A null hypothesis stating the Site data sets equal to or less than the background data sets were used to make the inferential determination. A two-sample t-test will generate a "P-value" which is a measure of the probability of obtaining the observed results, assuming that the null hypothesis is true. The lower the P-value, the greater the statistical significance of the observed difference and the less likely that the null hypothesis is correct. A P-value greater that 0.05 is considered an indicator that the null hypothesis is true. The following are the calculated P-values from the three t-tests:

5. Uncertainty Analysis

Estimation of risks to ecological receptors that may result from exposure to constituents in the environment is a complex process. Uncertainty is inherent in each step of the risk assessment process because each parameter used in estimating risk has a degree of variability and uncertainty associated with it. In each step of the risk assessment process, beginning with the data collection and analysis and continuing through risk characterization, conservative assumptions are made that are intended to be protective of ecological receptors and to ensure that risks are not underestimated.

The risk values generated in this RSLERA are not precise, deterministic estimates, but conditional estimates controlled by upper-bound assumptions regarding exposure and toxicity. The calculated risk values provide an upper bound estimate of the potential ecological risk values, as it is not possible to obtain an accurate or precise estimate of actual ecological risks. This section summarizes the major factors contributing to the uncertainty associated with this RSLERA in an effort to minimize their effects on the interpretation of results. Sources of uncertainty may include Site characterization and data quality, selection of COPECs, calculation of EPCs, exposure estimate variables and background impacts and are discussed in further detail in this section.

5.1 Site Characterization and Receptor Selection

The ecosystems potentially at risk were based initially on a comprehensive review of historical investigations and observations made during previous ecological investigations and Site reconnaissance. Aquatic habitat associated with the Hockanum River was identified and considered in this evaluation. In general, the Site is isolated and surrounded by roadways and residential and commercial development. The Site is less than 3.5 acres in size and consists almost entirely of developed land used for an electrical substation. The uncertainty associated with failing to identify a potentially exposed ecological resource is minimal.

This RSLERA focuses on calculated impacts to benthic invertebrates and fish (visa vie benthic invertebrates) via direct contact and semi-aquatic mammals via dietary modeling as assessment endpoints. The absence of elevated risk to benthic biota and semi-aquatic mammals and a diverse food web in this industrialized reach that is lacking extensive riparian or fringing wetland habitat suggest, with reasonable confidence, that risk to other potential receptors remains insignificant.

5.2 Data Sufficiency

Data sufficiency may contain a level of uncertainty for a variety of reasons. Uncertainty may be related to the number of samples used to characterize a given area and whether potential areas of high contamination have been sampled. Samples collected for the purposes of ecological evaluation need to be representative of all areas of potential impacts at the Site. The extent of sediment data collected from 2017 through 2022 provided widespread areal and temporal coverage creating data sets sufficient for use in this RSLERA.

The Site in question is relatively small and the samples collected were spatially distributed to provide a comprehensive evaluation of the Site. Sediment sample locations were also biased toward areas with the highest potential to contain depositional material most likely to have higher COPEC concentrations. As a result, the samples collected as part of the ecological investigation process may actually overestimate the potential for ecological risk at the Site as receptors will utilize all aspects of the Hockanum River as it pertains to the Site, not just areas of high deposition. More importantly, it is not expected that additional analytical information would afford a greater understanding of the ecological risks in these areas. The uncertainty associated with data sufficiency is comprehensively addressed throughout the RSLERA process and is considered to have a minimal effect on the conclusions of the RSLERA and, if anything, could potentially overestimate ecological risk at the Site.

5.3 Uncertainty Associated with the Calculation of EPCs

It is conventional to use less conservative exposure estimates in subsequent stages of the ERA process (like a refined SLERA or Baseline Ecological Risk Assessment) as compared to earlier stages (SLERA) of the ERA process where, for example, the maximum detected concentration is used in the screening level exposure estimate to ensure that potential impacts from toxic or bioaccumulative chemicals are not overlooked. However, ecological receptors would not be exposed to the maximum concentration for an extended period of time, particularly for mobile species. The actual EPC varies depending on receptor behavior and is likely to be lower than the maximum concentration.

EPCs generated by calculating the 95% UCL were used for risk characterization in the RSLERA. These represent a more conservative EPC value than the average concentration. Therefore, risk estimates derived using the 95% UCL poses limited levels of uncertainty in the ERA. Given the conservative nature of utilizing a 95% UCL vs another statistical output (like a geometric mean), the level of uncertainty associated with establishment of the exposure estimates is believed to be biased conservatively.

5.4 Uncertainty Associated with Exposure Estimates

There is uncertainty associated with each measured variable used in exposure models. When combining variables in models, uncertainty associated with these variables is cumulative, and is expressed in the model results. These effects should be considered when interpreting model results. Since uncertainty is unavoidable for this type of assessment, wherever possible, steps were taken to build conservatism into the model. Conservatism is the product of combining upper bound values of each variable incorporated in the model, potentially resulting in an overestimation of the actual values and minimizing the likelihood of underestimating the risk.

Dose models required several assumptions, which could result in either overestimation or underestimation of risks to receptors. Body weights and feeding rates used are considered suitable and representative for estimating exposure. In addition, receptors are assumed to feed exclusively on specified food sources, although raccoon may feed opportunistically on a variety of food types that may vary seasonally. In addition, a very conservative AUF of 1.0 was utilized in the dose models for this RSLERA. Overall, based on the nature of the modeling process, the level of uncertainty associated with establishment of the exposure estimates cannot be accurately determined but is believed to be biased conservatively.

5.5 Uncertainty Associated with TRV Selection

TRVs, which are used to place a "value" on the effects of contaminant exposure on a receptor, are predominantly based on results of reported laboratory toxicity studies for specific chemicals on a limited number of species, resulting in two main sources of uncertainty. First, laboratory conditions may not accurately reflect the effects of natural conditions on a constituent's toxicity to receptors in the environment. Environmental stresses and synergistic effects of multiple constituents could increase toxicity, while environmental compatibility and antagonistic effects of multiple constituents could decrease toxicity. Second, uncertainty exists as toxicity values are available for only a limited number of species. TRVs were not adjusted for body size differences between the experimental animal and the receptors evaluated herein (no allometric adjustments). This direct application of TRVs determined from evaluation of the experimental animal (e.g., mouse to mink) does not account for physiological differences between that species and the ROI utilized in the RSLERA (common raccoon) may lead to an overestimation or underestimation of risk.

In addition, NOAEL TRVs are relatively unreliable because, by definition, no effects were measured. More confidence with these values exists if the LOAEL is close to the NOAEL. However, all of the toxicity studies from which these TRVs were derived were conducted with chemical forms that likely overestimate bioavailability under natural conditions. Laboratory animals are selected and bred to be sensitive while natural stresses select for more

robust organisms in the wild. This is particularly true of organisms that populate urban settings. Due to the uncertainty involved with extrapolations between species, individuals, and laboratory studies, the less conservative exposure scenarios were developed using a LOAEL. The relative HQs and the differences between the NOAEL and LOAEL HQ calculations are discussed as part of the risk characterization.

Estimates of the potential for adverse effects in any ecological evaluation inevitably contain a level of uncertainty. Sources of uncertainty can include, but are not limited to, sampling error, the representative nature of the chosen sampling locations, the potential migration pathways, data analyses and associated detection limits, and representativeness of ESCs.

5.6 Uncertainty Associated with Calculation of Total PAH Values

The total PAH values were calculated as the sum of the detected PAHs and the non-detected PAHs (the MDL was utilized as a surrogate value for non-detected PAHs). This is appropriate as PAHs usually exist as mixtures and if one is present, most others are likely present as well. Based on this approach, the summed total PAH values may overestimate risk for sediment which further lends to the conservative nature of the RSLERA process.

5.7 Uncertainty Associated with Sediment Sample Depths

The biologically active zone was defined as 0 – 0.5 feet, consistent with USEPA protocol (USEPA 2015). However, it is possible for the depth of the biotic zone to vary based on substrate morphology. For instance, in silty sediments the biotic zone may extend only an inch or two due to anoxic conditions. This may introduce under- or over-estimation of risk if the contaminants are concentrated in the bottom or top interval of the sample, respectively.

Also, the probability of sediment movements of a magnitude sufficient to mobilize or uncover subsurface sediment in the future is unknown. Such remobilization could occur as a result of dredging or extreme weather events. While the conclusions are of high confidence for current conditions, the presence of much higher concentrations of PAHs in deeper sediment introduces uncertainty about future conditions. Confidence in sediment stability under future conditions would be necessary to evaluate if remobilization of subsurface contamination may be relevant.

6. Conclusions

Based on the RSLERA activities presented in this report, the following key conclusions can be drawn:

- Previous investigations indicated the presence of potential MGP-related constituents in Hockanum River media in the vicinity of the Site, including PAHs in sediment and metals in surface water.
- Initial screening of surface water data to ESCs did not show detected concentrations in exceedance of these conservative screening values. Based on the lack of ESC exceedances, the need to further assess potential ecological impacts from surface water was not warranted.
- Ecological receptors of interest for the Site were determined to include benthic invertebrates, fish, and semi-aquatic mammals.
- Exposure estimates of total PAHs calculated for direct contact by benthic invertebrate and fish communities to sediment indicated HQ slightly above 1.0 (HQ = 1.76).
- An additional line of evidence to assess potential Site-related impacts to the benthic invertebrate and fish communities was the evaluation of background or reference location total PAH concentrations on benthic invertebrates. Exposure estimates of background total PAHs concentrations for direct contact by benthic invertebrate and fish communities to sediments presented an HQ (Background HQ = 1.79) consistent with the Site HQ (Site HQ = 1.76).
- Exposure estimates of PAHs calculated for the common raccoon indicated LOAEL HQs less than 1.0 utilizing the most conservative scenario of a 100% AUF.
- A background assessment revealed no statistical difference between Site sediment PAH concentrations and background/reference PAH concentrations.

Based on this information, no further investigation, evaluation or action with respect to ecological receptors is warranted regarding Site sediments or surface water in the Hockanum River.

7. References

[CT DEEP] Connecticut Department of Energy and Environmental Protection. 2015. Ecological Risk Assessment Guidance, [accessed February 2, 2023]. https://portal.ct.gov/DEEP/Remediation--Site-Clean-Up/Guidance/Ecological-Risk-Assessment-Guidance

Di Toro, D.M., Zarba, C.S., Hansen, D.J., Berry, W.J., Swartz, R.C., Cowan, C.E., Pavlou, S.P., Allen, H.E., Thomas, N.A. and Paquin, P.R. (1991), Technical basis for establishing sediment quality criteria for nonionic organic chemicals using equilibrium partitioning. Environmental Toxicology and Chemistry, 10: 1541-1583. https://doi.org/10.1002/etc.5620101203

Edmisten-Watkin, G, and Stelljes, M, 1993. A Proposed Approach to Quantitatively Assess Potential Ecological Impacts to Terrestrial Receptors from Chemical Exposure. Environmental Toxicology and Risk Assessment. ASTM International , 1993.

Exponent. 2021. Screening-Level Ecological Risk Assessment, Rockville Former Manufactured Gas Plant Site 13 Maple Street/West Main Street Rockville, Vernon, Connecticut REM ID: 12390. March 2021.

GEI. 2022. Supplemental Phase II/III Environmental Site Assessment Work Plan. Rockville Former MGP Site. June 2022

ITRC (Interstate Technology & Regulatory Council). 2011. Incorporating Bioavailability Considerations into the Evaluation of Contaminated Sediment Sites. CS-1. Washington, D.C.: Interstate Technology & Regulatory Council, Contaminated Sediments Team. www.itrcweb.org.

Macdonald, D, Ingersoll C, and Berger T, 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology. 39 (20-21).

Rhomberg, L, and Wolff, S, 1998. Empirical Scaling of Single Oral Lethal Doses Across Mammalian Species Based on a Large Database. Risk Analysis. 18 (741-753).

Sample, B, and Arenal, C, 1999. Allometric models for interspecies extrapolation for wildlife toxicity data. Bulletin of Environmental Contamination and Toxicology. 62 (653-663).

Tighe & Bond. 2017. Phase I Environmental Site Assessment, Eversource Former Rockville MGP Site, 13 Maple Street/West Main Street, Rockville, Vernon, CT. March.

[USEPA] United States Environmental Protection Agency. 1992. Framework for Ecological Risk Assessment, USEPA/630/R-92/001, Risk Assessment Forum, Washington, DC, February 1992.

[USEPA] United States Environmental Protection Agency. 1994. Final Site Inspection Report for Northeast Utilities-Vernon, Vernon, Connecticut. CERCLIS No. CTD983870353. TDD No. 9304-40-ACS.

[USEPA] United States Environmental Protection Agency. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments - Interim Final. EPA 540-R-97-006.

[USEPA] United States Environmental Protection Agency. 1998. Guidelines for Ecological Risk Assessment. Office of Solid Waste and Emergency Response.

[USEPA] United States Environmental Protection Agency. 2001. The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments, Office of Solid Waste and Emergency Response, USEPA 540/F-01/014, June 2001.

[USEPA] United States Environmental Protection Agency. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013

[USEPA] United States Environmental Protection Agency. 2007. Ecological Soil Screening Levels for Polycyclic Aromatic Hydrocarbons (PAHs) – Interim Final OSWER Directive 9285.7-78. USEPA Office of Solid Waste and Emergency Response. June 2007.

[USEPA] United States Environmental Protection Agency (USEPA). 2009. Burgess, R.M. Evaluating Ecological Risk to Invertebrate Receptors from PAHs in Sediments at Hazardous Waste Sites. USEPA, Ecological Risk Assessment Support Center, Cincinnati, OH. EPA-600-R-06-162F. October 2009.

[USEPA] United States Environmental Protection Agency. 2015. Determination of the Biologically Relevant Sampling Depth for Terrestrial and Aquatic Ecological Risk Assessments (Final Report). U.S. Environmental Protection Agency, Ecological Risk Assessment Support Center, Cincinnati, OH, EPA/600/R-15/176, 2015.

Tables

Table 1. Summary of Surface Water Data
Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site, Rockville, CT

	Ecological Screening Criteria (ESC)				Site Samples													
Sample ID	**CT Water Quality Standards**		**USEPA Region 4 Surface Water**		**SW-01**		**SW-02**		**SW-03**		**SW-04**		**SW-05**		**SW-06**		**SW-07**	
Lab Sample ID	**Aquatic Life Criteria (ug/L)**		**Screening Values (ug/L)**		**CM98578**		**CM98600**		**CM98598**		**CM98596**		**CM98594**		**CM98592**		**CM98590**	
Sample Date	**Acute**	**Chronic**	**Acute**	**Chronic**	**12/6/2022**		**12/6/2022**		**12/5/2022**		**12/5/2022**		**12/5/2022**		**12/5/2022**		**12/5/2022**	
Misc Parameters																		
Hardness (CaCO3)	NS	NS	NS	NS														
Metals, Total (ug/L)																		
Antimony	NS	NS	900	190	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	
Arsenic	340	150	340	150	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	
Barium	NS	NS	2000	220	**42.0**		**44.0**		**42.0**		**41.0**		**40.0**		**41.0**		**50.0**	
Beryllium	NS	NS	93	11	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	
Cadmium	NS	NS	NS	NS	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	
Chromium	NS	NS	NS	NS	1.0	U	**7.0**		1.0	U	1.0	U	1.0	U	**1.0**		**3.0**	
Copper	NS	NS	NS	NS	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	**6.0**	
Lead	NS	NS	NS	NS	**2.0**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	**13.0**	
Mercury	1.4	0.77	1.4	0.77	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	
Nickel	NS	NS	NS	NS	1.0	U	**1.0**		1.0	U	1.0	U	1.0	U	1.0	U	**3.0**	
Selenium	20	5	20	5	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	
Silver	NS	NS	NS	NS	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	
Thallium	NS	NS	54	6	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	
Vanadium	NS	NS	79	27	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	**2.0**	
Zinc	NS	NS	NS	NS	**42.0**		**27.0**		**36.0**		**9.0**		**6.0**		**7.0**		**24.0**	
Metals, Dissolved (ug/L)																		
Antimony (Dissolved)	NS	NS	900	190	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	
Arsenic (Dissolved)	NS	NS	340	150	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	
Barium (Dissolved)	NS	NS	NS	NS	**38.0**		**42.0**		**40.0**		**40.0**		**39.0**		**39.0**		**37.0**	
Beryllium (Dissolved)	NS	NS	NS	NS	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	
Cadmium (Dissolved)	1	0.125	0.94	0.45	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	
Chromium (Dissolved)	323	42	323	42	1.0	U	**6.0**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	
Copper (Dissolved)	14.3	4.8	7	4.95	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	
Lead (Dissolved)	30	1.2	30.1	1.25	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	
Mercury (Dissolved)	NS	NS	1.4	0.77	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	
Nickel (Dissolved)	260.5	28.9	260	28.9	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	**1.0**	
Selenium (Dissolved)	NS	NS	NS	NS	11.0	U	11.0	U	11.0	U	11.0	U	11.0	U	11.0	U	11.0	
Silver (Dissolved)	1.02	NS	0.98	0.06	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	
Thallium (Dissolved)	NS	NS	NS	NS	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	
Vanadium (Dissolved)	NS	NS	NS	NS	2.0	U	2.0	U	2.0	U	2.0	U	**3.0**		2.0	U	**2.0**	
Zinc (Dissolved)	65	65	66	66	**34.0**		**24.0**		**31.0**		**14.0**		**6.0**		**6.0**		**7.0**	
Notes:																		
ug/L = micrograms per liter																		
Boxed concentrations is detected value which exceeds the most stringent ecological screening criteria.																		
NS = No standard currently established.																		
U = Not detected above laboratory detection limit.																		
Bold = Detected concentration.																		

Table 1. Summary of Surface Water Data
Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site, Rockville, CT

		Background Samples									
Sample ID		**SD-B01**		**SD-B02**		**SD-B03**		**SD-B04**		**SD-B05**	
Lab Sample ID		**CM98580**		**CM98582**		**CM98584**		**CM98586**		**CM98588**	
Sample Date		**12/6/2022**		**12/6/2022**		**12/6/2022**		**12/6/2022**		**12/6/2022**	
Misc Parameters											
Hardness (CaCO3)											
Metals, Total (ug/L)											
Antimony	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Arsenic	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
Barium		**206**		**40.0**		**41.0**		**49.0**		**34.0**	
Beryllium	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Cadmium	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chromium		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Copper		5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Lead		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Mercury	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel		**1.0**		1.0	U	1.0	U	**1.0**		1.0	U
Selenium	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U
Silver	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Thallium	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Vanadium		2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Zinc		**29.0**		**27.0**		**32.0**		**28.0**		**19.0**	
Metals, Dissolved (ug/L)											
Antimony (Dissolved)	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Arsenic (Dissolved)	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
Barium (Dissolved)		**195**		**39.0**		**39.0**		**47.0**		**33.0**	
Beryllium (Dissolved)	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Cadmium (Dissolved)	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Chromium (Dissolved)	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Copper (Dissolved)	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Lead (Dissolved)	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U
Mercury (Dissolved)	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Nickel (Dissolved)		0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Selenium (Dissolved)	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Silver (Dissolved)	U	11.0	U	11.0	U	11.0	U	11.0	U	11.0	U
Thallium (Dissolved)	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Vanadium (Dissolved)		2.0	U	**2.0**		2.0	U	2.0	U	**2.0**	
Zinc (Dissolved)		**29.0**		**34.0**		**31.0**		**24.0**		**17.0**	
Notes:											
ug/L = micrograms per liter											
Boxed concentrations is detected											
NS = No standard currently establ											
U = Not detected above laboratory											
Bold = Detected concentration.											

Table 2. Summary of Sediment Data
Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site, Rockville, CT

Sample ID	USEPA Region 4	SED-02		SED-03		SED-04		SED-05		SED-06		SED-06A	SED-06B	SED-06C
Sample Depth (ft bgs)	Freshwater	0-0.5		0-0.5		0-0.5		0-0.5		0-0.5		0-0.5	0-0.5	0-0.5
Lab Sample ID	Screening Values	BZ40750		BZ40751		BZ40752		BZ40753		BZ40754		CB20637	CB20638	CB20639
Site or Background Location	(mg/kg)	Site		Site		Site		Site		Site		Site	Site	Site
Sample Date		11/13/2017		11/13/2017		11/13/2017		11/13/2017		11/13/2017		8/28/2018	8/28/2018	8/28/2018
Metals (mg/kg)														
Antimony	25	-		-		-		-		-		-	-	-
Arsenic	33	2.26		1.5		2.1		1.26		3.95		-	-	-
Barium	60	49.5		27.5		40.6		29.6		24.5		-	-	-
Beryllium	NS	-		-		-		-		-		-	-	-
Cadmium	5	0.44	U	0.4		0.89		0.46	U	0.94		-	-	-
Chromium (Total)	111	17.5		10.2		14.6		11.3		17.4		-	-	-
Copper	149	26.1		27.6		46.4		20		**2190**		22.1	28.9	83.7
Lead	128	64.1		26.1		78.2		28.8		**153**		-	-	-
Nickel	48.6	8.7		7.53		9.02		7.97		12.2		-	-	-
Selenium	2.9	-		-		-		-		-		-	-	-
Silver	2.2	-		-		-		-		-		-	-	-
Thallium	NS	-		-		-		-		-		-	-	-
Vanadium	NS	37.3		31.9		41.5		31.7		26.5		-	-	-
Zinc	459	77.4		77.6		88.5		70.9		292		-	-	-
Mercury	1.1	0.03	U	0.03	U	0.03	U	0.03	U	0.1		-	-	-
High Molecular Weight PAHs (mg/kg)														
Benz(a)anthracene	0.108	**3**		**4**		**1**		**1.9**		**3.9**		-	-	-
Benzo[a]pyrene	0.15	**2.7**		**3.6**		**1.1**		**1.8**		**3.6**		-	-	-
Benzo(b)fluoranthene	0.19	**2.8**		**3.1**		**0.89**		**1.7**		3	U	-	-	-
Benzo[g,h,i]perylene	0.17	**1.6**		**1.8**		**0.78**		**1.1**		3.0	U	-	-	-
Benzo[k]fluoranthene	0.24	**2.6**		**3.4**		**1**		**1.7**		**3.4**		-	-	-
Chrysene	0.166	**3.5**		**4.1**		**1.2**		**2.1**		**4.7**		-	-	-
Dibenz(a,h)anthracene	0.033	0.31	U	**0.43**		0.26	U	0.31	U	3.0	U	-	-	-
Fluoranthene	0.423	**7.1**		**6.6**		**1.5**		**3.4**		**7**		-	-	-
Indeno[1,2,3-cd]pyrene	0.2	**1.7**		**2**		**0.77**		**1.1**		3.0	U	-	-	-
Pyrene	0.195	**5.6**		**6.3**		**1.6**		**3.1**		**8.3**		-	-	-
Total HMW PAHs	1	**30.91**		**35.33**		**10.1**		**18.21**		**42.9**		-	-	-
Low Molecular Weight PAHs (mg/kg)														
Acenaphthene	0.0067	0.31	U	0.27	U	0.26	U	0.31	U	3.0	U	-	-	-
Acenaphthylene	0.0059	**0.42**		**0.58**		**0.29**		**0.41**		3.0	U	-	-	-
Anthracene	0.057	**0.9**		**0.88**		0.26	U	**0.59**		3.0	U	-	-	-
Fluorene	0.077	**0.35**		**0.31**		0.26	U	**0.32**		3.0	U	-	-	-
Naphthalene	0.176	0.31	U	0.27	U	0.26	U	0.31	U	3.0	U	-	-	-
Phenanthrene	0.204	**4.3**		**2.5**		**0.81**		2.2		**5.5**		-	-	-
Total LMW PAHs	0.6	**6.59**		**4.81**		**2.14**		**4.14**		**20.5**		-	-	-
												-	-	-
Total PAHs	1.61	**37.5**		**40.1**		**12.2**		**22.4**		**63.4**		-	-	-

Notes:
ft bgs = Feet below ground surface.
mg/kg = Milligrams per kilogram.
% = Percent.
Boxed concentrations exceed the ecological screening values.
NS = No standard currently established.
U = Not detected above laboratory detection limit.
J = Result below the reporting limit (estimated value).
Bold = Detected concentration.

Table 2. Summary of Sediment Data
Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site, Rockville, CT

Sample ID	SED-201		SED-202		SD-01	SD-02	SD-03	SD-04	SD-05	SD-06	SD-07
Sample Depth (ft bgs)	0-0.5		0-0.5		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Lab Sample ID	460-228733-1		460-228733-2		L2268732-01	L2268732-12	L2268732-11	L2268732-10	L2268732-06	L2268732-08	L2268732-07
Site or Background Location	Site		Site		Site	Site	Site	Site	Site	Site	Site
Sample Date	2/24/2021		2/24/2021		1//06/2022	1//06/2022	1/5/2022	1/5/2022	1//06/2022	1/5/2022	1/5/2022
Metals (mg/kg)											
Antimony	1.1	U	1.4	U	-	-	-	-	-	-	-
Arsenic	2.5		1.9		-	-	-	-	-	-	-
Barium	28		52		-	-	-	-	-	-	-
Beryllium	0.43	U	0.57	U	-	-	-	-	-	-	-
Cadmium	1.1	U	1.4	U	-	-	-	-	-	-	-
Chromium (Total)	12		16		-	-	-	-	-	-	-
Copper	54		38		-	-	-	-	-	-	-
Lead	33		72		-	-	-	-	-	-	-
Nickel	8.9		7.7		-	-	-	-	-	-	-
Selenium	1.3	U	1.8	U	-	-	-	-	-	-	-
Silver	1.1	U	1.4	U	-	-	-	-	-	-	-
Thallium	0.43	U	0.57	U	-	-	-	-	-	-	-
Vanadium	19		24		-	-	-	-	-	-	-
Zinc	61		100		-	-	-	-	-	-	-
Mercury	0.019	U	0.049		-	-	-	-	-	-	-
High Molecular Weight PAHs (mg/kg)											
Benz(a)anthracene	**3.8**		**1.6**		**1.94**	**2.19**	**2**	**0.938**	**3.9**	**2.48**	**1.94**
Benzo[a]pyrene	**3.2**		**2.1**		**2.37**	**2.4**	**2.38**	**1.04**	**4.03**	**2.52**	**1.95**
Benzo(b)fluoranthene	**3.4**		**2.7**		**1.93**	**2.28**	**1.77**	**1.01**	**4.04**	**2.1**	**1.78**
Benzo[g,h,i]perylene	**2**		**1.8**		**1.72**	**1.68**	**1.63**	**0.771**	**2.84**	**1.58**	**1.19**
Benzo[k]fluoranthene	**1.2**		**0.67**		**1.97**	**1.94**	**2.16**	**0.855**	**3.41**	**2.21**	**1.55**
Chrysene	**3.7**		**2.1**		**2.02**	**2.27**	**2.23**	**1.12**	**4.3**	**2.4**	**2.05**
Dibenz(a,h)anthracene	**0.55**		**0.45**		**0.382**	**0.482**	**0.46**	**0.208**	**0.91**	**0.407**	**0.528**
Fluoranthene	**9.3**		**3.8**		**3.64**	**4.62**	**4.4**	**1.83**	**10**	**6.76**	**3.71**
Indeno[1,2,3-cd]pyrene	**1.7**		**1.5**		**1.62**	**1.63**	**1.56**	**0.711**	**2.82**	**1.6**	**1.6**
Pyrene	**8.8**		**3.6**		**3.47**	**4.01**	**4.44**	**1.81**	**8.33**	**8.22**	**3.33**
Total HMW PAHs	**37.65**		**20.32**		**21.062**	**23.502**	**23.03**	**10.293**	**44.58**	**30.277**	**19.628**
Low Molecular Weight PAHs (mg/kg)											
Acenaphthene	**1.2**		**0.073**		**0.0514**	**0.0818**	**0.0583**	**0.024**	**0.314**	**0.0498**	**0.032**
Acenaphthylene	**1.4**		**0.66**		**0.323**	**0.503**	**0.48**	**0.211**	**0.465**	**0.517**	**0.374**
Anthracene	**2.9**		**0.53**		**0.49**	**0.679**	**0.591**	**0.221**	**1.07**	**0.653**	**0.486**
Fluorene	**2.2**		**0.13**		**0.111**	**0.154**	**0.0922**	**0.0418**	**0.521**	**0.113**	**0.0791**
Naphthalene	**0.37**		0.16	U	**0.0443**	**0.0412**	**0.1**	**0.0399**	**0.0621**	**0.0517**	**0.0341**
Phenanthrene	**12**		**1.6**		**1.66**	**2.39**	**1.95**	**0.836**	**5.68**	**1.95**	**1.59**
Total LMW PAHs	**20.07**		**3.153**		**2.6797**	**3.849**	**3.2715**	**1.3737**	**8.1121**	**3.3345**	**2.5952**
Total PAHs	**57.7**		**23.5**		**23.7**	**27.4**	**26.3**	**11.7**	**52.7**	**33.6**	**22.2**

Notes:
ft bgs = Feet below ground surface.
mg/kg = Milligrams per kilogram.
% = Percent.
Boxed concentrations exceed the ecological sc
NS = No standard currently established.
U = Not detected above laboratory detection li
J = Result below the reporting limit (estimatec
Bold = Detected concentration.

Table 2. Summary of Sediment Data
Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site, Rockville, CT

Sample ID	SED-01		SED-07		SED-08		SED-09		SED-101		SED-102		SED-103		SED-104		SED-105
Sample Depth (ft bgs)	0-0.5		0-0.5		0-0.5		0-0.5		0-0.5		0-0.5		0-0.5		0-0.5		0-0.5
Lab Sample ID	BZ40749		CB20634		CB20635		CB20636		460-221363-1		460-221363-2		460-221363-3		460-221363-4		460-221363-5
Site or Background Location	Background		Background		Background		Background		Background		Background		Background		Background		Background
Sample Date	11/13/2017		8/28/2018		8/28/2018		8/28/2018		10/21/2020		10/21/2020		10/21/2020		10/21/2020		10/21/2020
Metals (mg/kg)																	
Antimony	-								1.2	U	1.2	U	1.2	U	1.2	U	1.1
Arsenic	0.79	U	0.73	U	0.85	U	7.3		1.2	U	1.2	U	1.2		1.4		1.1
Barium	29		30.3		23.7		**324**		26		20		26		24		26
Beryllium	-								0.5	U	0.49	U	0.48	U	0.47	U	0.46
Cadmium	0.4	U	0.36	U	0.43	U	2.9		1.2	U	1.2	U	1.2	U	1.2	U	1.1
Chromium (Total)	9.22		7.1		6.61		66.4		7.8		18		8.2		7.6		8.2
Copper	16.1		13.2		10		**149**		16		19		24		20		16
Lead	37.7		43.7		22.2		**267**		26		57		54		26		33
Nickel	6.81		7.6		6.37		41.6		6.5		7.2		7		6.8		7.6
Selenium	-								1.6	U	1.5	U	1.5	U	1.5	U	1.4
Silver	-								1.2	U	1.2	U	1.2	U	1.2	U	1.1
Thallium	-								0.5	U	0.49	U	0.48	U	0.47	U	0.46
Vanadium	21.7		16		15.2		109		18		27		35		23		22
Zinc	53.2		57.9		45.5		**606**		56		150		75		43		54
Mercury	0.03	U	0.03	U	0.03	U	0.21		0.02	U	0.019	U	0.02	U	0.02	U	0.02
High Molecular Weight PAHs (mg/kg)																	
Benz(a)anthracene	**7.2**		**0.7**		**2.4**		1.5	U	**2.3**		**1.6**		**1.6**		**0.89**		**1.4**
Benzo[a]pyrene	**6.1**		**0.77**		**2.4**		**1.9**		**2.1**		**1.4**		**1.3**		**0.76**		**1.1**
Benzo(b)fluoranthene	**5.3**		**1.2**		**4.1**		**3.7**		**2.5**		**1.6**		**1.5**		**0.94**		**1.3**
Benzo[g,h,i]perylene	**3.3**		0.28	U	0.3	U	1.5	U	**1.7**		**1.2**		**0.95**		**0.53**		**0.78**
Benzo[k]fluoranthene	**5.4**		**0.42**		**1.4**		1.5	U	**0.81**		**0.41**		**0.58**		**0.33**		**0.49**
Chrysene	**7.6**		**0.79**		**2.6**		**2.2**		**2.3**		**1.5**		**1.5**		**0.87**		**1.2**
Dibenz(a,h)anthracene	**0.8**		0.28	U	0.3	U	1.5	U	**0.51**		**0.37**		**0.36**		**0.17**		**0.25**
Fluoranthene	**19**		**1.6**		**5.2**		**3.6**		**5.1**		**3.9**		**3.7**		**2**		**2.8**
Indeno[1,2,3-cd]pyrene	**3.9**		0.28	U	**0.44**		1.5	U	**1.5**		**1**		**0.88**		**0.51**		**0.71**
Pyrene	**16**		**1.5**		**4.3**		**3.2**		**4.7**	J	**3.8**	J	**3.3**	J	**1.9**		**2.5**
Total HMW PAHs	**74.6**		**7.82**		**23.44**		**22.1**		**23.52**		**16.78**		**15.67**		**8.9**		**12.53**
Low Molecular Weight PAHs (mg/kg)																	
Acenaphthene	**1.3**		0.28	U	0.3	U	1.5	U	**0.12**	J	**0.13**	J	**0.15**	J	**0.06**		**0.083**
Acenaphthylene	**0.38**		0.28	U	**0.33**		1.5	U	**0.89**		**0.57**		**0.45**		**0.26**		**0.41**
Anthracene	**3.3**		0.28	U	**0.6**		1.5	U	**0.79**		**0.73**		**0.66**		**0.32**		**0.47**
Fluorene	**1.4**		0.28	U	0.3	U	1.5	U	**0.25**		**0.34**		**0.25**		**0.12**		**0.16**
Naphthalene	**0.77**		0.28	U	0.3	U	1.5	U	**0.065**		**0.096**		**0.047**		**0.034**		**0.43**
Phenanthrene	**19**		**1.2**		**2.8**		1.5	U	**2.6**		**3.3**		**2.6**		**1.3**		**1.7**
Total LMW PAHs	**26.15**		**2.6**		**4.63**		**9**		**4.715**		**5.166**		**4.157**		**2.094**		**3.253**
Total PAHs	**100.8**		**10.4**		**28.1**		**31.1**		**28.2**		**21.9**		**19.8**		**11.0**		**15.8**

Notes:
ft bgs = Feet below ground surface.
mg/kg = Milligrams per kilogram.
% = Percent.
Boxed concentrations exceed the ecological sc
NS = No standard currently established.
U = Not detected above laboratory detection li
J = Result below the reporting limit (estimatec
Bold = Detected concentration.

Table 2. Summary of Sediment Data
Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site, Rockville, CT

Sample ID		SD-B01	SD-B02	SD-B03	SD-B04	SD-B05
Sample Depth (ft bgs)		0-0.5	0-0.5	0-0.5	0-0.5	0-0.5
Lab Sample ID	5	L2268732-02	L2268732-03	L2268732-04	L2268732-05	L2268732-06
Site or Background Location	l	Background	Background	Background	Background	Background
Sample Date		1//06/2022	1//06/2022	1//06/2022	1//06/2022	1//06/2022
Metals (mg/kg)						
Antimony	U	-	-	-	-	-
Arsenic	U	-	-	-	-	-
Barium		-	-	-	-	-
Beryllium	U	-	-	-	-	-
Cadmium	U	-	-	-	-	-
Chromium (Total)		-	-	-	-	-
Copper		-	-	-	-	-
Lead		-	-	-	-	-
Nickel		-	-	-	-	-
Selenium	U	-	-	-	-	-
Silver	U	-	-	-	-	-
Thallium	U	-	-	-	-	-
Vanadium		-	-	-	-	-
Zinc		-	-	-	-	-
Mercury	U	-	-	-	-	-
High Molecular Weight PAHs (mg/kg)						
Benz(a)anthracene		**3.5**	**1.21**	**1.7**	**1.61**	**0.566**
Benzo[a]pyrene		**3.76**	**1.44**	**1.8**	**1.79**	**0.693**
Benzo(b)fluoranthene		**3.34**	**1.28**	**1.56**	**1.58**	**0.606**
Benzo[g,h,i]perylene		**3.47**	**0.997**	**1.22**	**1.28**	**0.54**
Benzo[k]fluoranthene		**3.49**	**1.25**	**1.49**	**1.53**	**0.588**
Chrysene		**3.92**	**1.42**	**1.86**	**1.78**	**0.641**
Dibenz(a,h)anthracene		**1.01**	**0.273**	**0.33**	**0.366**	**0.114**
Fluoranthene		**8.77**	**2.6**	**3.71**	**5.18**	**1.44**
Indeno[1,2,3-cd]pyrene		**3.84**	**0.974**	**1.18**	**1.22**	**0.499**
Pyrene		**7.78**	**2.28**	**3.43**	**3.23**	**1.25**
Total HMW PAHs		**42.88**	**13.724**	**18.28**	**19.566**	**6.937**
Low Molecular Weight PAHs (mg/kg)						
Acenaphthene		**0.209**	**0.0399**	**0.0563**	**0.0999**	**0.0227**
Acenaphthylene		**0.494**	**0.264**	**0.358**	**0.271**	**0.137**
Anthracene		**0.788**	**0.284**	**0.474**	**0.534**	**0.159**
Fluorene		**0.219**	**0.0955**	**0.146**	**0.166**	**0.0372**
Naphthalene		**0.0933**	**0.0262**	**0.0568**	**0.0361**	**0.0211**
Phenanthrene		**4.74**	**1.26**	**2.16**	**2.2**	**0.772**
Total LMW PAHs		**6.5433**	**1.9696**	**3.2511**	**3.307**	**1.149**
Total PAHs		**49.4**	**15.7**	**21.5**	**22.9**	**8.1**

Notes:
ft bgs = Feet below ground surface.
mg/kg = Milligrams per kilogram.
% = Percent.
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NS = No standard currently established.
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Bold = Detected concentration.

Table 3. Selected TRVs
Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site, Rockvillle, CT

Analyte	NOAEL TRV (mg/kg-day)	Source	Test Species	Endpoint	LOAEL TRV (mg/kg-day)	Source	Test Species	Endpoint
Total HMW-PAHs	6.15E-01	a	Mouse	Survival	3.07E+00	a	Mouse	Survival
Total LMW-PAHs	6.56E+01	a	Rat	Growth	3.28E+02	a	Rat	Growth
Total PAHs	1.00E+01	b	Mouse	Reproduction	4.00E+01	b	Mouse	Reproduction

Notes:
(a) USEPA Eco SSL - A geometric mean of the NOAEL and LOAEL values for reproduction and growth were used. If the geometric mean of the NOAEL value was higher than the lowest bounded LOAEL for reproduction, growth or mortality results, the highest bounded NOAEL (and its associated LOAEL) below the lowest bounded LOAEL for reproduction, growth, or survival was used.
(b) Most conservative NOAEL/LOAEL from TCEQ PCL Database
mg/kg-d = milligrams per kilogram per day.
HMW-PAHs = high molecular weight polycyclic aromatic hydrocarbons
LMW-PAHs = low molecular weight polycyclic aromatic hydrocarbons

Table 4. Food Chain Modeling Input Data
Refined Screening Level Ecologial Risk Assessment
Rockville Former MGP Site, Rockville, CT

Receptor	Body Weight (kg)	Food Ingestion Rate (kg dry weight/day)	Sediment Ingestion (kg sediment/day)	Water Ingestion Rate (L/day)	Home Range (acres)	Seasonal Use Factor (%)	Area Use Factor (AUF) (%)	Food Item Percentages
Raccoon (semi-aquatic)	5.597 a	0.1507 b	0.0142 c	0.459 d	568.00 e	100% a	100% g	Benthic Invertbrates = 90%, Fish 10% h

Notes:
(a) Information obtained from the *Wildlife Exposure Factors Handbook*. United States Environmental Protection Agency (USEPA), 1993. Average of all provided male and female adult values per species.
(b) Estimated food ingestion rate (kg/day dry weight) for mammalian omnivores = (0.432[Body Weight in g] $^{0.0.678}$)/1000 (Nagy, 2001).
(c) Calculated as 9.4% of food ingestion rate [Semi-Aquatic Raccoon sediment/soil ingestion rate used as surrogate (Beyer et al. 1994)].
(d) Based on water ingestion rate of 0.082g/g BW - day from Wildlife Exposure Factors Handbook (USEPA, 1993) coverted to L/day
(e) Average of lowest adult ranges proivded in Wildlife Exposure Factors Handbook (USEPA, 1993)
(g) For conservative nature of Step 3A screening, a home range of 100% was assumed
(h) TCEQ default dietary percentages
L = liters.
kg = kilogram.

Table 5. Benthic Invertebrate Exposure Estimates
Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site, Rockville, CT

Analyte	Sediment TEC (mg/kg) (a)	Sediment PEC (mg/kg) (a)	Upstream EPC (mg/kg)	Site EPC (mg/kg)	Upstream Benthic Invertebrate HQs		Site Benthic Invertebrate HQs	
					TEC HQ	PEC HQ	TEC HQ	PEC HQ
Total PAHs	1.61	22.8	40.9	40.1	25.39	1.79	24.9	1.76

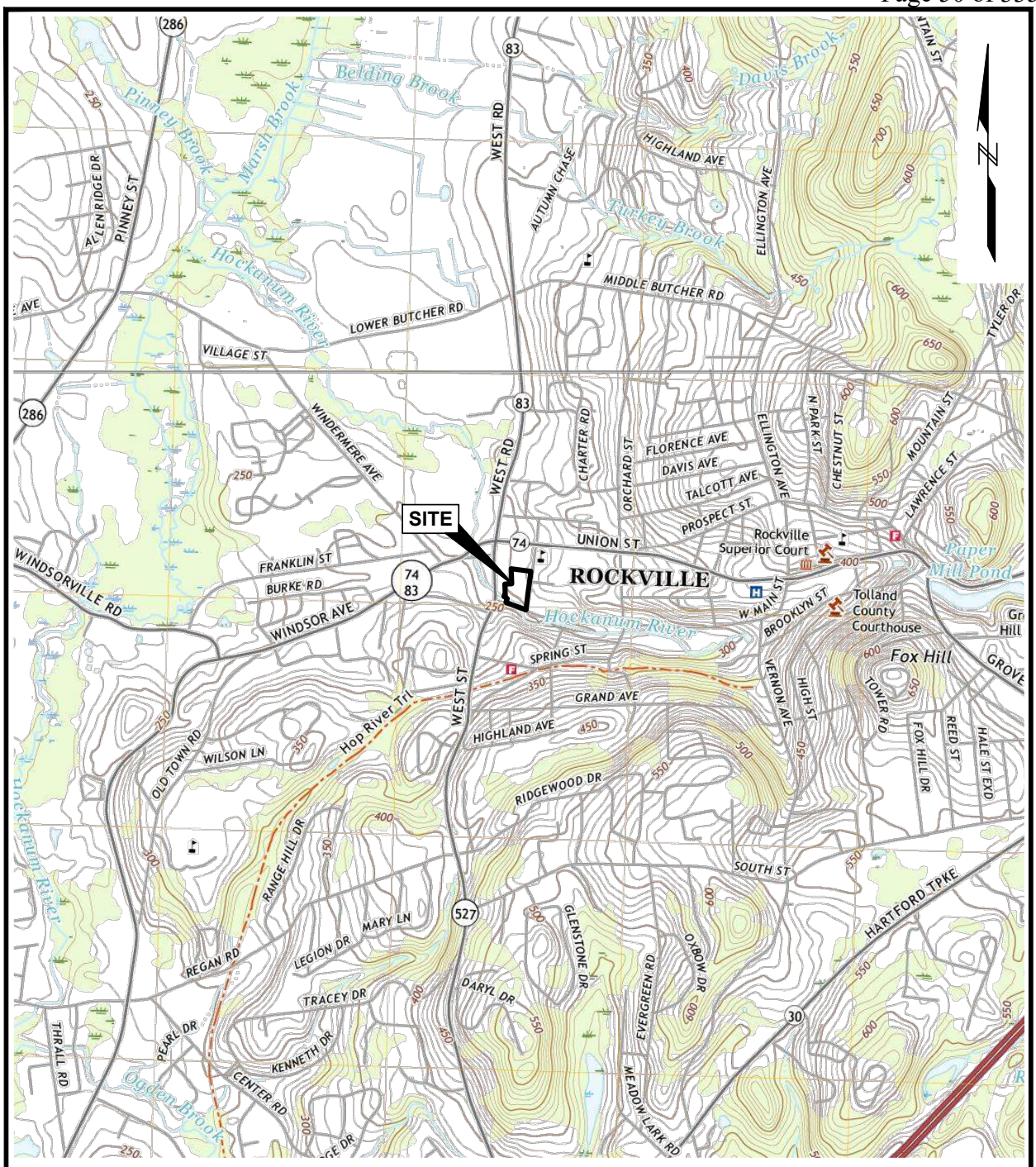
Notes:
(a) Information obtained from Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. MacDonald, Ingersoll, and Berger, 2000.
EPC = Exposure Point Concentration (95% Upper Confidence Limit, derived from ProUCL Software).
mg/kg = milligram per kilogram.
HQs = Hazard Quotients.
TEC = Threshold Effect Concentration.
PEC = Probable Effect Concentration.
Shaded cells indicate HQs equal to or greater than 1.0.

Table 6. Raccoon Exposure Estimates
Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site, Rockville CT

Analyte	Sediment EPC (mg/kg)	Sediment Ingestion Rate (a) (kg/day)	Area Use Factor (a)	Dose from Sediment (b) (mg/kg/day)	Dietary Ingestion Rate (a) (kg/day)	Sediment to Invertebrate BAF (c)	Sediment to Fish BAF (c)	Dose from Diet (d) (mg/kg/day)	Average Body Weight (a) (kg)	Seasonal Use Factor (a)	Average Daily Dose (f) (mg/kg/day)	Toxicity Reference Value (TRV) (g)		Hazard Quotient (HQ)	
												(NOAEL)	(LOAEL)	NOAEL HQ	LOAEL HQ
Total HMW-PAHs	31.7	0.0142	100%	0.080	0.1507	2.36	0.06	1.811	5.5970	100%	1.89	0.62	3.07	**3.08**	0.62
Total LMW-PAHs	8.7	0.0142	100%	0.022	0.1507	2.25	0.43	0.472	5.5970	100%	0.49	65.60	328.00	0.01	0.00
Total PAHs	40.1	0.0142	100%	0.101	0.1507	2.32	0.20	2.252	5.5970	100%	2.35	10.00	40.00	0.24	0.06

Notes:
EPC = Exposure Point Concentration (95% Upper Confidence Limit, derived from ProUCL Software).
HMW-PAHs = high molecular weight polycyclic aromatic hydrocarbons
LMW-PAHs = low molecular weight polycyclic aromatic hydrocarbons
mg = milligrams.
kg = kilograms
Shaded cells indicate HQs equal to or greater than 1.0.
(a) Value references Ingestion Rates, Range, and Body Weight for Aquatic Receptors Table.
(b) Dose from Sediment = (Concentration of Contaminant in Sediment * Sediment Ingestion Rate * Area Use Factor) / Average Body Weight.
(c) Information obtained from TCEQ's Conducting Ecological Risk Assessments at Remediation Sites in Texas. RG-263 (Revised January 2017).
(d) Dose from Diet = (Concentration of Contaminant in Sediment * Dietary Ingestion Rate * BAF * Area Use Factor) / Average Body Weight.
(e) Dose from Water = (Concentration of Contaminant in Surface Water * Dietary Ingestion Rate * BAF * Area Use Factor) / Average Body Weight.
(f) Average Daily Dose = (Dose from Sediment + Dose from Diet + Dose from Water) * Seasonal Use Factor.
(g) Value references Mammalian NOAEL Toxicity Reference Values Table.

Figures



SOURCE:
MAP CREATED ROCKVILLE, CT QUADRANGLE, 7.5-MINUTE USGS TOPOGRAPHIC MAP, 2021 AND ELLINGTON, CT QUADRANGLE, 7.5-MINUTE USGS TOPOGRAPHIC MAP, 2021.

Refined Screening Level Ecological Risk Assessment Rockville Former MGP Site Rockville, Vernon, Connecticut	GEI Consultants	SITE LOCATION MAP
Eversource Energy Berlin, Connecticut	Project 2200138	March 2023 Fig. 1

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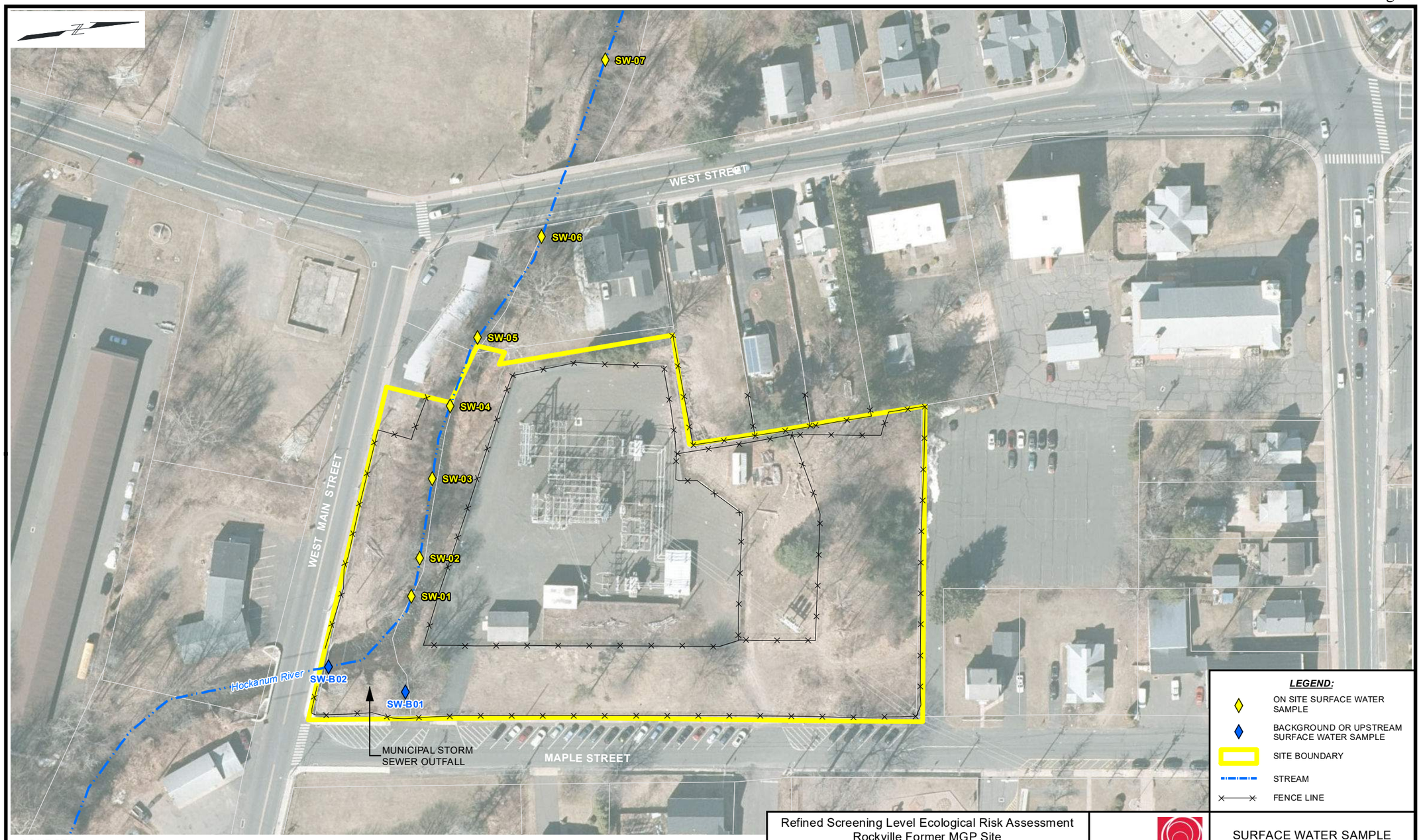

SOURCES:
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2. WORLD IMAGERY LAYER, Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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SCALE, FEET

Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site
Rockville, Vernon, Connecticut

Eversource Energy
Berlin, Connecticut

GEI Consultants

SURFACE WATER SAMPLE LOCATIONS (2022)

Project 2200138 | March 2023 | Fig. 2

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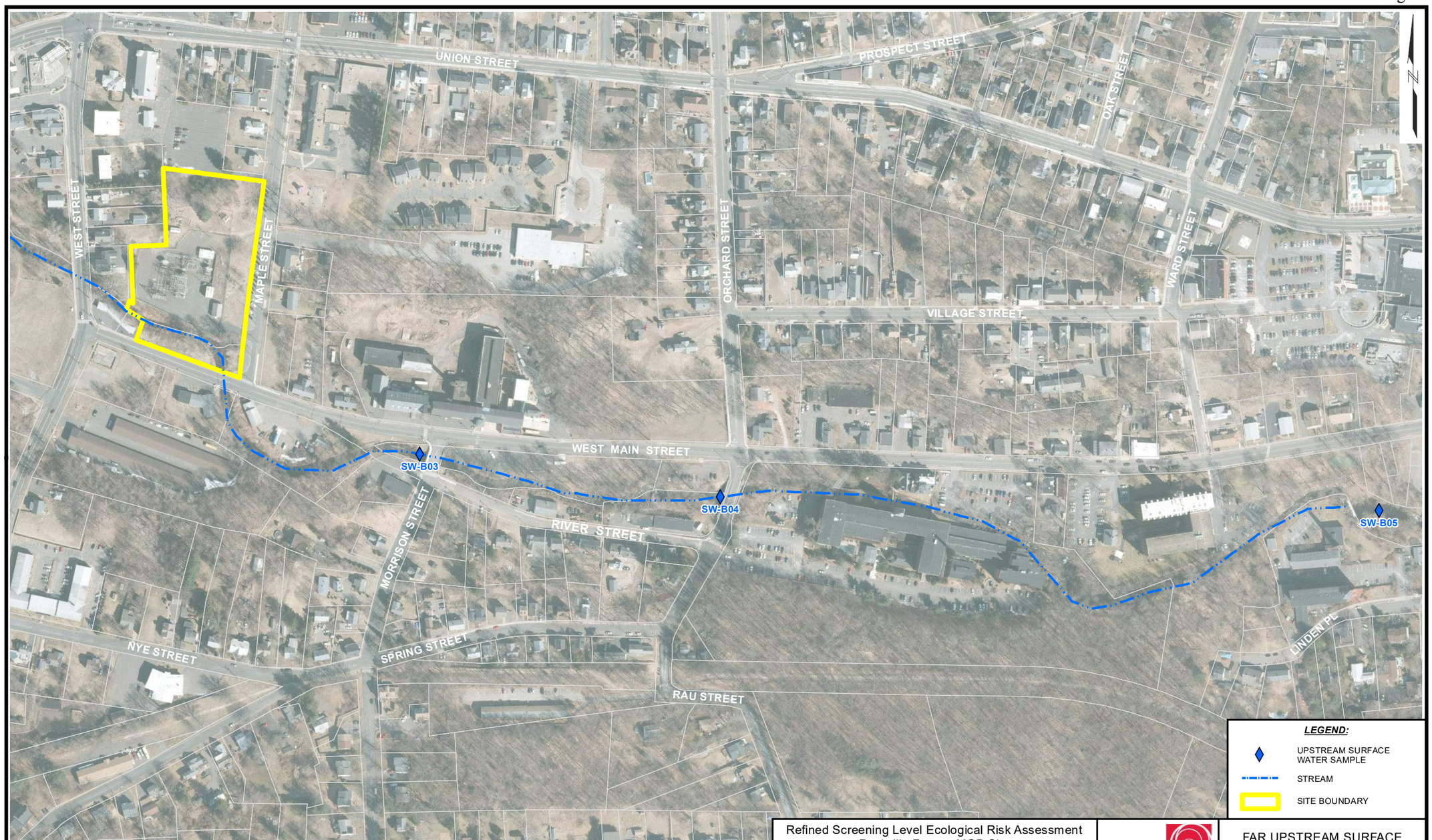

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Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site
Rockville, Vernon, Connecticut

Eversource Energy
Berlin, Connecticut

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FAR UPSTREAM SURFACE WATER SAMPLE LOCATIONS (2022)

Project 2200138 | March 2023 | Fig. 3

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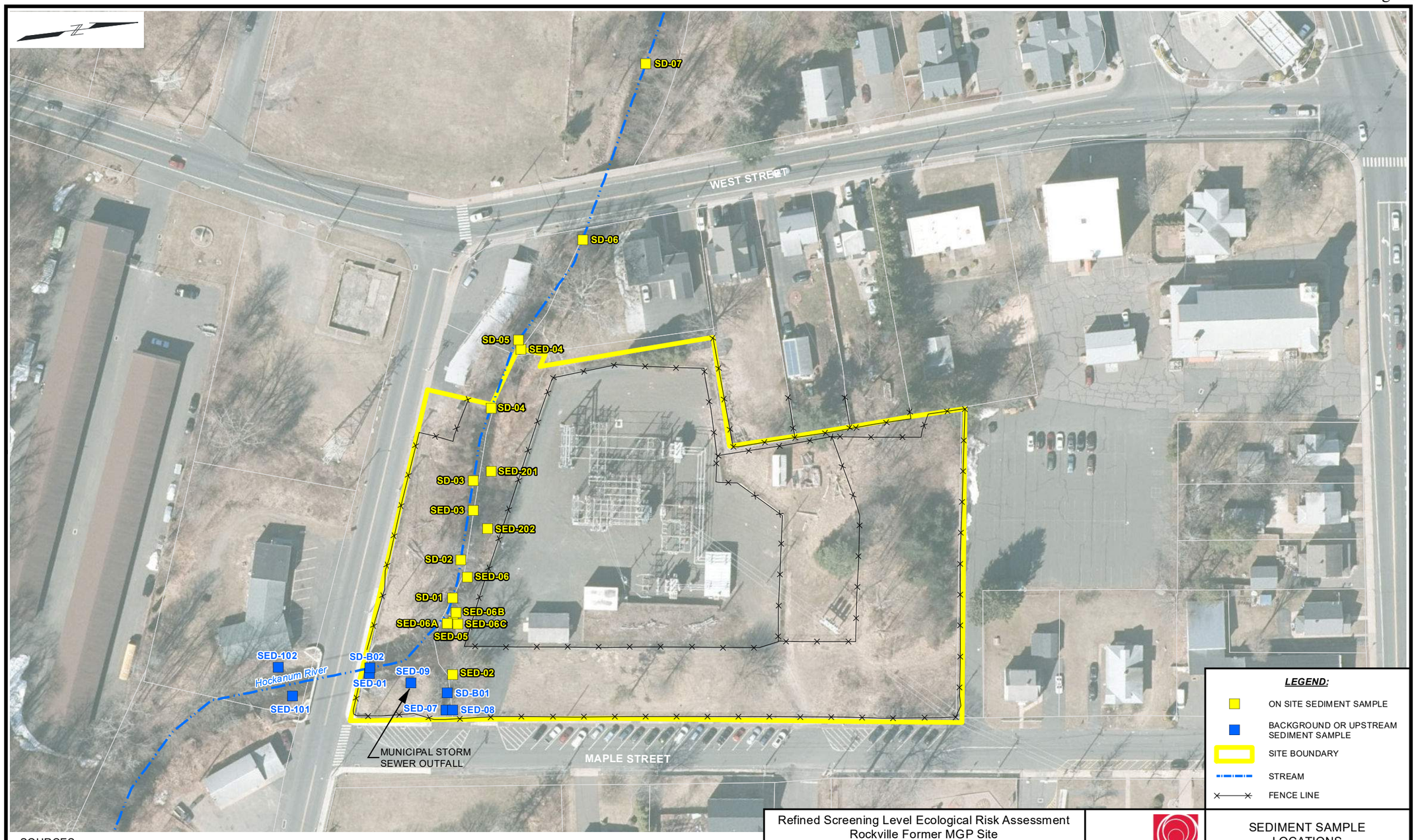

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Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site
Rockville, Vernon, Connecticut

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Berlin, Connecticut

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SEDIMENT SAMPLE LOCATIONS
(2017 - 2022)

Project 2200138 | March 2023 | Fig. 4

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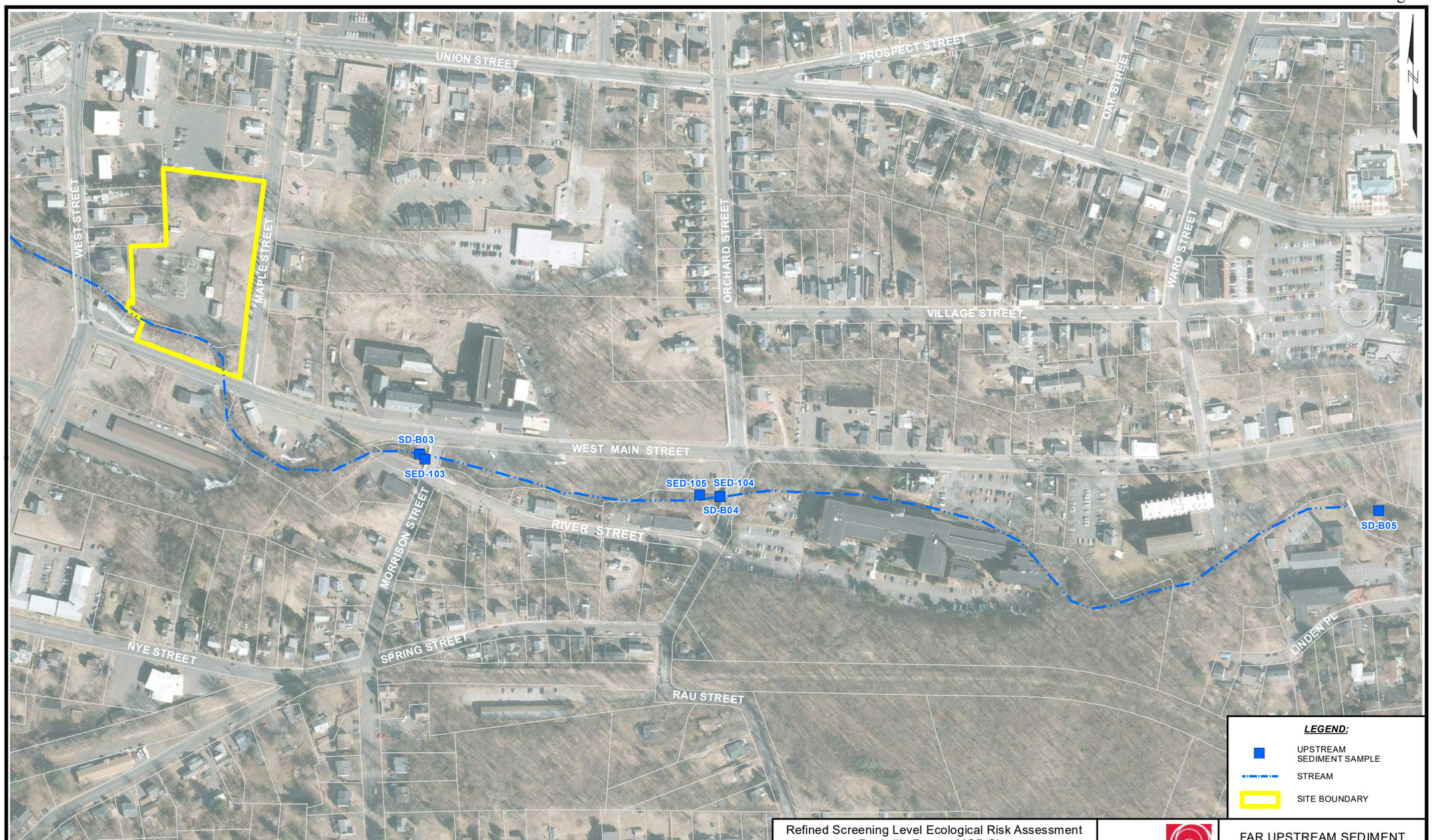

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SCALE, FEET

Refined Screening Level Ecological Risk Assessment
Rockville Former MGP Site
Rockville, Vernon, Connecticut

Eversource Energy
Berlin, Connecticut

GEI Consultants

FAR UPSTREAM SEDIMENT SAMPLE LOCATIONS (2017 - 2022)

Project 2200138 | March 2023 | Fig. 5

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Appendix A

Exponent 2021 Screening-Level Ecological Risk Assessment

Ecological & Biological Sciences

Screening-Level Ecological Risk Assessment, Rockville Former Manufactured Gas Plant Site 13 Maple Street/West Main Street Rockville, Vernon, Connecticut REM ID: 12390

Exponent®

Screening-Level Ecological Risk Assessment, Rockville Former Manufactured Gas Plant Site 13 Maple Street/West Main Street Rockville, Vernon, Connecticut REM ID: 12390

Prepared for

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March 30, 2021

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Acronyms and Abbreviations

%	percent
BAF	bioaccumulation factor
BCC	bioaccumulative chemical compound
BERA	baseline ecological risk assessment
CTDEEP	Connecticut Department of Energy and Environmental Protection
CL&P	Connecticut Light and Power Company
CoPEC	chemical of potential ecological concern
dba	doing business as
Eco-SSL	ecological soil screening level
ECOTOX	ECOTOXicology database
EPC	exposure point concentration
ERA	ecological risk assessment
ERAGS	Ecological Risk Assessment Guidance for Superfund
Eversource	Eversource Energy
ETPH	Extractable Total Petroleum Hydrocarbons
SL	screening level
ESV	ecological screening value
ft	feet
FWS	U.S. Fish and Wildlife Service
HQ	hazard quotient
LOAEL	lowest-observed-adverse-effect level
MDC	maximum detected concentration
MGP	manufactured gas plant
MRL	maximum reporting limit
NDDB	Natural Diversity Data Base
NOAEL	no-observed-adverse-effect level
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
RCRA	Resource Conservation Recovery Act
RSV	refined screening value
RSR	Remediation Standard Regulations
SLERA	screening-level ecological risk assessment
SVOC	semi-volatile organic compound
TEC	threshold effect concentration
TEL	threshold effect level
TPH	total petroleum hydrocarbon
TRV	toxicity reference value
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound
VRP	Voluntary Remediation Program

1 Introduction

On behalf of The Connecticut Light and Power Company (CL&P) dba Eversource Energy (Eversource), Exponent, Inc., under contract to Tighe and Bond, Inc. (Tighe & Bond), has prepared this screening-level ecological risk assessment (SLERA) for the Rockville Former Manufactured Gas Plant (MGP) site located at 13 Maple Street/West Main Street in Rockville, Vernon, Connecticut, referred to as the Site. The Site location is provided on Figure 1.

This SLERA was developed as a component of the Phase III Environmental Site Assessment (ESA) of the Site, which is being conducted by Tighe & Bond, Inc. (Tighe & Bond) to assess potential exposure pathways to ecological receptors at the Hockanum River. The Phase III ESA is being completed under the Connecticut Department of Energy and Environmental Protection (CTDEEP) Voluntary Remediation Program (VRP). The SLERA was prepared, as described by United States Environmental Protection Agency (U.S. EPA) guidance (U.S. EPA 1992, 1997), for the Rockville Former MGP Site. The SLERA includes a site description and habitat characterization, identification of complete exposure pathways, and a screening-level exposure estimate and risk calculation (U.S. EPA 1997).

The SLERA is based on U.S. EPA guidance per CTDEEP recommendation and considers the following key guidance documents:

- **The U.S. EPA Framework for Ecological Risk Assessment (Framework)** (U.S. EPA 1992) – The Framework describes a consistent approach for conducting an ecological risk assessment (ERA), it also identifies key issues, and defines terms used in ERA. The ERA process was developed to be flexible while providing a logical and scientific structure to accommodate a broad array of stressors. Guidance documents followed to further the ERA concepts presented in the Framework.
- **The U.S. EPA Ecological Risk Assessment Guidance for Superfund (ERAGS)** (U.S. EPA 1997) – ERAGS is specific guidance establishing the fundamental tiered process for conducting an ERA at hazardous waste sites. This SLERA focuses on the first two steps of the ERA process.
- **Guidelines for Ecological Risk Assessment (Guidelines)** (U.S. EPA 1998) – The Guidelines focus on the processes of ERA to improve the quality and consistency of ERAs conducted for hazardous waste sites.

The objective of a SLERA is either to provide a defensible conclusion that negligible ecological risk exists or show that certain chemicals and exposure pathways can be eliminated from further consideration in the ERA process (U.S. EPA 1997). The pathways assessment is a critical step in this process, because it can be used to determine which complete exposure pathways do not exist, and could not exist in the future, and therefore, to conclude that present or future ecological impacts are negligible for these incomplete pathways. The ERAGs Guidance (U.S. EPA 1997) states that a SLERA may reach one of the following conclusions:

- There is adequate information to conclude that ecological risks are negligible, and therefore, no need exists for remediation based on ecological risk.
- The information is inadequate to make a decision at this point, and the ERA process will continue.
- The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

If a SLERA supports the first conclusion (i.e., negligible risk), the ERA process ends with an appropriately performed and documented SLERA.

According to the ERAGs Guidance (U.S. EPA 1997), the SLERA contains two steps:

- Step 1. Screening-level problem formulation. The intent of the first step is to develop the ecological conceptual site model (CSM) that describes how biota may be exposed to hazardous chemicals present in Site media. This step involves assessing the habitat quality, environmental media of concern, and exposure pathways that could result in biota exposure to hazardous chemicals.
- Step 2. Screening-level exposure estimate and risk calculation. The purpose of the second step is to evaluate whether maximum exposure estimates of chemicals of potential ecological concern (CoPECs) warrant further evaluation in a site-specific ERA (also called a baseline ecological risk assessment [BERA]). The outcome of this second step is highly conservative because it is based on conservative assumptions of exposure. Because of this conservativeness, this step is used to eliminate any CoPECs or pathways that do not present a potential for adverse effects to biota present at the Site.

2 Site Conditions

This section provides a brief summary of the site description, site history, previous investigations, and available data. This section also describes the habitats present at the Site and species of concern. Finally, this section presents an evaluation of ecological habitats and exposure pathways.

2.1 Site Description and History

The Site is located at 13 Maple Street/West Main Street, Rockville, Vernon, Connecticut. The Site is the former MGP property, which is currently used by Eversource as an electrical substation (Rockville 14W) to supply electricity to the surrounding community (Figure 2). The Site is on 3.43 acres of land, which consists of a 2.88-acre parcel located at 13 Maple Street and a second 0.55-acre parcel located at West Main Street. The 2.88-acre parcel contains the active substation, whereas the 0.55-acre parcel on the south side of the substation parcel contains a portion of the Hockanum River (Figure 3). The Hockanum River flows through the southern portion of the Site and is classified by CTDEEP as Class B waters, meaning that it is designated for use as navigation, recreation, industrial and agricultural water supply, and potential habitat for fish and other aquatic life and wildlife. The river receives stormwater discharges from outfalls along Maple Street at the Site as well as multiple upstream stormwater outfalls. Historical outfall pipes were noted along the river at the Site as discussed below in Sections 2.2.3 through 2.2.5.

The Site is in a developed part of Vernon, Connecticut, and mostly surrounded by properties that are zoned as Historic District Neighborhood. To the west of the Site are residential lots, to the northeast of the Site is the Town of Vernon Maple Street School, to the north of the Site are paved areas for St. Joseph Church, and to the south of the Site is West Main Street and developed lots (Figure 2).

Formerly, a MGP was located at the Site and operated from 1863 until the 1950s when natural gas was brought to the region (Tighe & Bond 2017). Gas production occurred until circa mid-1930s after which the Site appears to have been primarily used for gas storage. A portion of the gas produced was also used to generate electricity at the plant. The MGP manufactured gas from coal using both coal gas and water gas productions methods. The primary by-products of the gasification process were tar, coke, and ammonia liquors that were recycled or sold where possible. Gas purifier wastes were also produced as part of gas manufacturing. Chemicals associated with these by-products include polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), sulfides, cyanides, and ammonia. Inorganic chemicals such as metals can be found in higher concentrations in purifier wastes at MGP sites; however, purifier waste deposits have not been encountered during the Phase III ESA investigations.

Historically, the Hockanum River was integral to the industrial development of Rockville. The river was dammed and re-channelized for waterpower for multiple textile mills. Fill materials were likely used during initial development of the area based upon the Phase III ESA investigations completed between the Hockanum River and West Main Street at the Site.

Eleven historical mill complexes operated upstream of the Site, including the nearby Hockanum Mill and Springville Manufacturing Company mill complexes. Based upon textile manufacturing processes at the time waste products likely could have included dyes (including coal-tar derived dyes), chromium salts, copper sulfate, zinc chloride, mineral oils, sulfuric acid and soda ash. Prior to the development of the sewer system in the late 1890s, process wastes from textile manufacturing could have been discharged to the ground or possibly directly to the river; however, the specific waste disposal practices are unknown. Following World War II, the textile industry in the region began to decline which continued through the following decades after which, many of the mills were left abandoned or underutilized.

2.2 Previous Investigations and Available Data

The Phase I Environmental Site Assessment Report for the Site (Tighe & Bond 2017) describes in detail previous investigations that took place at the Site. The relevant investigations and available data for this SLERA are described in this section.

2.2.1 Manufactured Gas Plant Site Investigation: Rockville, March 1992

In 1990, the Northeast Utilities Service Company conducted a site investigation to assess impacts to the Site and its surroundings from the former Rockville MGP (Northeast Utilities Service Company 1992). The investigation included soil and groundwater sampling as well as the collection of four river sediment and five surface water samples from the Hockanum River. One sediment and surface water station was located upstream of the former MGP (Station A), two stations were located adjacent to former MGP (Stations B and C), and one station was located downstream of the former MGP (Station D) (Figure 4). Sediment samples were collected by grab sample within 6 ft of the shore and surface water samples were collected by grab sample. The sediment and surface water samples were analyzed for VOCs, semi-volatile organic compounds (SVOCs) including PAHs, metals and cyanide. Chemical concentration data for sediment and surface water samples from the 1990 sampling event are available only for analytes that were detected at least once in the respective medium.

2.2.2 Rockville Manufactured Gas Plant Site, Field Summary Report (1994), April 1995

In summer and fall of 1994, the Northeast Utilities Service Company conducted various field sampling at the former Rockville MGP Site (Northeast Utilities Service Company 1995). The field sampling was conducted to support the development of a human health risk assessment for

the Site, and samples included surficial soil as well as sediment and fish from the Hockanum River. Three sediment samples were collected: two samples were collected from stations (R-SED-A and R-SED-B) adjacent to the former MGP and one station (R-SED-C) at the edge of the property downstream of the former MGP (Figure 4). Sediment samples were collected from the 5 to 12 inches below the riverbed because the river bottom at depths between 0 and 5 inches was very hard. The sediment samples were analyzed for VOCs, PAHs, total petroleum hydrocarbons (TPH), Aroclor polychlorinated biphenyls (PCBs), Resource Conservation Recovery Act (RCRA)-13 metals, pH, and cyanide (total and amenable). Fish (white sucker) samples were collected by seine net. The fish were generally 10 to 16 inches long and weighed approximately one to two pounds. Fish were composited into seven fish samples and were analyzed for PAHs, Aroclor PCBs, RCRA-8 metals, and total cyanide.

2.2.3 Tighe & Bond Sediment and Surface Water Sampling in 2017

Tighe & Bond collected sediment and surface water samples from the Hockanum River in 2017 since sediment samples collected previously were approximately 26 to 30 years old and no longer represent current conditions near the Site.

On November 13, 2017, Tighe & Bond collected sediment samples from six locations (SED-01, SED-02, SED-03, SED-04, SED-05, and SED-06) in the Hockanum River and one field duplicate sample from location SED-02 (Figure 5). Sediment was collected using decontaminated stainless-steel hand sampling tools from within the top six inches of the sediment surface (surficial samples) in areas typically downstream of rocks in depositional zones. This sampling strategy increased the opportunity to detect potential chemicals in the sediment. The following are descriptions of the sediment samples and locations:

- SED-01: Brown, medium to coarse sand, some gravel, and little silt. The sample was collected at the upstream Site boundary in an area of finer sediment at the bridge.
- SED-02: Brown, fine to medium sand, trace silt, and abraded asphalt in sand. Bricks and concrete were observed nearby. The sample was collected at the confluence of stream and downstream from the outfalls from Maple Street, discussed below in Section 2.2.4.
- SED-03: Brown, medium to coarse sand, little gravel, trace silt, and trace pieces of fill (glass and brick were present). The sample was collected near the previous sediment sample SED-B.
- SED-04: Brown/ Dark Brown, medium to coarse sand, little gravel, and little pieces of fill (glass and brick were present). The sample was collected at the downstream Site boundary near the previous sediment sample SED-C.
- SED-05: Brown, medium to coarse sand, some gravel, trace silt, and possible paint chips. Bricks and concrete were observed nearby. The sample was

collected downstream of SED-02 and upstream of samples SED-03, SED-04, and SED-06.

- SED-06: Brown, medium to coarse sand, some gravel, and trace silt. The sample was collected adjacent to cast iron steel outfall pipes in the northern back of the river and near the previous sediment sample SED-A.

The sediment samples were analyzed for CT extractable total petroleum hydrocarbons (ETPH), 15 metals (antimony, arsenic, barium, beryllium, cadmium, chromium (total), copper, lead mercury, nickel, selenium, silver, thallium, vanadium, and zinc), cyanide (total), PCB Aroclors, SVOCs, VOCs and total organic carbon.

On November 13, 2017, Tighe & Bond collected surface water samples from four locations (SW-01, SW-02, SW-03, and SW-04) in the Hockanum River and one field duplicate sample from station SW-01 (Figure 5). The SW-01, SW-02, SW-03, and SW-04 surface water stations were collocated with the sediment SED-01, SED-02, SED-03 and SED-04 stations, respectively. The surface water samples were analyzed for CT ETPH, 15 metals (antimony, arsenic, barium, beryllium, cadmium, chromium (total), copper, lead mercury, nickel, selenium, silver, thallium, vanadium, and zinc), cyanide (total), SVOCs, and VOCs.

2.2.4 Tighe & Bond Sediment Sampling in 2018

Tighe & Bond collected additional sediment samples from the Hockanum River in 2018 to investigate: 1) a sediment location where the 2017 sediment sample (SED-06) contained an elevated concentration of copper (2,190 mg/kg) and, 2) possible sources of off-site contamination to Hockanum River near the Site.

On August 28, 2018, Tighe & Bond collected sediment samples from six locations (SED-06A, SED-06B, SED-06C, SED-07, SED-08, and SED-09) near the Site and one field duplicate sample from station SED-07 was sampled (Figure 5). The following are descriptions of the new sediment samples and locations:

- SED-7: Medium to coarse sand. The sample was collected at the base of the plastic outfall pipe from Maple Street that conveys stormwater drainage from the Maple Street right-of-way and upgradient properties.
- SED-8: Medium to coarse sand. The sample was collected from within the stone masonry constructed outfall at Maple Street. The outfall was associated with the former Hockanum Mill, located approximately 270 ft to the east, and reportedly discharged to the Hockanum River during the operation of the mill.
- SED-9: Fine silty sand. The sample was collected from concrete outfall pipe located near the intersection of the Maple Street and West Main Street and likely receives stormwater drainage from near the intersection of Maple and West Main Street.

Sediment was collected using decontaminated stainless-steel hand sampling tools from within the top six inches of the sediment surface in areas typically downstream of rocks in depositional zones. The sediment samples SED-06A, SED-06B, and SED-06C were only analyzed for copper to determine if the copper concentrations in the 2017 SED-06 sample could be replicated and delineated. The sediment samples SED-07, SED-08 and SED-09 and the field duplicate sample were analyzed for CT ETPH, CTDEEP RSR 15 metals list (antimony, arsenic, barium, beryllium, cadmium, chromium (total), copper, lead mercury, nickel, selenium, silver, thallium, vanadium, and zinc), cyanide (total), PCB Aroclors, SVOCs, and VOCs.

2.2.5 Tighe & Bond Sediment Sampling in 2021

Tighe & Bond collected additional sediment samples from the Hockanum River in 2021 to investigate the locations of former outfall pipes associated with substation piping based upon historical plans along the Hockanum River to determine if they could have contributed to chemical contamination of the river in those areas. Only sediment samples were collected since the pipe outfalls could not be located.

On February 28, 2021, Tighe & Bond collected sediment samples from two locations (SED-201, and SED-202) just downstream of the two pipes along the Hockanum River at the Site (Figure 5). The following are descriptions of these sediment samples:

- SED-201: Medium to coarse sand with little gravel and brick fragments.
- SED-202: Fine to medium sand and organic materials with little silt.

Sediment was collected using decontaminated stainless-steel hand sampling tools from within the top six inches of the sediment surface. The sediment samples SED-201 and SED-202 were analyzed for CT ETPH, 15 metals (antimony, arsenic, barium, beryllium, cadmium, chromium (total), copper, lead mercury, nickel, selenium, silver, thallium, vanadium, and zinc), cyanide (total), PCB Aroclors, 17 PAHs, grain size, and total organic carbon.

2.3 Habitat Characterization

The Site is approximately 3.4 acres and currently contains an active electrical substation that is surrounded by a chain-link fence. Along the southern portion of the Site is a portion of the Hockanum River, which flows in a northwestern direction across that portion of the Site. Much of the Site is developed land used for the electrical substation. The remaining area includes the Hockanum River and narrow wooded areas along the Hockanum River to the western and southern portions of the Site. The Site is surrounded by streets and developed land. To the north of the Site is the former St. Joseph School, St. Joseph Church, the church parking lot, and residences. To the east of the Site is Maple Street and residences. To the south of the Site is West Main Street and other developed lots including a home heating oil supplier Gottier Fuel, which has a large aboveground fuel oil storage tank adjacent to the Hockanum River. To the west of the Site are residences. Thus, the Site currently provides fragmented habitat for aquatic

life and semi-aquatic wildlife associated with the section of the Hockanum River that flows through the Site.

The Hockanum River begins at the outlet of Shenipsit Lake in Rockville and flows through Vernon, Ellington, Manchester, and East Hartford for about 23 miles before terminating at the Connecticut River. The portion of the Hockanum River present at the Site was narrow (approximately 21 to 25 ft wide) and shallow (approximately 0.5 ft in depth in areas with riffles and runs and approximately 3 ft in depth in pooled areas) when Exponent, Inc. (Exponent) conducted a site visit on September 28, 2020. The river is what is called a losing stream, meaning that groundwater does not flow into it, but surface water from the stream moves into the surrounding groundwater (Tighe & Bond 2017). Historically, the river was used heavily for industry, but the stretches of the riverbank have been redeveloped as parks and hiking trails. The Hockanum River can support aquatic life, such as benthic invertebrates and fish, amphibians, and a variety of water-dependent birds and mammals.

2.4 Species of Special Concern and Sensitive Habitats

According to the CTDEEP Natural Diversity Data Base (NDDB), which was updated in June 2020, the Site is not located within a Natural Diversity Area (Figure 6). The NDDB represents the approximate location of endangered, threatened, and special concern species and significant natural communities in Connecticut. This is consistent with previous investigations and an EPA report (U.S. EPA 1994) that indicated that there were no Federally Endangered Species or Connecticut Species of Concern at the Site. The closest record was more than a mile downstream.

In addition, the NDDB freshwater mussel map shows that the Site is not near any state listed freshwater mussel species (Figure 7). Another species of concern in Connecticut is northern long-eared bat and the Site is not located in area with known places of hibernation for this bat species (Figure 8).

2.5 Evaluation of Ecological Habitats and Exposure Pathways

The following conditions must be met for an area to be considered habitat in the context of an ERA at a site and for that area to be carried forward for further evaluation, within the SLERA:

- Upland (terrestrial) habitat
  - A hazardous constituent release to soil occurred (as documented or inferred from information from previous investigations)
  - The upland habitat is undeveloped and is of sufficient size to support potential ecological receptors
  - The upland habitat is sufficiently accessible to potential ecological receptors

  - The upland habitat will continue to support potential ecological receptors into the foreseeable future.

- Aquatic habitat
  - A hazardous constituent release to the water body occurred (as documented or inferred from information from previous investigations)
  - The water body is of sufficient size and hydroperiod to support potential ecological receptors
  - The water body is sufficiently accessible to potential ecological receptors
  - The water body will continue to support potential ecological receptors into the foreseeable future.

The upland areas present at the Site are currently developed and mostly covered by the electrical substation footprint where the former MGP was located. Small, fragmented wooded areas are found near the Hockanum River on the southern and western portion of the Site, but they provide little to no significant habitat to terrestrial receptors as these areas are discontinuous corridors surrounded by developed lots and streets. Therefore, the upland areas on the Site will not be evaluated in the SLERA.

For aquatic habitats on Site, the stretch of the Hockanum River on the Site provides habitat for aquatic life and some wildlife that may use aquatic areas to feed. Hazardous constituents from the MGP activities may have been historically transported to the river. Previous investigations found fill materials in the southern boundary of the Inner Substation fence along the bank of the Hockanum River. In addition, two cast iron pipes were found near the current southeast corner of the inner substation fence; however, the use of the pipes is unknown (Tighe & Bond 2017). Of note, the river also received stormwater runoff from paved roads and historically received wastes from mills upstream of the Site. The Hockanum River is of sufficient size and flows year-round to support potential ecological receptors. In addition, the river is accessible to potential ecological receptors, such as amphibians, fish, benthic invertebrates, birds and mammals. However, this stretch of the Hockanum River is within a developed area and those species that are more tolerant to human activities are more likely to use this stretch of the river. The Hockanum River will continue to support aquatic life and limited semi-aquatic wildlife into the foreseeable future.

3 Screening-level Problem Formulation

The problem formulation step in the SLERA summarizes and identifies complete exposure pathways, assessment and measurement endpoints, and the process for selecting CoPECs.

3.1 Site Visit

On September 28, 2020, Ms. Margaret McArdle, an ecotoxicologist and ecological risk assessor with Exponent, conducted a site visit to assess site conditions and habitat characteristics of the Hockanum River to evaluate potential exposure pathways for the SLERA and identify ecological receptors that could use the Site.

During the site visit, Ms. McArdle observed the following species:

- Fishes, including small minnows (*Cyprindae* sp.)
- Invertebrates, including water striders (order Heteroptera)
- Amphibians, including green frog (*Rana* sp.).

These observations provide field evidence that the Site is capable of supporting small fish species, juvenile fish, aquatic invertebrates, and amphibians. In addition, the habitat appears to be capable of supporting the following species as some portion of their habitat, although Ms. McArdle did not directly observe them during her site visit:

- Larger fish species, such as centrachids (e.g., bluegill sunfish) and bottom dwelling fish (e.g., suckers and bullheads)
- Semi-aquatic birds and mammals (e.g., mallard,[1] great blue heron, and raccoon).

Ms. McArdle looked for but did not find any sheens or other visible hazardous waste associated with the former MGP in the river or along the bank. However, the riverbank and bed did contain plastic bags, broken glass, plastics, fabric, bricks, asphalt pieces and other debris from historical filling of the riverbanks.

[1] A type of dabbling duck.

3.2 Exposure Pathways and Conceptual Site Model

The primary sources of chemicals to the Hockanum River at the Site could be historic fill materials from the former MGP as well as outfall pipes to the river that originate in the northern bank of the river near the former MGP area, former outfall pipes that were located in the northern river back at the current substation, stormwater outfall pipes along Maple Street, and the historic outfall associated with the Hockanum Mill. This stretch of the Hockanum River is characterized as a "losing stream", meaning that the stream is not replenished by nearby groundwater, rather the surface water replenishes the nearby groundwater. Based upon Tighe & Bond Phase III ESA investigations, groundwater to the north of the Hockanum River in the area of the former MGP and substation flows northward away from the river. Therefore, chemicals in groundwater from the Site are unlikely to migrate to the Hockanum River through this pathway. Chemicals in the fill material could reach the river sediment and surface water. In addition, pipes found along the riverbank from the former MGP area could have historically discharged MGP-related chemicals to the river surface water and deposited on sediments. The Site is located with an urban area and conditions at the Site are also likely to be influenced by urban runoff and upstream point sources.

Benthic invertebrates, amphibians and fish within the Hockanum River at the Site could be exposed to chemicals associated with the former MGP and other sources, e.g., urban runoff, via direct contact and ingestion of contaminated surface water and sediment as well as ingestion of contaminated prey. In addition, omnivorous and piscivorous wildlife may drink and feed from the Hockanum River and be exposed to chemicals associated with the former MGP through ingestion of surface water, sediment and biota. Direct contact with contaminated sediment and surface water is considered an incomplete pathway for wildlife since their time in the river is often limited. Food-chain pathways for herbivores would likely be limited due to the little aquatic vegetation observed in this stretch of the Hockanum River; however, herbivorous birds could use this stretch of the river to dabble for aquatic vegetation occasionally. The ecological conceptual site model for the Hockanum River portion of the Site is shown in Figure 9.

3.3 Assessment and Measurement Endpoints

U.S. EPA guidance (U.S. EPA 1997) states that "assessment endpoints focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals from the site." According to this guidance, the selection of assessment endpoints depends on:

- The chemicals present and their concentrations
- Mechanisms of toxicity of the chemicals to different groups of organisms
- Ecologically relevant receptor groups that are potentially sensitive or highly exposed to the chemical and attributes of their natural history
- Potentially complete exposure pathways.

Metals, PAHs, other SVOCs, and VOCs were detected in Site media and thus need to be evaluated in the SLERA. Aquatic life, amphibians, and semi-aquatic wildlife may be exposed to these CoPECs in the Hockanum River through the exposure pathways shown in the conceptual site model (Figure 9). Therefore, the assessment endpoints selected for this SLERA are as follows:

1. Survival, growth, and reproduction of benthic invertebrates that live in the Hockanum River sediments near the Site
2. Survival, growth, and reproduction of amphibians that live in the Hockanum River surface water near the Site
3. Survival, growth, and reproduction of fishes that live in the Hockanum River sediment and surface water near the Site
4. Survival, growth, and reproduction of semi-aquatic wildlife, as represented by the mallard, great blue heron, and raccoon, that could use the Hockanum River near the Site.

The assessment endpoints were selected in accordance with U.S. EPA guidance (U.S. EPA 1997). The assessment endpoint represents ecologically relevant receptor groups that are the most highly exposed to the hazardous chemicals and also considers the potentially complete exposure pathways at the Site.

The measurement endpoint used to evaluate the above assessment endpoints are:

1. Survival, growth, and reproduction of benthic invertebrates that live in the Hockanum River sediments near the Site
    - Measurement endpoint 1 is the comparison of the exposure concentration (maximum concentration of CoPECs in the Hockanum River sediment near the Site) to sediment screening levels.
2. Survival, growth, and reproduction of amphibians that live in the Hockanum River surface water near the Site
    - Measurement endpoint 2 is the comparison of the exposure concentration (maximum concentration of CoPECs in the Hockanum River surface water near the Site) to amphibian values.
3. Survival, growth, and reproduction of fishes that live in the Hockanum River surface water near the Site
    - Measurement endpoint 3 is the comparison of the exposure concentration (maximum concentration of CoPECs in the Hockanum River surface water near the Site) to surface water screening levels.
4. Survival, growth, and reproduction of semi-aquatic wildlife, as represented by the mallard, great blue heron, and raccoon, that could use the Hockanum River near the Site.

- Measurement endpoint 4 is the comparison of the total dietary exposure (maximum concentration of CoPECs in the Hockanum River sediment, surface water, aquatic invertebrates, and fish near the Site) to toxicity reference values (TRVs) for the mallard, great blue heron, and raccoon, estimated by using simplified food-chain models.

3.4 Identification of Chemicals of Potential Ecological Concern

The selection process for selecting CoPECs is shown in Figure 10. Each medium (sediment and surface water) are analyzed separately to create two separate lists of CoPECs. The first step of the selection process is to determine if the chemical was detected or not. If the chemical is not detected, then it is determined if an appropriate ecological screening level (SL) is available and whether the maximum reporting limit (MRL) exceeds the SL. If the MRL for non-detected chemical exceeds the SL and there is historical presence (based on historical data from 1990 and 1994 sampling events) or use of chemical at the Site, then the chemical is evaluated in the uncertainty analysis. If the MRL for the non-detected chemical does not exceed the SL or there is no historical presence or use at the Site, then the chemical is eliminated as a CoPEC. If the chemical is detected, but the maximum detected concentration (MDC) does not exceed the SL or no SL is available, and the chemical is not bioaccumulative, then it is eliminated as a CoPEC. If the chemical is detected and the MDC does not exceed the SL or no SL is available, but the chemical is bioaccumulative, then the chemical is retained as a CoPEC. The process for determining if a chemical was bioaccumulative was based on a U.S. EPA document on bioaccumulation (U.S. EPA 2000). If the MDC for the detected chemical exceeds the SL, then it is retained as a CoPEC.

While SLs are useful for the purpose of selecting CoPECs and screening chemistry data, SLs are highly conservative, such that they do not take into account any site-specific characteristics that reduce bioavailability of chemicals in natural sediments and water. In addition, SLs are often derived using uncertainty factors that make the SLs 10- to 100-fold lower than the actual toxicity values on which they are based. Unlike PCBs and certain metals (e.g., cadmium, lead, and mercury), VOCs and most SVOCs are readily metabolized by ecological receptors and therefore generally not bioaccumulative. Uptake of these compounds by living organisms, and accumulation in their tissues, is not an important fate process for these chemicals; therefore, this is not a complete exposure pathway for wildlife. Thus, the bioaccumulative potential of chemicals is considered when selecting CoPECs, in addition to whether the SLs are exceeded.

Sediment and surface water samples were historically collected and chemically analyzed in 1990 and 1994 as part of early site investigations (see Sections 2.2.1 and 2.2.2), yet these historical chemistry data do not represent current conditions due to their age. However, the historical chemistry data were considered in the selection of CoPECs as described above and shown in Figure 10. More current chemistry data are available for the Hockanum River sediment and surface water and best represent current conditions. As described in Sections 2.2.3, 2.2.4, and 2.2.5, sediment and surface water samples were collected from the Hockanum

River in 2017, 2018, and 2021[2] and analyzed for CT ETPH, 15 metals, total cyanide, VOCs, SVOCs, PCB Aroclors (sediments only) and total organic carbon (sediment only) (Tables A-1 and A-2 in Appendix A; data are summarized in Tables 1 and 2). Figure 5 indicates sampling locations for current (2017, 2018, and 2021) sediment and surface water samples.

CoPEC selection for chemicals in sediment and surface water are discussed in more detail, below.

3.4.1 Sediment

Chemistry data for the 2017, 2018, and 2021 sediment samples were screened against available ecological SLs for freshwater sediments and evaluated in additional ways described above in Section 3.4 to identify CoPECs. Surficial sediment samples were collected, when possible, from the top six inches of the sediment column in the Hockanum River at the Site. Samples were analyzed for CT ETPH, metals, cyanide, VOCs, SVOCs, PCB Aroclors (Table A-1 of Appendix A contain the data used in the SLERA; data are summarized in Table 1).

Sediment samples were collected from several locations in the Hockanum River at the Site (Figure 5). Two stations (SED-02 and SED-7) had field duplicates and these results were combined as follows:

- If the results for both the primary and the field duplicate sample were detected values, then the average of the two detected values was used to represent that sample.
- If the results for both the primary and the field duplicate sample were non-detected values, then the lower reported limit was used to represent that sample.
- If the results for the primary or the field duplicate sample was a detected value and the other was a non-detected value, then the detected value was used to represent that sample.

Concentrations of chemicals in sediment were compared to available ecological SLs for freshwater sediment. The NOAA SQuiRT (Buchman 2008) was the predominant source of freshwater sediment SLs (Table 3). Buchman (2008) includes multiple SLs, listed in order of preference: Threshold Effect Concentration (TEC), Threshold Effect Level (TEL), and ARCS Threshold Level (*Hyalella azteca*) (TEL-H). If these sediment SLs were not available for a given chemical, SLs were derived from the following sources, in order of preference: Ecotox Thresholds (U.S. EPA 1996), U.S. EPA Region III BTAG Freshwater Sediment Screening Benchmarks (U.S. EPA 2006), and U.S. EPA Region 5 RCRA Ecological Screening Levels

[2] Surface water samples were collected in the 2017 sampling event but not the 2018 and 2021 sampling events. Sediment samples were collected in the 2017, 2018, and 2021 sampling events.

(U.S. EPA 2003). Finally, if no toxicity-based SLs were available, background levels provided by Buchman (2008) were used as a conservative surrogate for the ecological SL for sediment.

The complete CoPEC evaluation conducted for sediments for all measured analytes is provided in Table B-1 in Appendix B. The summary of chemicals selected as CoPECs for sediment is shown in Table 4. The following chemicals in sediment samples at the Site were retained as CoPECs:

- Ten metals– arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, vanadium, and zinc
- All of the measured PAHs.

While CT ETPH was retained as a CoPEC, it was evaluated through individual compounds in the PAH list since PAHs were detected above their respective sediment SLs.

Several analytes in the sediment samples, including antimony, selenium, silver, cyanide, 35 SVOCs, and 11 VOCs (see Table 4), were not detected but the MRLs were above the respective sediment SLs. These chemicals are discussed further in the uncertainty section (Section 5.2).

3.4.2 Surface Water

Chemistry data for 2017 surface water samples were screened against available ecological SLs for freshwater and evaluated in additional ways described above in Section 3.4 to identify CoPECs. Surface water samples were collected form the Hockanum River at the Site (Figure 5). Surface water samples were analyzed for CT ETPH, metals, cyanide, VOCs, and SVOCs (Tables A-2 of Appendix A contain the data used in the SLERA; data are summarized in Table 2).

Surface water samples were collected from four locations in the Hockanum River at the Site (Figure 5). One station (SW-01) had a field duplicate and these results were combined as follows:

- If the results for both the primary and the field duplicate sample were detected values, then the average of the two detected values was used to represent that sample.
- If the results for both the primary and the field duplicate sample were non-detected values, then the lower reported limit was used to represent that sample.
- If one of the results for the primary or the field duplicate sample was a detected value and the other was a non-detected value, then the detected value was used to represent that sample.

Concentrations of chemicals in surface water were compared to available ecological SLs for freshwater. The Connecticut Water Quality Standards (CT DEEP 2011) was the predominant source of freshwater SLs (Table 5). For chemicals not regulated by the Connecticut Water

Quality Standards, SLs for surface water were derived from the following sources, in order of preference: the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRT; Buchman 2008), Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota (Suter and Tsao 1996), Ecotox Thresholds (U.S. EPA 1996), U.S. EPA Region III BTAG Freshwater Screening Benchmarks (U.S. EPA 2006), and U.S. EPA Region 5 RCRA Ecological Screening Levels (U.S. EPA 2003).

The complete CoPEC evaluation conducted for surface water for all measured analytes is provided in Table B-2 in Appendix B. The summary of chemicals selected as CoPECs for surface water is shown in Table 6. The following chemicals in surface water samples at the Site were retained as CoPECs:

- Two metals– barium and zinc.

Several analytes in the surface water samples, including six metals, cyanide, three PAHs, nine SVOCs and three VOCs (see Table 6), were not detected but the MRLs were above the respective surface water SLs. These chemicals are discussed further in the uncertainty section (Section 5.2).

4 Screening-Level Exposure Estimate and Risk Calculation

For sediment, ten metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, vanadium, and zinc) and all of the PAHs were retained as sediment CoPECs (Table 4). In surface water, barium and zinc were retained as surface water CoPECs (Table 6). A combined list of sediment and surface water CoPECs are presented in Table 7. Therefore, exposure to these chemicals was assessed in the screening-level exposure estimate and risk calculation. The screening process concludes with a scientific management decision point, where it is determined that (1) ecological threats are negligible; (2) the ERA should continue to determine whether a risk exists; or (3) there is a potential for adverse ecological effects, and a more detailed ERA or BERA incorporating more site-specific information, is needed (U.S. EPA 1997).

4.1 Exposure Estimate and Risk Calculation for Benthic Invertebrates, Amphibians, and Fishes

In the screening-level exposure estimate for aquatic life, amphibians, and benthic invertebrates of the Hockanum River, which includes benthic invertebrates, fish and amphibians, the concentrations of CoPECs are compared to ecological screening values (ESVs) for sediment and surface water to develop quantitative risk estimates called hazard quotients (HQs). The HQ is the ratio of the measured or predicted exposure concentration to the ESV:

$$HQ = \frac{\text{Site Conc.}_{CoPEC}}{SL_{CoPEC}}$$

where:

HQ	=	Hazard quotient (unitless)
$\text{Site Conc.}_{CoPEC}$	=	Maximum detected concentration of the CoPEC for that medium (mg CoPEC/kg sediment or mg CoPEC/L water)
SL_{CoPEC}	=	Ecological screening value of the CoPEC for that medium (e.g., mg CoPEC/kg sediment or mg CoPEC/L water).

4.2 Exposure Estimate and Risk Calculation for Wildlife

In the screening-level exposure estimate for semi-aquatic wildlife that use the Hockanum River, CoPECs to which ecological receptors are exposed were estimated using a simple food-chain model. In the risk calculation, risk was estimated by comparing the exposure estimates from the

food-chain model to no-effect toxicity reference values (TRVs) to develop quantitative risk estimates called hazard quotients (HQs). The HQ is the ratio of the measured or predicted exposure concentration (dose) to the TRV:

$$HQ = \frac{Dose_{CoPEC}}{TRV_{CoPEC}}$$

where:

HQ	=	Hazard quotient (unitless)
$Dose_{CoPEC}$	=	Total dose of the CoPEC (mg CoPEC/kg body weight/day)
TRV_{CoPEC}	=	Toxicity reference value of the CoPEC (mg CoPEC/kg body weight/day).

HQs below 1 indicate that the chemical is unlikely to cause adverse ecological effects. HQs above 1 indicate some potential for adverse ecological effects but do not signify unacceptable risk. Other pieces of information, such as sources of uncertainty and site-specific exposure information, are weighted in the risk evaluation and the interpretation of the ecological significance of HQs.

4.2.1 Wildlife Representative Receptors

To quantitatively assess risk to an ecological community or feeding guild, it is necessary to select a representative receptor or receptors. The diversity of potentially exposed species and the lack of fundamental knowledge of the interactions between chemicals and many exposed species preclude assessment of risk to all species. According to U.S. EPA guidance, selection of representative receptors may be based on a number of factors, including the following (U.S. EPA 1997):

- Species known to be present at the site
- Species likely to be highly exposed
- Species typical of the community or guild they represent in their behavior, physiology, or sensitivity to CoPECs
- Species for which adequate data exist to allow assessment of exposure and risk.

Risk assessments for representative receptors are therefore interpreted to apply not only to the species assessed but to other species in the community or guild represented. The mallard, great blue heron and raccoon were selected as the representative receptors to evaluate ecological risk at the Site, because they are likely to be present at the Site, highly exposed to chemicals in environmental media, typical of the community or guild they represent in their behavior, physiology, or sensitivity to CoPECs, and because adequate data exists to estimate their exposure and potential risk to CoPECs at the Site.

The mallard (*A. platyrhynchos*) is a surface-feeding duck found in freshwater and saltwater wetland habitats throughout the United States. They feed primarily on aquatic plants; however, females consume benthic invertebrates in the spring before egg production (U.S. EPA 1993). Clutch size range from 1 to 18 eggs, with an average of 9 eggs (U.S. EPA 1993). Breeding occurs in spring but can continue through summer to replace lost nests. Females stay with the young until they fledge. Home ranges of adult females range from 40–1,440 hectares (U.S. EPA 1993).

The great blue heron (*A. herodias*) lives in both saltwater and freshwater environments. It consumes primarily fish, although it also eats small amphibians, larger invertebrates (crabs, crayfish, etc.), insects, and occasionally small mammals (Terres 1980). Great blue herons wade in shallow water and strike at their prey with their long beaks. Their varied carnivorous and piscivorous diet places it high up on the food web and makes them susceptible to adverse effects resulting from bioaccumulation of CoPECs.

The raccoon (*P. lotor*), a medium-sized mammal, is common throughout North America. Its preferred types of habitat are wetlands and suburban areas. The raccoon is known to consume aquatic invertebrates, fish, insects, mollusks, annelids, bird eggs, small passerine birds, small mammals such as squirrels, and plants (Chapman and Feldhamer 1982). Aquatic species may make up only a small portion of the raccoon diet if other sources of food (e.g., domestic or commercial refuse) are readily available. Foraging raccoons can be exposed to CoPECs in sediments and water, as well as in their diet.

Receptor profiles were developed for the mallard, great blue heron, and raccoon (Table 8). A receptor profile summarizes the parameters used to calculate an estimated daily dose of chemicals to a particular wildlife receptor. These parameters are body weight, normalized food ingestion rate, normalized sediment/soil ingestion rate, main dietary components, and foraging ranges. If information for both sexes was available, profiles were made for the female. In general, females tend to be more sensitive to chemicals because of reproductive differences.

The *Wildlife Exposure Factor Handbook* (U.S. EPA 1993) provides ranges of typical body weights and ingestion rates of food, as well as foraging areas, for the wildlife species used in this assessment. Nagy (2001) provides more current estimates of food ingestion rates for wild animals. Beyer et al. (1994) present sediment/soil ingestion rates for selected wildlife. These sources were used to develop exposure factors for the wildlife receptors considered in this SLERA. In some cases, the *Wildlife Exposure Factor Handbook* lists several values for a particular parameter. In general, the values selected are from studies of habitats that align with the habitats at this Site, from the same general region, if possible. In those cases, the study from which the value was selected is noted in Table 8.

The estimates of food ingestion rates presented by Nagy (2001) were used for the wildlife receptors in this assessment. The food ingestion rate for the mallard was estimated using the wet ingestion rate equation for omnivorous birds in Nagy (2001). The food ingestion rate for great blue heron was estimated using the wet ingestion rate equation for carnivorous birds in Nagy (2001). The food ingestion rate for the raccoon was estimated using the wet ingestion rate equation for omnivorous mammals in Nagy (2001). Food ingestion rates were normalized to body weight.

The percentages of soil in diets of the mallard and raccoon were taken from Beyer et al. (1994). However, Beyer et al. (1994) do not present percentages of soil in diets of the great blue heron. The percentage of sediment in the diet of the bald eagle was used as a surrogate for the great blue heron. The body-weight-normalized soil/sediment ingestion rate was calculated from the dry-weight-normalized food ingestion rate ($NFIR_{dry}$) equations and percentage of sediment/soil in diet provided by Nagy (2001).

The water ingestion rates for the wildlife receptors were estimated using the body-weight-normalized water ingestion rate equations published by Calder and Braun (1983).

The portion of the Hockanum River within the Site boundaries is considerably smaller than the home ranges for the mallard, great blue heron, and raccoon. However, it was conservatively assumed in this SLERA that these receptors would forage only within the Site portion of the river.

4.2.2 Screening-level Food-chain Models for Wildlife

Food-chain models were used to estimate the dietary exposure of the mallard, great blue heron, and raccoon to CoPECs in the portion of the Hockanum River within the Site boundaries. The food-chain modeling approach is standard and consistent with U.S. EPA's wildlife exposure guidance (U.S. EPA 1993). The food-chain model is a tool for estimating dietary exposure as a body-weight-normalized total daily dose.

The general model can be described by the following equation:

$$Dose_{CoPEC} = Dose_{food} + Dose_{soil/sediment} + Dose_{water}$$

where:

$Dose_{CoPEC}$ = total dose from all sources (mg CoPEC consumed/kg body weight of animal/day or mg/kg/day)

$Dose_{food}$ = dose from food (mg CoPEC consumed in food/kg body weight of animal/day)

$Dose_{soil/sediment}$ = dose from soil or sediment (mg CoPEC consumed in soil or sediment/kg body weight of animal/day)

$Dose_{water}$ = dose from water (mg CoPEC consumed in water/kg body weight of animal/day).

The daily dose of each CoPEC consumed by the receptor in each medium (e.g., sediment, food, or water) is estimated from the body-weight-normalized rates of consumption of each medium (e.g., daily food ingestion rate) and the concentration of CoPEC in that medium as follows:

$$Dose_M = IR_M \times C_M$$

where:

$Dose_M$ = dose from a particular medium (mg CoPEC/kg body weight/day)

IR_M = consumption rate of that medium normalized to body weight (kg medium consumed/kg body weight/day)

C_M = concentration of CoPEC in that medium (mg CoPEC/kg medium).

For species-specific input parameters, such as body weight and ingestion rate, there is a range of possible values that can be used. For example, adult body weights for any species are variable and may depend on several factors, including region of the country, habitat, local climate, and the availability of food. Similarly, the feeding behavior of receptor species can vary greatly, depending on geographic location and habitat type. For the purposes of this SLERA, single-value point estimates are used for all food-chain model exposure parameters.

The model provides an estimated total dietary exposure for CoPECs resulting from consumption of food and water, and the incidental ingestion of soil or sediment, on a mg/kg body-weight-day basis. The exposure estimate conservatively assumes that the entire receptor diet comes from within the Site and that 100% of a chemical in ingested food is absorbed. The maximum measured or estimated onsite CoPEC concentration was used to estimate dietary exposures, consistent with U.S. EPA guidance for conducting SLERAs (U.S. EPA 1997).

4.2.3 Exposure Point Concentrations

4.2.3.1 Sediment and Surface Water

An exposure point concentrations (EPC) is the concentration of a chemical in a given medium (e.g., sediment, water, and food item) that is used to represent the exposure concentration at the Site. EPCs are determined separately for each medium (sediment, water, and food items). For SLERAs, U.S. EPA recommends using the maximum concentration in each medium to represent the EPCs. The sediment and surface water EPCs used in the screening-level risk calculations were either the MDC, if the CoPEC was detected in that medium, or MRL, if the CoPEC was not detected in that medium but was still a CoPEC for the other medium (Table 9).

Total PAHs were evaluated as a CoPEC as well as the individual PAHs because some TRVs are available as the sum of individual PAHs (or Total PAHs). For the sediment total PAH EPC, the sum of the individual PAHs was calculated for each sample (if the sample contained a PAH that was not detected, one-half of the value of the reporting limit was used) and the maximum total PAH concentration of all the samples was used. For the surface water total PAH EPC, the MRLs were determined for each individual PAH and summed and used as the total PAH EPC since none of the measured PAHs were detected in the surface water samples.

4.2.3.2 Biota

Because concentrations of CoPECs in biota have not been measured at the Site, concentrations were estimated from EPCs for sediment (Table 9) using published bioaccumulation factors (BAFs) and trophic transfer factors (Table 10). These factors provide a conservative way to estimate biota concentrations from concentrations measured in sediment from the Site.

BAFs are quantitative relationships between sediment concentrations and biota derived from empirical measurement. The simplest BAFs are expressed as constant ratios between biota and sediment concentrations. Aquatic uptake of metals and organic substances is especially non-linear as a function of sediment concentration; therefore, the use of simple ratio BAFs was avoided if non-linear equations were available, and the model described below was employed, when possible.

The BAF model used is:

$$\log[biota] = B0 + B1 \times \log[sed]$$ [3]

where:

log[*biota*]	=	Log, base 10, of the chemical concentration in aquatic invertebrate tissue (dry weight)
*B*0 and *B*1	=	Empirically derived, chemical-specific constants
log[*sed*]	=	Log, base 10, of the chemical concentration in sediment (dry weight).

Sediment to plant tissue BAFs are literature-based BAFs for plants and a dry-to-wet conversion factor of 0.2 since plant tissues are typically 20% solids. Sources of literature BAFs for plants were U.S. EPA (2007) and Bechtel Jacobs Company LLC (1998a). BAFs are expressed as either a regression equation between sediment and tissue concentrations or as a factor applied to the sediment concentration, as provided in the source. These BAFs for plants were taken from terrestrial plant studies since BAFs are not widely available for aquatic plants. EPCs for plants were estimated using the maximum sediment concentrations and the sediment-plant BAF equations (Table 10).

Sediment to benthic invertebrate tissue BAFs are literature-based BAFs for benthic invertebrates (or soil invertebrates where BAFs for benthic invertebrates are unavailable) and a dry-to-wet conversion factor of 0.3 since benthic invertebrates are typically 30% solids. Sources of literature BAFs for invertebrates were U.S. EPA (2007) and Bechtel Jacobs Company LLC (1998b). BAFs are expressed as either a regression equation between soil and tissue concentrations or as a factor applied to the soil concentration, as provided in the source. No reliable BAFs or appropriate surrogates for benthic invertebrates were identified based on similar chemical properties for PAHs. The uptake of these chemicals by benthic invertebrates

[3] Some of the models are based on natural log normalized data, see Table 10.

was modeled by assuming a conservative BSAF of 1.0 (i.e., aquatic invertebrate tissue concentrations are assumed to be equal to sediment concentrations). EPCs for benthic invertebrates were estimated using the maximum sediment concentrations and the sediment-invertebrate BAF equations (Table 10).

Trophic transfer factors were used to estimate fish tissue concentrations from estimated benthic invertebrate concentrations. Since chemical exposure of fish is more closely linked to food ingestion than to exposure to sediments, trophic transfer factors were used to estimate fish body burdens from benthic invertebrate tissue concentrations at the Site. In addition, trophic transfer factors inherently take into account excretion, metabolism and/or biomagnification of chemicals. Fish concentrations were modeled using trophic transfer factors developed by U.S. ACE WES (Dillon et al. 1995). Dillon et al. (1995) summarized trophic transfer factors for several chemicals, including arsenic, cadmium, chromium, copper, lead, mercury, methyl mercury, nickel, vanadium, zinc, and total PAHs, among other chemicals. Chemicals with trophic transfer factors greater than 1 were considered to have the potential for biomagnification in aquatic systems. Dillon et al. (1995) demonstrated that trophic transfer factors correlate with log K_{OW}, (a value which describes how chemical partitions in water and organic phases [e.g., tissue]). Dillon's review found most inorganic and organic chemicals appear to have a low potential for trophic transfer. However, total and methyl mercury and arsenic (at higher trophic levels) have the potential to biomagnify.

Maximum trophic transfer factors for fish presented in Dillon et al. (1995) are presented in Table 10. Trophic transfer factors are expressed as a factor applied to the benthic invertebrate tissue concentration, as provided in the source. A trophic transfer factor was unavailable for barium; thus, a value of 1 is used as a surrogate because it is unlikely that this metal biomagnifies and a value of 1 is conservative. In other words, the barium concentration for benthic invertebrates was used as a surrogate for the fish concentration for barium. EPCs for fish were estimated using the maximum benthic invertebrate concentrations and the maximum trophic transfer factors (Table 10).

4.2.4 Toxicity Reference Value for Benthic Invertebrates, Fishes, and Amphibians

4.2.4.1 Benthic Invertebrates and Fishes

The same ecological SLs for sediment and surface water used in the CoPEC selection were used as TRVs in the assessment endpoints for benthic invertebrates (sediment SLs) and fishes (surface water SLs) since these represent conservative values appropriate for use in SLERAs per U.S. EPA guidance and guidelines (U.S. EPA 1997, 1998). These TRVs are described in Sections 3.4.1 and 3.4.2 and provided in Table 11 for CoPECs only.

4.2.4.2 Amphibians

Water benchmarks or values were developed to evaluate the potential for adverse effects on amphibians from exposure to surface water in the Hockanum River. U.S. EPA maintains and periodically updates the ECOTOXicology database (ECOTOX),[4] which contains single-chemical toxicity data for aquatic life, terrestrial plants, and wildlife. U.S. EPA derives these data from toxicity studies, predominately from the peer-reviewed literature, for aquatic life, terrestrial plants, and terrestrial wildlife.

ECOTOX was searched recently for toxicological data for amphibians. The following search parameters were used in an advanced database search:

- Taxonomic entries: animals, amphibians, frog, salamander, toad
- Chemical entries: metals, PAHs
- Concentration-based endpoint entries: LC/LDxx, EC/EDxx, IC/IDxx, LOEC, NOEC, NOEL, LOEL, MATC, LETC/ATCN, LETH
- Time-based endpoint entries: LTxx, ETxx
- Effect measurements entries: ecosystem group, growth group, population group, mortality group, reproduction group
- Test condition entries: lab tests, freshwater, any exposure types, and measured or unmeasured chemical concentrations
- Publication years: all.

The results of this search were downloaded and organized by chemical. The lowest available relevant effect level (e.g., LC/LDxx, EC/EDxx, IC/IDxx, LOEC, LOEL, MATC, LETC/ATCN, LETH) in the ECOTOX search for a given chemical was selected as the amphibian water value for that chemical. Table 11 shows the selected amphibian water values that were used as TRVs for amphibians (Appendix C provides details on the studies used to develop the amphibian water values).

While amphibian water values were developed for many of the CoPECs, there were not sufficient data to develop them for all of the CoPECs. Due to lack of relevant data, amphibian water values were not developed for 2-methylnaphthalene, acenaphthalene, acenaphthylene, benz(a)anthracene, benz(b)fluoranthene, benz(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, and phenanthrene.

[4] http://cfpub.epa.gov/ecotox/

4.2.5 Toxicity Reference Values for Wildlife

Wildlife TRVs for comparison to estimated dietary exposure to CoPECs were taken directly from the literature or derived from published studies on laboratory animals (Tables 12 and 13; derivation of the wildlife TRVs is provided in Appendix D). The chronic no-observed-adverse-effect level (NOAEL) was used as a conservative estimate of the adverse-effects threshold. The NOAEL is the highest dose administered during a chronic toxicity study that did not produce adverse toxic effects. The true effect threshold, under the tested exposure conditions, is somewhere above the NOAEL. At an exposure level equal to the NOAEL, no adverse effect is expected. As the concentration increases above the NOAEL, the probability of an effect occurring increases.

Because controlled laboratory experiments are rarely conducted with wildlife species, it is typically necessary to derive TRVs by extrapolating data from related laboratory or domestic species to the representative receptors. In this assessment, source studies were selected that considered survival, growth, reproductive, and developmental effects or other critical effects that would indicate overt impacts to individual organisms that may affect population size or stability. Studies incorporating chronic exposure durations, multiple exposure levels, and statistical evaluation of test results were selected preferentially.

No toxicity studies exist for the raccoon; therefore, NOAELs were derived from laboratory test animal (e.g., rat and mouse) studies using this allometric relationship described by Sample et al. (1996):

$$NOAEL_w = NOAEL_t\,[bw_t/bw_w]^{1/4}$$

where:

$NOAEL_w$ is the NOAEL for the wildlife species in question

$NOAEL_t$ is the NOAEL for the test species

bw_t is the body weight of the test species

bw_w is the body weight of the wildlife species in question.

Note that smaller animals will have larger NOAELs, because, according to Sample et al. (1996), the smaller animals tend to have higher metabolic rates and are more resistant to toxic chemicals. Using the study-derived NOAELs for the raccoon, which is larger than most of the laboratory test animals, would have underestimated risk had the study-derived values been used in the SLERA; hence, allometric adjustments from Sample et al. (1996) to the NOAELs are appropriate. Avian TRVs are not allometrically adjusted (Sample et al. 1996).

The avian and mammalian TRVs are summarized in Tables 12 and 13, respectively.

4.3 Results of Screening-Level Exposure Estimate and Risk Calculation

This section presents the results of the HQs for the four receptor groups and whether a BERA is required for any CoPECs and exposure pathway at the Site.

4.3.1 Screening-level Results for Benthic Invertebrates (Assessment Endpoint 1)

The screening-level risk assessment for benthic invertebrates was conducted by comparing the EPCs (maximum concentrations of CoPECs in the Hockanum River sediment near the Site) to sediment SLs, which were used as benthic invertebrates TRVs. All CoPECs, except for arsenic and benzo(b)fluoranthene, exceeded the sediment TRVs for benthic invertebrates (HQs ranged from 0.5 to 463) (Table 14). Barium had the highest HQ (463), followed by acenaphthylene (237). Other PAHs also had relatively high HQs. Copper had the second highest HQ for metals at 69. The remaining metals (arsenic, cadmium, chromium, mercury, nickel, and vanadium had relatively low HQs (0.7 to 3). All CoPECs, except for arsenic which had HQ was less than 1, should be carried forward into a BERA for benthic invertebrates. While the HQ for benzo(b)fluoranthene was less than 1, it will be carried forward into the BERA because PAHs are often assessed collectively for ecological risk. To obtain better estimates of exposure to CoPECs at the Site, sediment samples should be collected from the Site and evaluated in laboratory toxicity testing using a sensitive benthic invertebrate species.

4.3.2 Screening-level Results for Amphibians (Assessment Endpoint 2)

The screening-level risk assessment for amphibians was conducted by comparing the EPCs (maximum concentrations of CoPECs in the Hockanum River surface water near the Site) to amphibian values. None of the CoPECs exceeded the available amphibian values (all HQs < 1) (Table 15). However, amphibian values were unavailable for some PAHs, but those for which amphibian values were available, the HQs were very low (0.00002 to 0.002) suggesting the PAHs would not pose a risk to amphibians. Therefore, CoPECs at the Site do not appear to pose a risk to amphibians and this exposure pathway does not need to be carried forward into a BERA.

4.3.3 Screening-level Results for Fishes (Assessment Endpoint 3)

The screening-level risk assessment for fishes was conducted by comparing the EPCs (maximum concentrations of CoPECs in the Hockanum River surface water near the Site) to surface water SLs, which were used as TRVs for fishes. Barium (HQ = 14), cadmium (HQ = 8), copper (HQ = 1), lead (HQ = 2), benzo(a)anthracene (HQ = 2), benzo(a)pyrene (HQ = 4), and pyrene (HQ = 2) exceeded the surface water SLs for fishes (Table 15). However, cadmium, copper, lead, and all of the PAHs were not detected in any of the surface water samples.

Because of the elevated reporting limits for these chemicals, these CoPECs should be carried forward along with barium and zinc, which were detected above the SLs, into a BERA for fishes. To obtain better estimates of exposure of fishes to CoPECs at the Site, tissue samples of fishes should be collected from the Hockanum River and analyzed for CoPECs and compared to tissue-based effect levels for fishes.

4.3.4 Screening-level Results for Wildlife (Assessment Endpoint 4)

Food-chain models (Appendix E) for the mallard, great blue heron, and raccoon were used to estimate risk to wildlife receptors that use the portion of Hockanum River near the Site. The current conditions are expected not to change in the future; thus, the results for current conditions also apply to future conditions. Because concentrations of aquatic biota (plants, fish and benthic invertebrates) have not been collected from the Hockanum River, they were modeled using conservative sediment-biota uptake factors and trophic transfer factors from the literature. In accordance with U.S. EPA guidance and guidelines for conducting SLERAs (U.S. EPA 1997, 1998), EPCs used in the food-chain models were maximum concentrations in sediment, surface water, and biota, and it was assumed that wildlife receptors would spend 100% of their time at the Site. The results of the food-chain models found that chromium (HQ = 2) and vanadium (HQ =7) pose a potential risk to the raccoon, and PAHs pose a potential risk to the mallard (HQ = 9), great blue heron (HQ = 14), and the raccoon (HQ =9) (Table 16). Therefore, these chemicals and exposure pathways should be carried forward into a BERA for wildlife. To obtain better estimates of wildlife exposure to CoPECs, tissue samples of plants, fishes and invertebrates should be collected from the Hockanum River, analyzed for these CoPECs and used in site-specific food-chain models for the mallard, great blue heron, and raccoon.

4.3.5 Summary of Screening-level Results

Table 17 summarizes the results of the screening-level calculations, expressed as HQs, for all ecological receptors considered to use the Site portion of the Hockanum River. The ecological receptors with the greatest number of HQs above 1 were benthic invertebrates, followed by fish, and then wildlife. Therefore, risk to these receptors cannot be ruled out with the available information. However, all of the HQs for amphibians at the Site were below 1 and thus this receptor does not require further evaluation.

5 Uncertainty Analysis

Several sources of uncertainty are associated with the assumptions in this SLERA. These sources of uncertainty are common to the ERA process in general. Uncertainty is associated with the use of screening levels, TRVs, elevated analytical detection limits, selection of exposure parameters, and accumulation factors; these are discussed below. The magnitude of uncertainty differs among sources and can vary with CoPEC and receptor.

5.1 Uncertainties Associated with SLs and TRVs

The primary area of uncertainty for the SLERA is associated with conservative SLs and TRVs that may lead to an overestimation of risk to ecological receptors. SLs and TRVs are significant sources of uncertainty in SLERAs for the following reasons:

- Test conditions may not accurately mimic natural exposure
- Relative sensitivity of the receptor compared to the test species may be unknown
- Identification of the no-effect threshold is imprecise and depends on selected dose intervals
- Uncertainty factors applied in calculating some SLs and TRVs are generalized and ignore species-specific sensitivities
- Chronic no-effect thresholds have not been measured for all hazardous constituents and may need to be estimated from low-effect thresholds or acute exposure studies.

While these factors could lead to uncertainty in SLERA, that uncertainty results in conservative estimates of risk (e.g., overestimating risk), which is appropriate for the purposes of a SLERA. This means that additional assessments should be conducted using site-specific information and data to reduce the uncertainty and develop more realistic estimates of exposure and risk in a BERA.

5.2 Uncertainty Associated with CoPEC Selection

A number of analytes were retained as CoPECs based solely on their status as bioaccumulative chemical compounds (BCCs) (see the CoPEC selection tables, Tables B-1 and B-2 in Appendix B). The process for determining if a chemical was bioaccumulative was based on a U.S. EPA document on bioaccumulation (U.S. EPA 2000). CoPEC selection was based on comparison to protective screening criteria. Thus, to remain conservative, detected compounds with the potential to bioaccumulate, but below screening levels, were retained as COPECs if detected. Inclusion of these constituents as CoPECs may overestimate the potential risk.

A large number of chemicals lacked surface water SLs; however, none of these chemicals were detected in any of the surface water samples. In the case of sediment, two detected analytes (CT ETPH and carbazole) were detected in sediment samples but lacked sediment SLs. CT ETPH was retained as a CoPEC but this analyte consists of a number of chemicals that were evaluated individually in the SLERA. For carbazole, while there is no sediment SL for carbazole, this chemical was detected in only two of the nine sediment samples and is not a BCC; therefore, it was eliminated as a CoPEC.

For many undetected chemicals, there is often uncertainty as to whether they could elicit adverse ecological effects, because the detection limits for these chemicals exceed sediment and surface water SLs. This is largely because the SLs have been developed to be conservative using various often compounded uncertainty factors. Some of the analytes never detected in a given medium had MRLs in exceedance of the applicable SL (Appendix B). Analytes that were never detected in any media were not retained as CoPECs. This elimination may result in an underestimate of Site risk by an unknown amount. However, the presence of data reported as non-detected above a specific reporting limit in a data set has the potential to affect risk estimates because such data introduce uncertainty as the true concentration is somewhere between the reporting limit and zero. The underestimation of risk would likely be low because if the non-detected chemicals were actually site-related and present at levels of significant concern, they likely would have been found at concentrations above the detection limits at some point in the investigation.

5.3 Uncertainty Associated with Bioaccumulation Factors and Trophic Transfer Factors

Concentrations of CoPECs in biota have not been measured at the Site, and Site-specific sediment bioaccumulation tests were not conducted for this assessment. Instead, this assessment used BAFs for plants and invertebrates and trophic transfer factors derived from the literature. However, these literature-derived factors are recognized as being conservative, so it is likely that estimating exposure of wildlife to CoPECs in biota from the literature-derived accumulation or transfer factors led to an overestimate, rather than underestimate, of risk.

5.4 Uncertainty Associated with the Food-Chain Models

There are inherent uncertainties in the use of the food-chain model, because the model incorporates simplifying assumptions to represent a complex ecological system. For example, food-chain models assume that chemicals in food and incidentally ingested sediment are completely available to the receptor. This will overestimate risk for constituents for which only a fraction of the ingested dose is bioavailable.

The actual diets of the wildlife receptors include more diverse food types than are represented in this SLERA. This assessment assumes exposure from consumption of particular prey types can be estimated based on concentrations in particular food items representative of the prey type.

There is uncertainty in the ingestion rates of the wildlife receptors. However, studies were used that present conservative estimates of quantity of food and soil/sediment in the diet (Nagy 2001; U.S. EPA 1993; Beyer et al. 1994) to reduce the likelihood of underestimating risk.

5.5 Chemical Concentrations Upstream of the Site in Hockanum River

The Site is located in an urbanized watershed and the Hockanum River receives inputs from several point and non-point sources. To investigate whether off-site concentrations of chemicals in sediments and surface waters could be influencing chemical concentrations in sediments and surface waters near the Site, Tighe & Bond collected sediment and surface water samples from five locations in the Hockanum River upstream of the Site (Figure 11) in 2020. The sample collection and analysis is described below (Section 5.5.1). Screening-level calculations of exposure and risk were made for the upstream data using the same methods as described for the Site data in Section 4; the results for the upstream data are described below (Section 5.5.2).

5.5.1 Tighe & Bond Upstream Sediment and Surface Water Sampling 2020

On October 21, 2020, Tighe & Bond collected sediment samples from five locations (SED-101, SED-102, SED-103, SED-104, and SED-105) upstream of the Site. The upstream locations were selected by Exponent, Inc. and Tighe & Bond based on visual inspection of the sediment substrate and its similarity to sediment substrates near the Site. Sediment was collected using decontaminated stainless-steel hand sampling tools from within the top six inches of the sediment surface (surficial samples). The sediment samples were analyzed for CT ETPH, 15 metals (antimony, arsenic, barium, beryllium, cadmium, chromium (total), copper, lead mercury, nickel, selenium, silver, thallium, vanadium, and zinc), 17 PAHs, grain size, and total organic carbon.

On October 21, 2020, Tighe & Bond collected surface water samples from two locations (SW-100 and SW-101) in the Hockanum River. The surface water stations SW-100 and SW-101 were collocated with two of the upstream sediment SED-101 and SED-104 stations, respectively (Figure 11). The surface water samples were analyzed for CT ETPH, 15 total and dissolved metals (antimony, arsenic, barium, beryllium, cadmium, chromium (total), copper, lead mercury, nickel, selenium, silver, thallium, vanadium, and zinc), 17 PAHs, and water hardness.

Several chemicals were detected in sediment and surface water located upstream of the Site. Tables 18 and 19 present the summary statistics for concentrations of chemicals in upstream sediment and surface water, respectively.

5.5.2 Screening-Level Exposure Estimate and Risk Calculation for Upstream Data

5.5.2.1 Exposure Point Concentrations for Upstream Data

Table 20 compares the EPCs for the upstream sediment and surface water samples to that for the Site EPCs for sediment and surface water data. The EPCs for both data sets were calculated either as the MDC or the MRL. The EPCs for the Site sediment data were higher than those for the upstream sediment data. However, the Site surface water EPCs were very similar to the EPCs for the upstream surface water data, with some exceptions due to slightly higher reporting limits in the upstream samples.

5.5.2.2 Results of Screening-level Ecological Risk Assessment using Upstream Data

Using the upstream EPCs, HQs were calculated for benthic invertebrates, aquatic life, and wildlife to assess whether upstream concentrations could lead to potential risk (as indicated by HQs > 1) (see Appendix F for the supporting tables for this analysis). HQs for many Site CoPECs, including barium, cadmium, lead, vanadium, zinc and most of the PAHs, were above 1 in the at least one of the assessments for benthic invertebrates, aquatic life, and wildlife upstream of the Site (Table 21). This indicates that background sediments and surface water upstream of the Site contain CoPECs at concentrations that could present possible risk from current and historical inputs to the Hockanum River. These results suggest that the assumptions used in the SLERA are quite conservative (reasons discussed above in this section). The background sediment results also could suggest that concentrations of chemicals upstream above screening levels could be influencing chemical concentrations downstream via sediment transport and deposition at the Site.

6 Summary and Conclusions

On behalf of Eversource, Exponent, Inc., under contract to Tighe & Bond, has prepared this SLERA for the Rockville Former MGP site located at 13 Maple Street/West Main Street in Rockville, Vernon, Connecticut. This SLERA was developed as part of the Phase III ESA to assess potential exposure pathways to ecological receptors at the Hockanum River at the Site, which are being completed under the CTDEEP VRP.

The Site encompasses 3.43 acres this is comprised of two parcels of land. The first parcel encompasses 2.88-acres and is located at 13 Maple Street. The parcel is developed for use as an active substation (Rockville 14W) and includes grassed yard and brush/wooded areas on the northern bank of the Hockanum River. The MGP footprint was located primarily in the central portion of the 13 Maple Street Parcel. The second parcel is a 0.55-acre parcel located along West Main Street. The Hockanum River is located this parcel and the property is undeveloped and overgrown and wooded areas are located along the southern riverbank (Figure 2 and 3).

The Hockanum River is classified by CTDEEP as Class B waters, meaning that it is designated for use as navigation, recreation, industrial and agricultural water supply, and potential habitat for fish and other aquatic life and wildlife. Based upon Phase III ESA investigation, the Hockanum River is a “losing stream”, where the stream recharges to groundwater at the Site. Groundwater flows northward away from the Hockanum River at the former MGP Site and Rockville 14W substation. The river receives stormwater inputs from two stormwater outfalls on-site as well as from upstream sources. Two historic outfall pipes were also identified based upon historical substation mapping and two outfalls were potentially associated with the former MGP along the northern bank of the river at the Site. An outfall believed to be associated with the former Hockanum Mill is located 270 ft north of the Site at Maple Street on the eastern site boundary.

Historically, the Hockanum River was integral to the industrial development of Rockville. The river was dammed and re-channelized for waterpower for multiple textile mills upstream of the site. Fill materials were likely used during initial develop development of the area based upon site investigations. The textile mills operated from the early 1800s through the World War II era with operations declining in the following decades. The mills generated textile processing wastes that could have potentially been discharged textile production waste materials to the river as part of operations. The MGP operated from circa 1863 until circa mid-1930s after which the Site appears to have been primarily used for manufactured gas storage until the 1950s.

The Site is located in an area of mixed residential with some commercial use to the south along West Main Street including a home heating oil distributor with aboveground oil tank, Gottier Fuel, which is located at the intersection of Maple Street and West Main Street, directly upstream of the Site. The facility maintains a large above-ground heating oil tank for fuel oil delivery trucks.

The ecological conceptual site model identified primary sources of CoPECs for on-site historic fill and outfall pipes from the MGP and the historic outfall pipes (including the Hockanum Mill) associated with subsurface piping at the adjacent to the substation. Off-site sources for stormwater runoff and impacted sediments that could impact river ecological receptors including benthic invertebrates, amphibians, fishes, and wildlife (Figure 9).

The SLERA identified several CoPECs, including PAHs, barium, cadmium, chromium, copper, lead, mercury, nickel, vanadium and zinc, present at concentrations in sediment and/or surface waters that resulted in HQs (quantitative risk estimates) in exceedance of 1. Upstream sediment and/or surface water samples contained similar PAHs and some similar metals (barium, cadmium, lead, and zinc) present at concentrations that resulted in HQs in exceedance of 1. ETPH was retained as a CoPEC for sediment and surface waters collected on-site and upstream but was assessed under risk from PAH compounds.

At the end of the screening-level exposure estimate and risk calculation step, a scientific/ management decision point is reached. Per U.S. EPA guidance (U.S. EPA 1997), the weight of evidence is considered to decide among the following:

- There is adequate information to conclude that ecological risks are negligible, and therefore, there is no need for remediation based on ecological risk.
- The information is inadequate to make a decision at this point, and the ERA process will continue.
- The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

Based on the screening-level exposure estimate and risk calculations, Exponent has determined that the last conclusion list above has been reached for the Site. In other words, the available information indicates a potential for adverse ecological effects from CoPECs in the Hockanum River portion of the Site to benthic invertebrates, fishes, and semi-aquatic wildlife, which requires further evaluation in a BERA. However, potential exposure and risk to amphibians at the Site does not require further evaluation.

It is important to note that chemical concentrations of CoPECs were also detected in upstream Hockanum River sediment and surface water samples at concentrations above ecological screening levels. These represent on-going sources of CoPECs that could likely be influencing chemical concentrations downstream at the Site. This also suggests that the risk assumptions used in the SLERA for on-site ecological receptors are quite conservative. Therefore, careful consideration should be given with regards to the future BERA in light of elevated concentrations of a number of chemicals found in the Hockanum River upstream of the Site.

Exponent recommends completing the BERA to assess the potential on-site ecological risk from CoPECs within the Hockanum River at the Site. For the BERA, sediment samples should be collected from the Site and evaluated in laboratory toxicity testing using a sensitive benthic invertebrate species to obtain better estimates of benthic invertebrate exposure to CoPECs at the Site. Fish tissue samples should also be collected from the Hockanum River and analyzed for CoPECs and compared to tissue-based TRVs for fishes. In addition, tissue samples of plants,

fishes (same as those for the fishes TRVs comparisons), and invertebrates should be collected from the Hockanum River, analyzed for CoPECs, and used in site-specific food-chain models for the wildlife species.

7 References

Bechtel Jacobs. 1998. Biota sediment accumulation factors for invertebrates: Review and recommendations for the Oak Ridge Reservation. BJC/OR-112. Oak Ridge National Laboratory.

Beyer, W.N., E. Conner, and S. Gerould. 1994. Estimates of soil ingestion by wildlife. J. Wildl. Manag. 58:375–382.

Bechtel Jacobs. 1998a. Empirical models for the uptake of inorganic chemicals from soil to plants. BJC/OR-133. Oak Ridge National Laboratory.

Bechtel Jacobs. 1998b. Biota sediment accumulation factors for invertebrates: Review and recommendations for the Oak Ridge Reservation. BJC/OR-112. Oak Ridge National Laboratory.

Buchman, M.F. 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division, NOAA, 34 p.

Calder, W.A., and E.J. Braun. 1983. Scaling of osmotic regulation in mammals and birds. Am. J. Physiol. 224:R601-R606.

Chapman, J.A., and G.A. Feldhamer. 1982. Wild Mammals of North America: biology, management, and economics. Johns Hopkins University Press.

CT DEEP. 2011. Numerical Water Quality Criteria for Chemical Constituents. State of Connecticut Department of Environmental Protection. Bureau of Water Protection and Land Reuse Planning and Standards Division, 2011 Connecticut Water Quality Standards (CWQS).

Dillon, et al. 1995. Trophic transfer and biomagnification potential of contaminants in aquatic ecosystems. Environmental Effects of Dredging Technical Notes US Army Engineer Waterways Experiment Station. EEDP-01-33. January.

Nagy, K.A. 2001. Food requirements of wild animals: Predictive equations for free-living mammals, reptiles, and birds. Nutr. Abst. Rev. Ser. B 71:21R–31R.

Northeast Utilities Service Company. 1992. Manufactured Gas Plant Site Investigation: Rockville. March.

Northeast Utilities Service Company. 1995. Rockville MGP Site Field Summary Report (1994). Submitted to CDM Federal Programs Corporation and Connecticut Department of Environmental Protection. April.

Sample, B.E., R.L. Hinzman, B.L. Jackson, and L. Baron. 1996. Preliminary assessment of the ecological risks to wide-ranging wildlife species on the Oak Ridge Reservation. 1996 Update. DOE/OR/01-1407&D2, ORNL.

Suter, G.W., II and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. ES/ER/TM-96/R2. Oak Ridge National Laboratory.

Terres, J.K. 1980. The Audubon Society encyclopedia of North American birds. Alfred A. Knopf, New York.

Tighe & Bond. 2017. Phase I Environmental Site Assessment, Eversource Former Rockville MGP Site, 13 Maple Street/West Main Street, Rockville, Vernon, CT. March.

U.S. EPA. 1992. Framework for ecological risk assessment. EPA 630/R-92-001. U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC.

U.S. EPA. 1993. Wildlife exposure factors handbook. Volumes I and II. EPA 600-R-93-187. U.S. Environmental Protection Agency, Washington, DC.

U.S. EPA. 1994. Final Site Inspection Report for Northeast Utilities-Vernon, Vernon, Connecticut. CERCLIS No. CTD983870353. TDD No. 9304-40-ACS.

U.S. EPA. 1996. Ecotox Thresholds. ECO Update. Publication 9345.0-12FSI. EPA 540/F-95/038. Office of Solid Waste and Emergency Response. January.

U.S. EPA. 1997. Ecological risk assessment guidance for Superfund: Process for designing and conducting ecological risk assessments. Interim Final. EPA/630/R-92/001 U.S. Environmental Protection Agency, Environmental Response Team, Edison, NJ. February.

U.S. EPA. 1998. Guidelines for ecological risk assessment. EPA/630/R-95/002F. U.S. Environmental Protection Agency, Washington, DC. April.

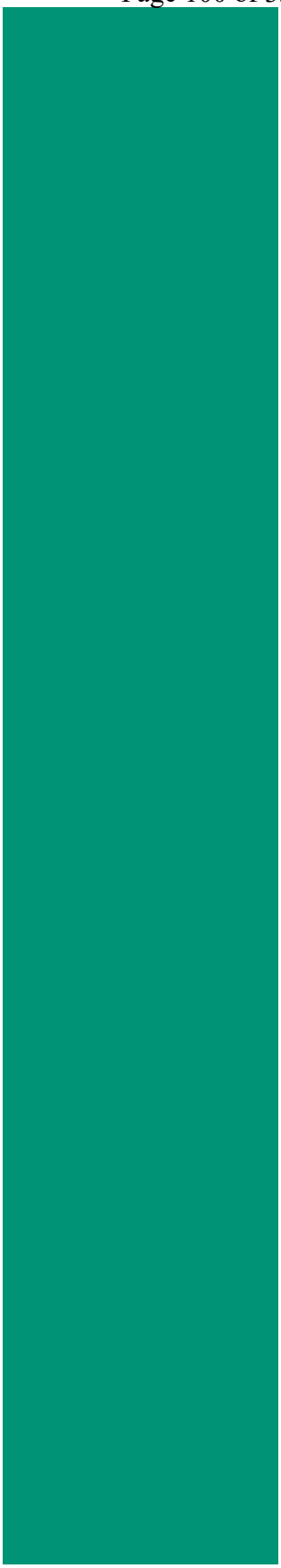
U.S. EPA. 2000. Bioaccumulation testing and interpretation for the purpose of sediment quality assessment: status and needs. EPA-823-R-00-001, Office of Water and Office of Solid Waste, Washington, DC. February.

U.S. EPA. 2003. Region 5, RCRA Ecological Screening Levels. August. https://archive.epa.gov/region5/waste/cars/web/pdf/ecological-screening-levels-200308.pdf

U.S. EPA. 2006. Region III BTAG. Freshwater Sediment and Surface Water Screening Benchmarks. https://www.epa.gov/risk/freshwater-sediment-screening-benchmarks; https://www.epa.gov/risk/freshwater-screening-benchmarks

U.S. EPA. 2007. Ecological soil screening levels (Eco-SSLs) for polycyclic aromatic hydrocarbons (PAHs), Interim final. U.S. Environmental Protection Agency, OSWER Directive 9285.7-78. June.

Figures



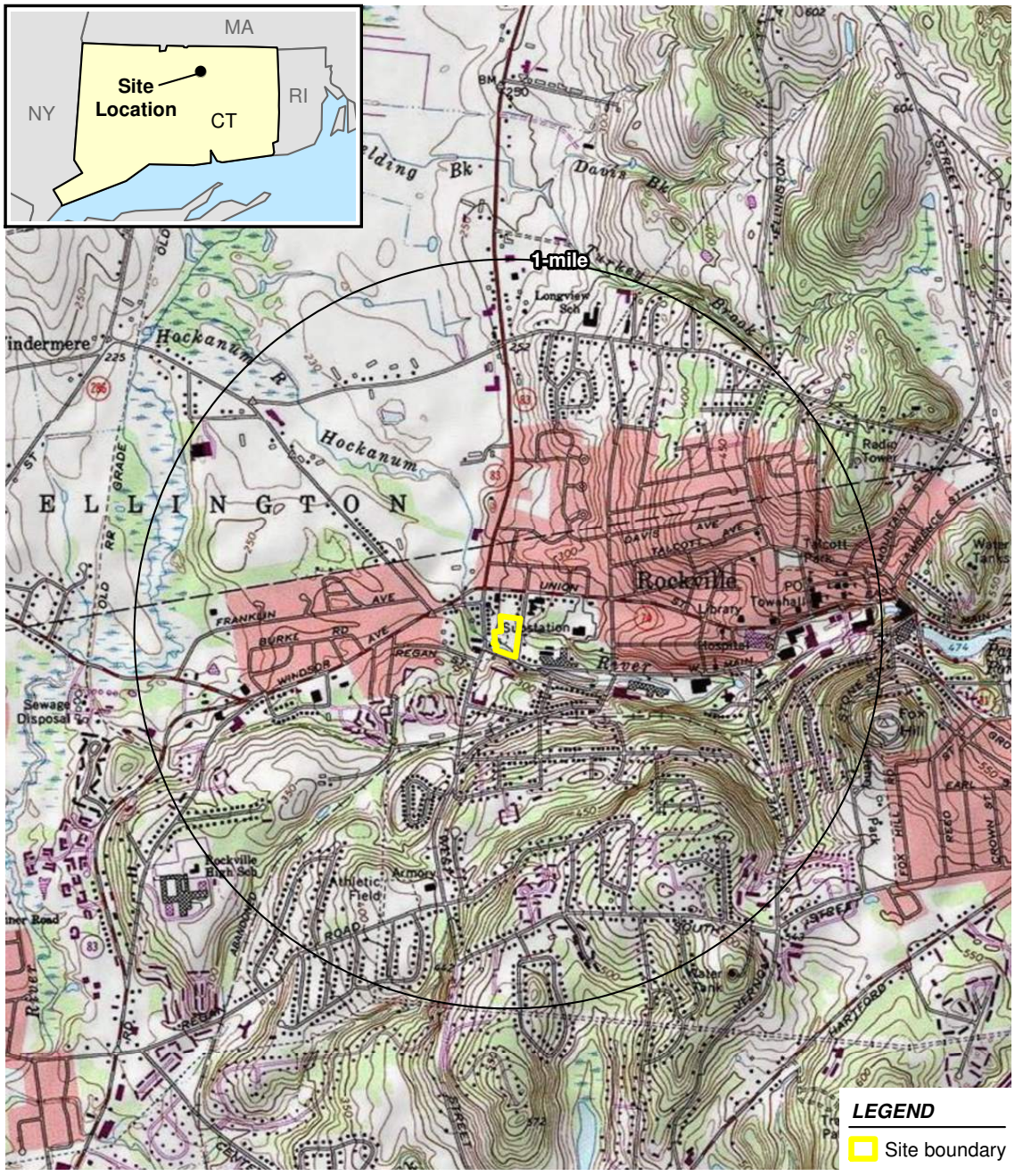


Figure 1. Site location map, Rockville Former MGP Site, Rockville, Vernon, Connecticut

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September 18, 2020 | C:\temp\2000174\projects\site location.mxd



Source:
Aerial photograph from USGS (2016).

Figure 2. Aerial photograph, Rockville Former MGP Site, Rockville, Vernon, Connecticut

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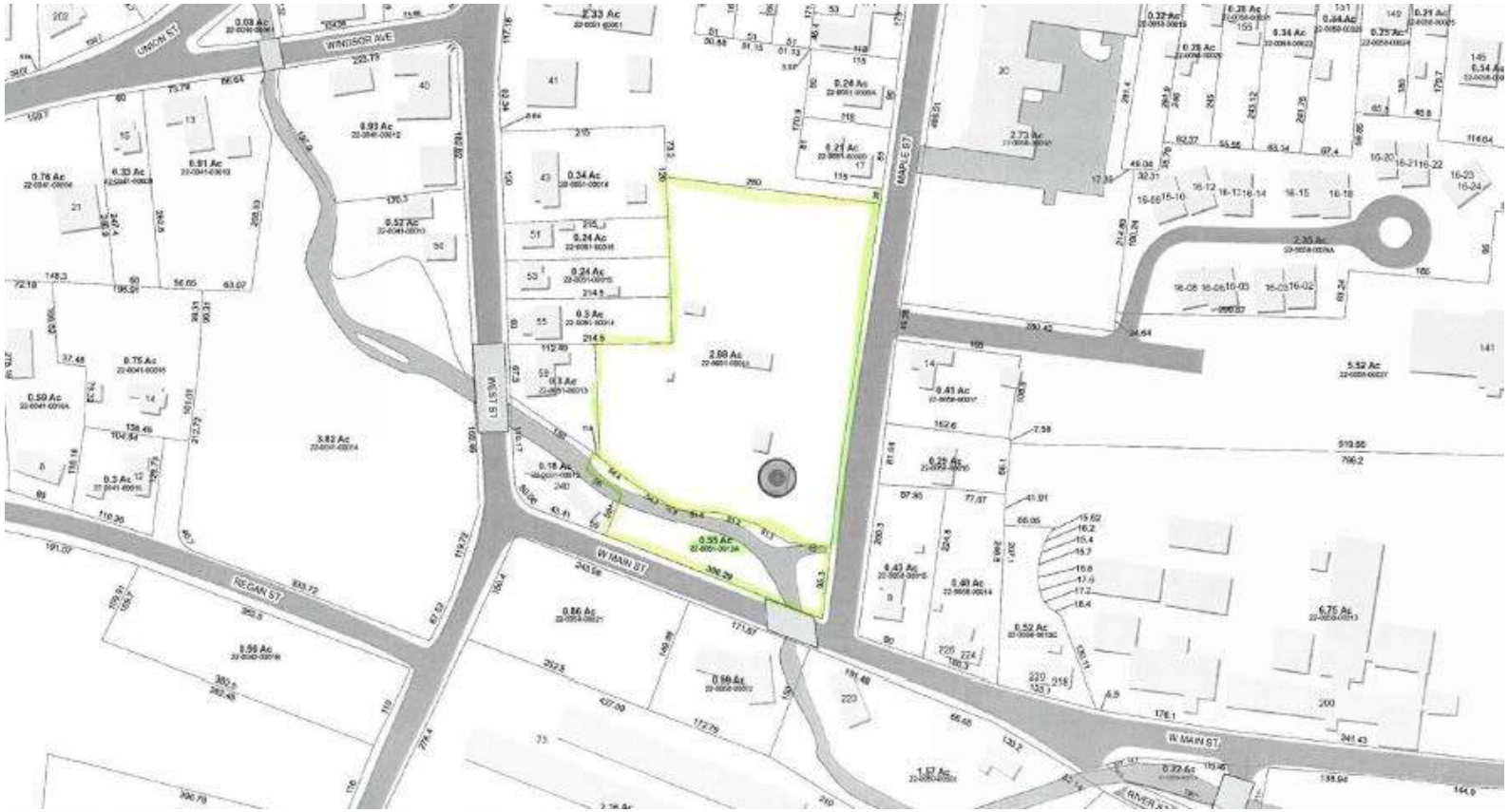
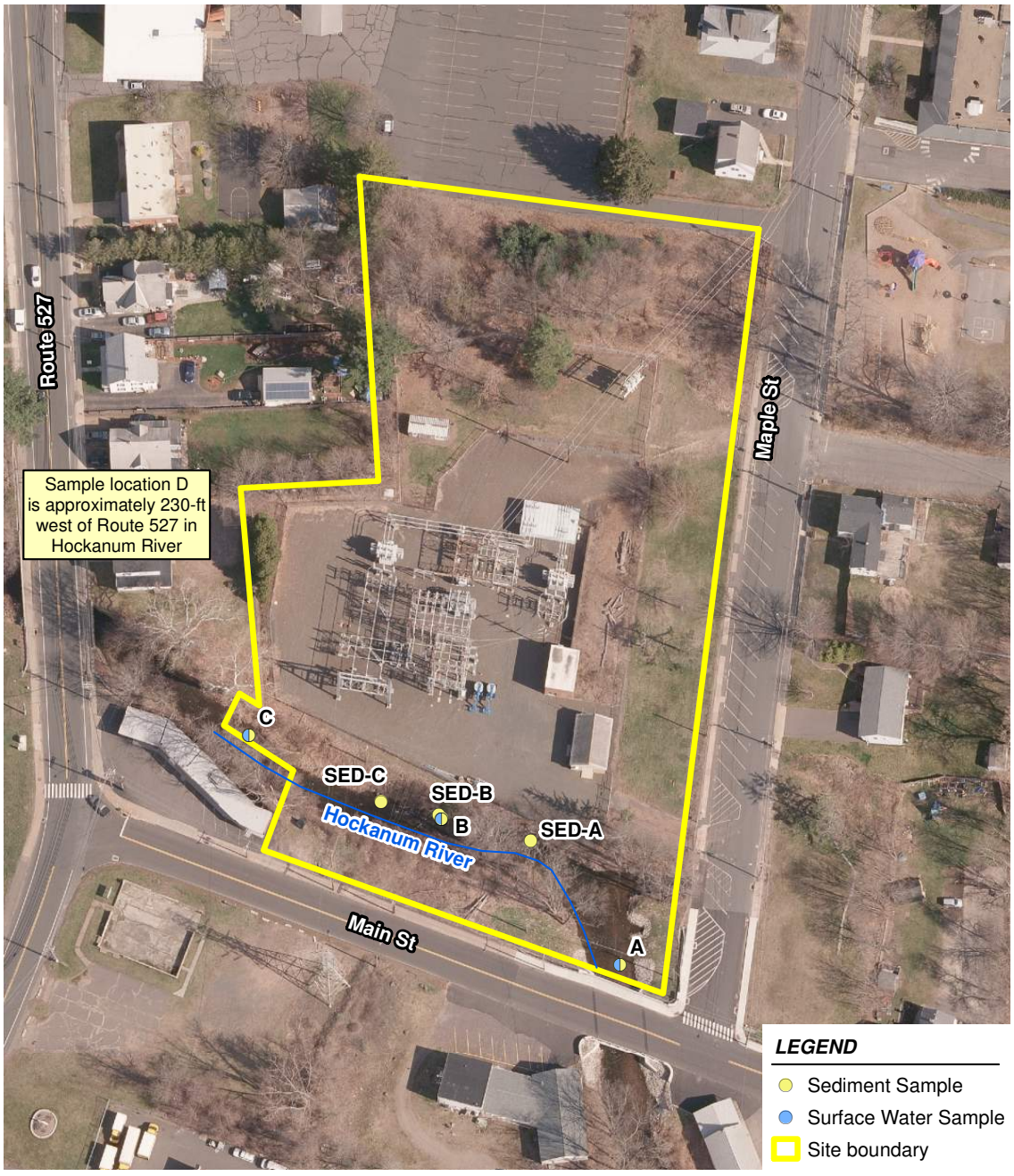


Figure 3. Parcels of land that comprise the Rockville Former MGP Site, Rockville, Vernon, Connecticut



Source:
Aerial photograph from USGS (2016).

Figure 4. Historical sediment and surface water sample location in the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

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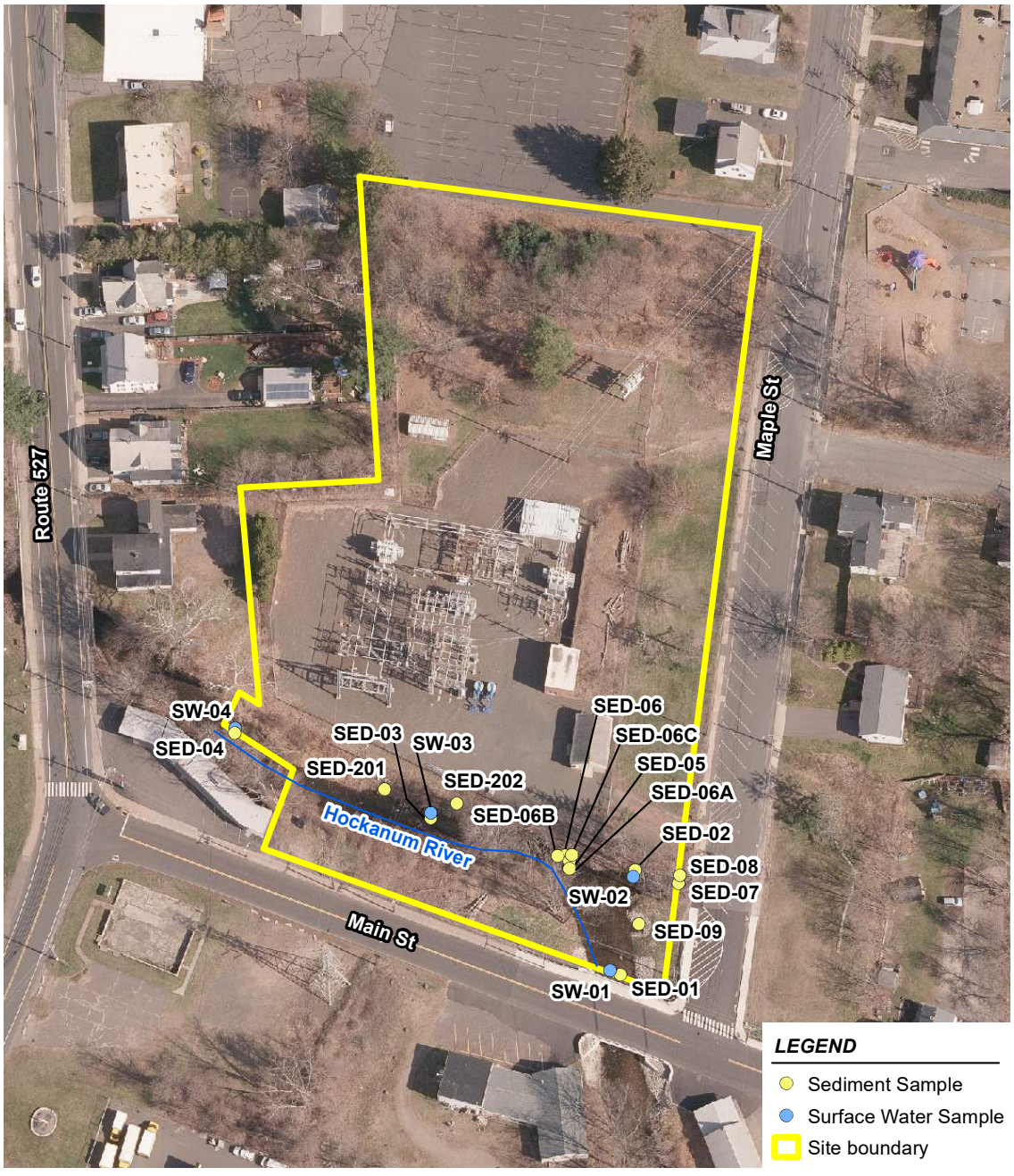
October 21, 2020 | C:\temp\2000174\projects\Historical sample locations.mxd



Source:
Aerial photograph from USGS (2016).

Figure 5. Current sediment and surface water sample locations in the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

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March 30, 2021 | \\befile\pfs\20\2000174.000-Vernon Connecticut Former MGP\GIS\projects\Current sample locations.mxd

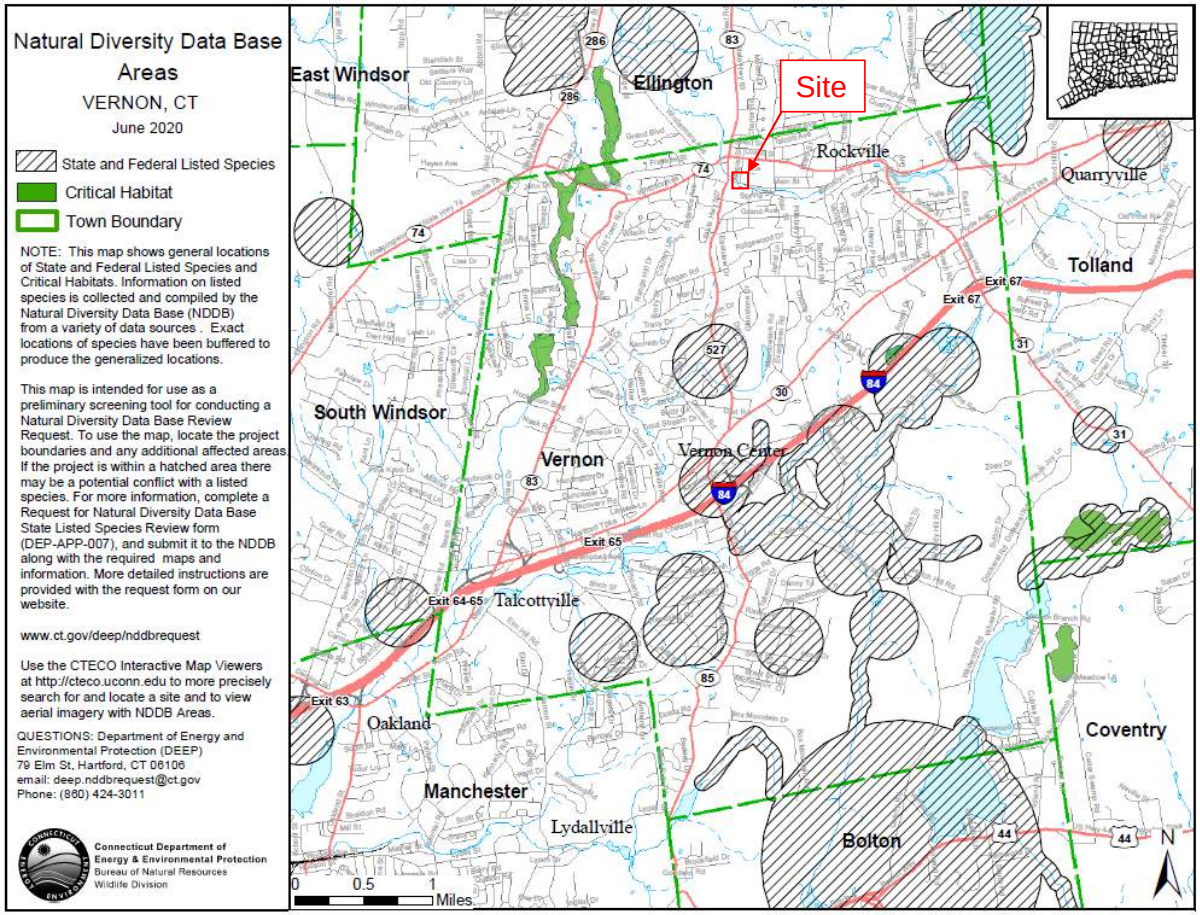

Figure 6. Natural Diversity Data Base Areas relative to the Rockville Former MGP Site, Rockville, Vernon, Connecticut

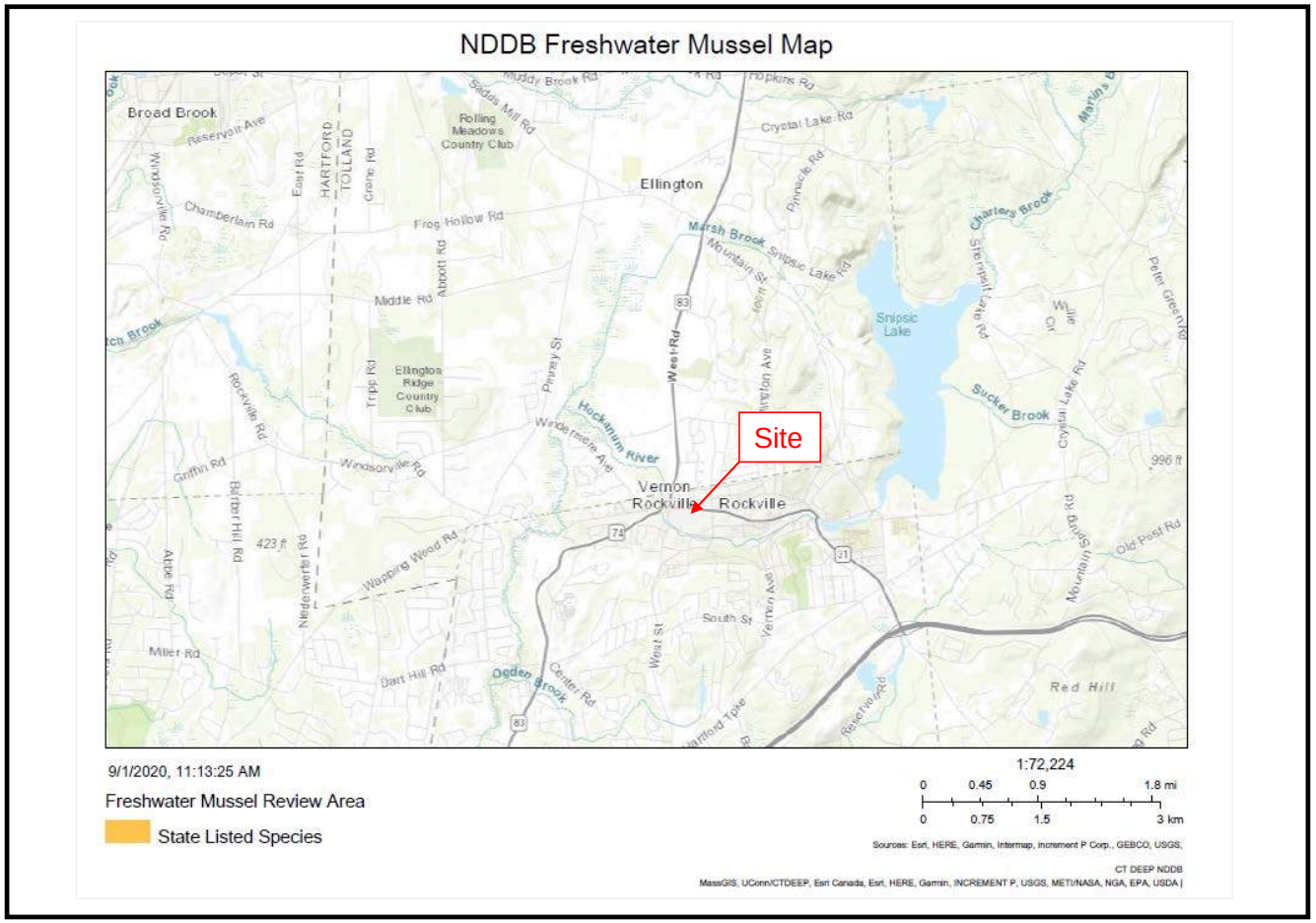

Figure 7. Natural Diversity Data Base freshwater mussel map near the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Note that there are no state-listed freshwater species shown near the Site.

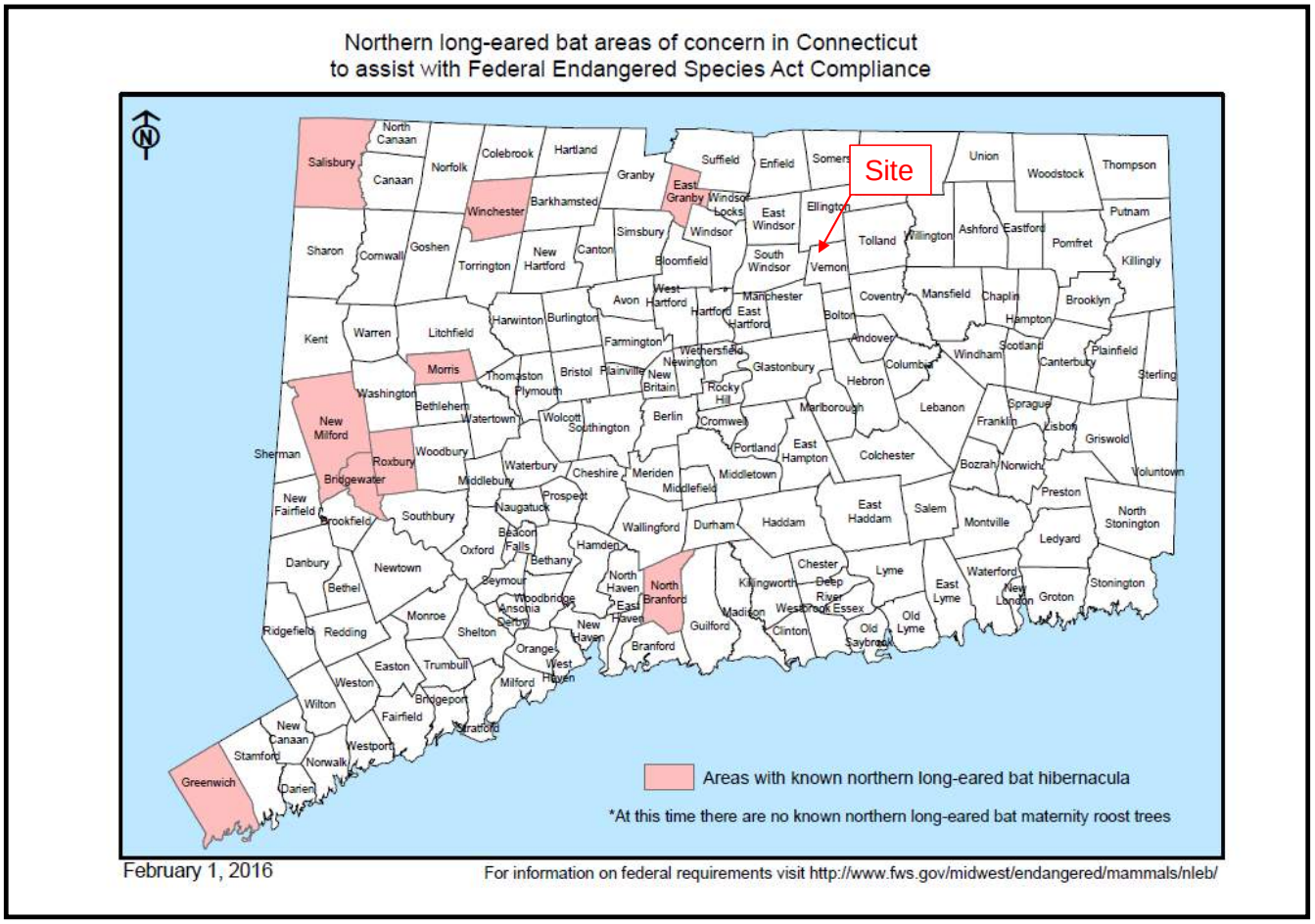

Figure 8. Locations of northern long-eared bat areas in Connecticut relative to the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Note that there are known northern long-eared bat hibernacula (places of hibernation) near the Site.

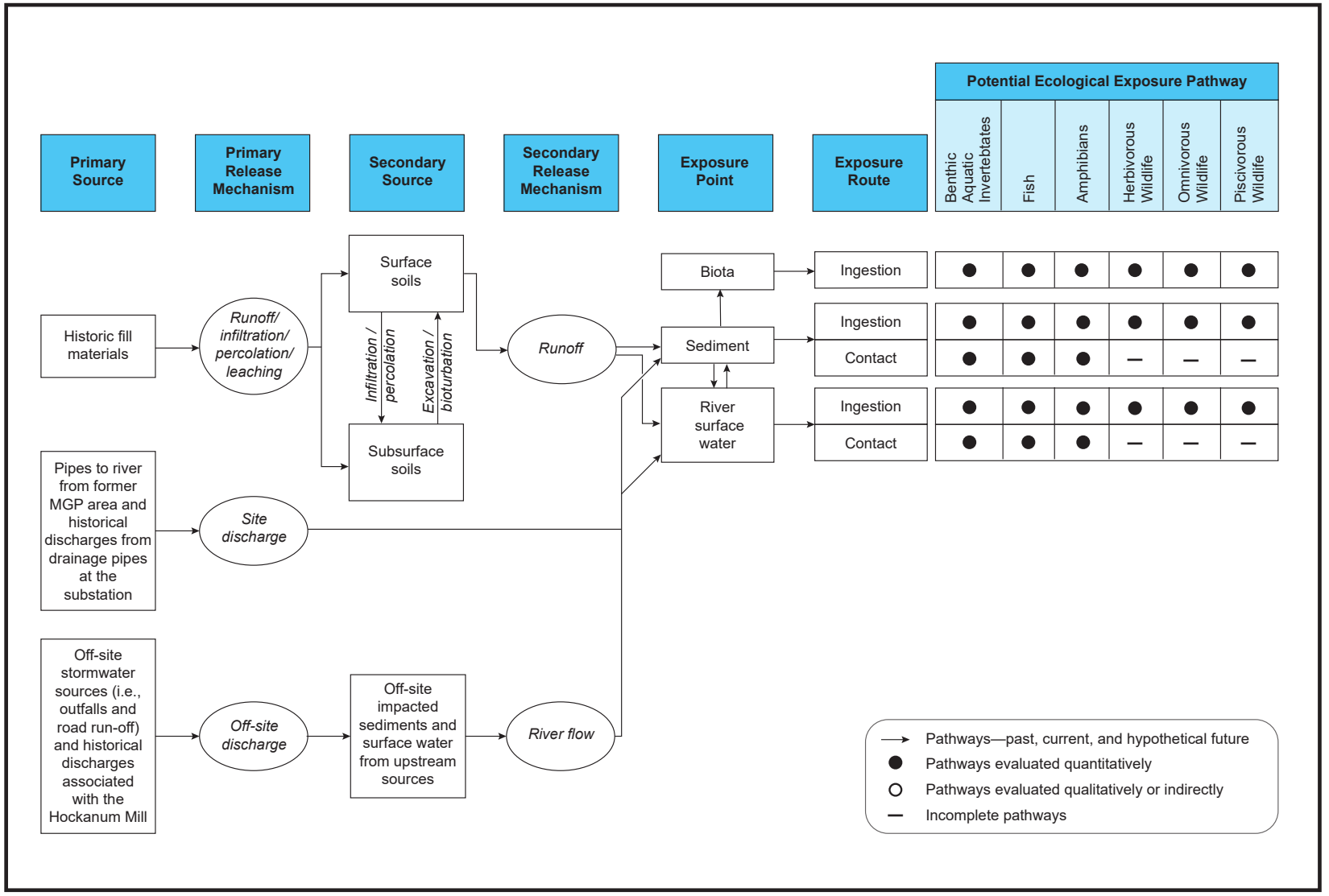

Figure 9. Ecological conceptual site model for the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

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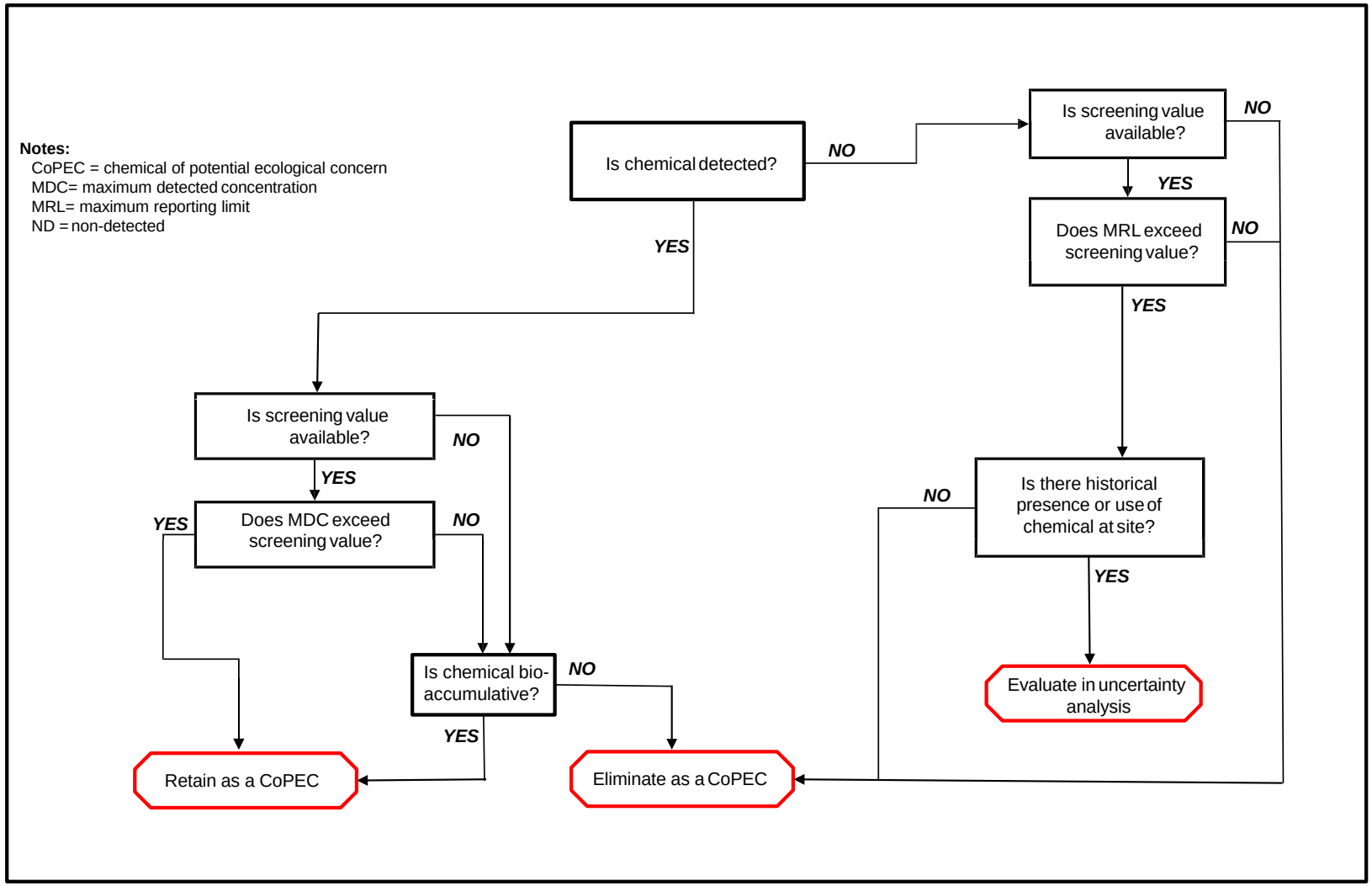

Figure 10. Selection process for chemical of potential ecological concern in sediment and surface water, Rockville Former MGP Site, Rockville, Vernon, Connecticut

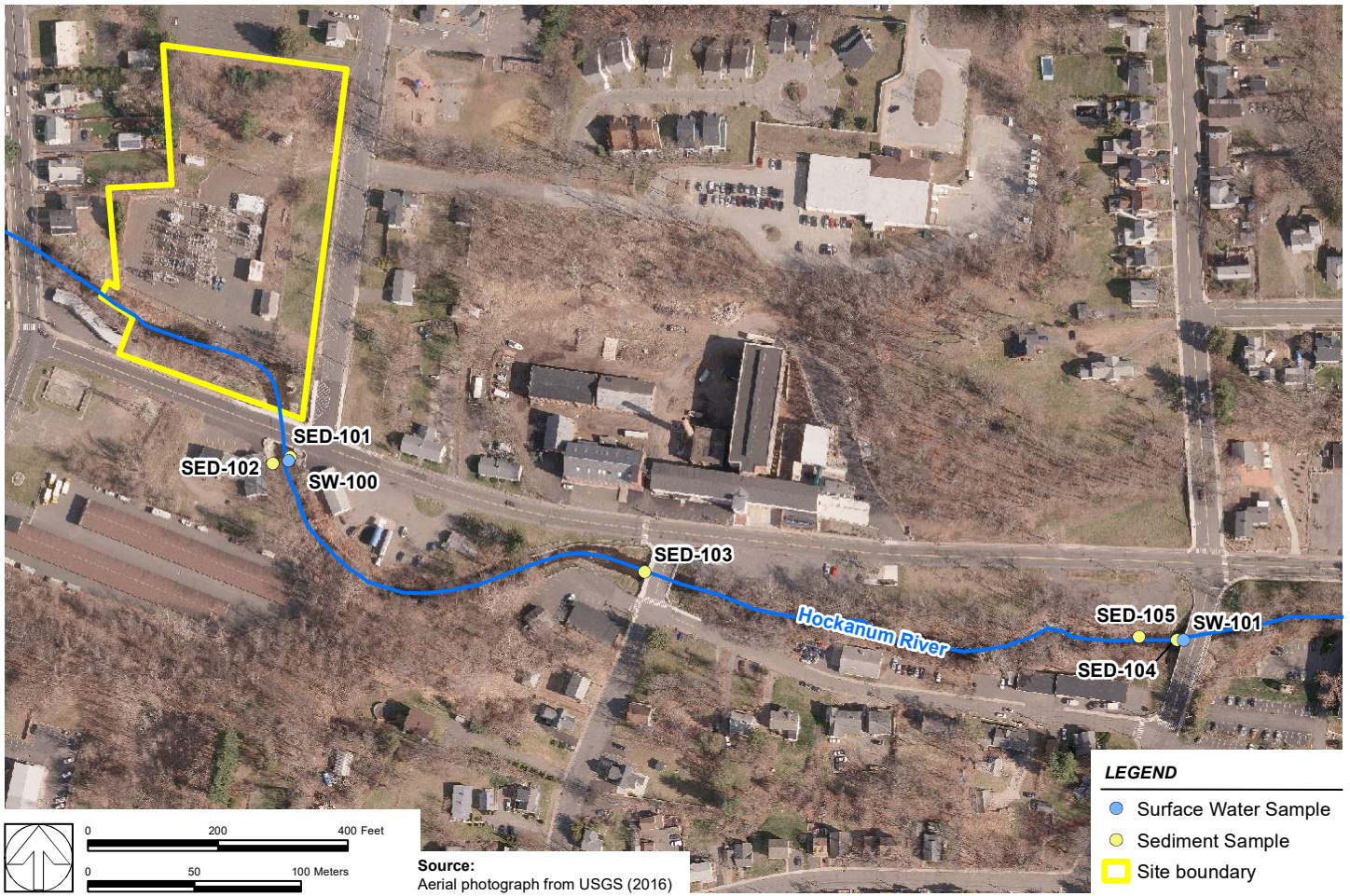

Figure 11. Current sediment and surface water sample locations in the Hockanum River upstream of the Rockville Former MGP Site, Rockville, Vernon, Connecticut

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March 1, 2021 | \\befile\pfs\20\2000174.000-Vernon Connecticut Former MGP\GIS\projects\sample locations.mxd

Tables

Table 1. Summary statistics of chemistry data for sediment samples in the Hockanum River at the Site

	Total No. Samples	Detects Count	Maximum Detected Conc. (mg/kg)	Maximum Reporting Limit (mg/kg)
CT ETPH	11	9	1400	290
Antimony	11	0	NA	22
Arsenic	11	8	7.3	0.85
Barium	11	11	324	NA
Beryllium	11	0	NA	1.8
Cadmium	11	4	2.9	1.4
Chromium (Total)	11	11	66.4	NA
Copper	14	14	2190	NA
Lead	11	11	267	NA
Mercury	11	3	0.21	0.03
Nickel	11	11	41.6	NA
Selenium	11	0	NA	8.9
Silver	11	0	NA	2.2
Thallium	11	0	NA	20
Vanadium	11	11	109	NA
Zinc	11	11	606	NA
Cyanide (Total)	6	0	NA	0.61
Aroclor-1016	11	0	NA	0.44
Aroclor-1221	11	0	NA	0.44
Aroclor-1232	11	0	NA	0.44
Aroclor-1242	11	0	NA	0.44
Aroclor-1248	11	0	NA	0.44
Aroclor-1254	11	0	NA	0.44
Aroclor-1260	11	0	NA	0.44
Aroclor-1262	11	0	NA	0.44
Aroclor-1268	11	0	NA	0.44
PCBs (Total)	11	0	NA	0.44
Tetrachlorobenzene, 1,2,4,5-	9	0	NA	3
Diphenylhydrazine, 1,2-	9	0	NA	4.3
Trichlorophenol, 2,4,5-	9	0	NA	3
Trichlorophenol, 2,4,6-	9	0	NA	3
Dichlorophenol, 2,4-	9	0	NA	3
Dimethylphenol, 2,4-	9	0	NA	3
Dinitrophenol, 2,4-	9	0	NA	4.3
Dinitrotoluene, 2,4-	9	0	NA	3
Dinitrotoluene, 2,6-	9	0	NA	3
Chloronaphthalene, 2-	9	0	NA	3
Chlorophenol, 2-	9	0	NA	3
Methylnaphthalene, 2-	11	2	0.79	3
Methylphenol, 2-	9	0	NA	3
Nitroaniline, 2-	9	0	NA	4.3
Nitrophenol, 2-	9	0	NA	3
Methylphenol, 3&4 (Cresol, m&p-)	9	0	NA	4.3
Dichlorobenzidine, 3,3-	9	0	NA	3
Nitroaniline, 3-	9	0	NA	4.3
Dinitro-2-methylphenol, 4,6-	9	0	NA	4.3

Table 1. Summary statistics of chemistry data for sediment samples in the Hockanum River at the Site

	Total No. Samples	Detects Count	Maximum Detected Conc. (mg/kg)	Maximum Reporting Limit (mg/kg)
Bromophenyl Phenyl Ether, 4-	9	0	NA	4.3
Chloro-3-methylphenol, 4-	9	0	NA	3
Chloroanilne, p- (4-Chloroaniline)	9	0	NA	3
Chlorophenyl-phenylether, 4-	9	0	NA	3
Nitroaniline, 4-	9	0	NA	6.9
Nitrophenol, 4-	9	0	NA	3
Acenaphthene	11	3	1.3	3
Acenaphthylene	11	8	1.4	3
Acetophenone	9	0	NA	3
Aniline	9	0	NA	4.3
Anthracene	11	7	3.3	3
Benzo(a)anthracene	11	10	7.2	1.5
Benzidine	9	0	NA	3
Benzo(a)pyrene	11	11	6.1	NA
Benzo(b)fluoranthene	11	10	5.3	3
Benzo(g,h,i)perylene	11	7	3.3	3
Benzo(k)fluoranthene	11	10	5.4	1.5
Benzoic acid	9	0	NA	8.6
bis(2-Chloroethoxy)methane	9	0	NA	3
bis(2-Chloroethyl)ether	9	0	NA	4.3
bis(2-Chloroisopropyl)ether	9	0	NA	3
bis(2-Ethylhexyl)phthalate	9	0	NA	3
Butyl benzyl phthalate	9	0	NA	3
Carbazole	9	2	1.5	4.3
Chrysene	11	11	7.6	NA
Dibenz(a,h)anthracene	11	4	0.80	3
Dibenzofuran	9	1	1.1	3
Diethylphthalate	9	0	NA	3
Dimethyl phthalate	9	0	NA	3
Di-N-Butyl Phthalate	9	0	NA	8.6
Di-N-Octyl Phthalate	9	0	NA	3
Fluoranthene	11	11	19	NA
Fluorene	11	6	2.2	3
Hexachlorobenzene	9	0	NA	3
Hexachlorocyclopentadiene	9	0	NA	3
Hexachloroethane	9	0	NA	3
Indeno(1,2,3-cd)pyrene	11	8	3.9	3
Isophorone	9	0	NA	3
Nitrobenzene	9	0	NA	3
N-Nitrosodimethylamine	9	0	NA	4.3
N-Nitroso-di-N-propylamine	9	0	NA	3
N-Nitrosodiphenylamine	9	0	NA	4.3
Pentachloronitrobenzene	9	0	NA	4.3
Pentachlorophenol	9	0	NA	4.3
Phenanthrene	11	10	19	1.5
Phenol	9	0	NA	3

Table 1. Summary statistics of chemistry data for sediment samples in the Hockanum River at the Site

	Total No. Samples	Detects Count	Maximum Detected Conc. (mg/kg)	Maximum Reporting Limit (mg/kg)
Pyrene	11	11	16	NA
Pyridine	9	0	NA	4.3
Naphthalene	11	2	0.77	3
Trichlorobenzene,1,2,4-	9	0	NA	3
Dichlorobenzene, 1,2- (o-DCB)	9	0	NA	3
Dichlorobenzene, 1,3-(m-DCB)	9	0	NA	3
Dichlorobenzene, 1,4- (p-DCB)	9	0	NA	3
Hexachlorobutadiene	9	0	NA	3
Naphthalene	9	0	NA	0.033
Tetrachloroethane, 1,1,1,2-	9	0	NA	0.033
Trichloroethane, 1,1,1-	9	0	NA	0.033
Tetrachloroethane, 1,1,2,2-	9	0	NA	0.02
Trichlorotrifluoroethane, 1,1,2-	9	0	NA	0.065
Trichloroethane, 1,1,2-	9	0	NA	0.033
Dichloroethane, 1,1-	9	0	NA	0.033
Dichloroethene, 1,1-	9	0	NA	0.033
Dichloropropene, 1,1-	9	0	NA	0.033
Trichlorobenzene, 1,2,3-	9	0	NA	0.033
Trichloropropane, 1,2,3-	9	0	NA	0.033
Trichlorobenzene,1,2,4-	9	0	NA	0.033
Trimethylbenzene, 1,2,4-	9	0	NA	0.033
Dibromo-3-chloropropane,1,2-	9	0	NA	0.033
Dichlorobenzene, 1,2- (o-DCB)	9	0	NA	0.033
Dichloroethane, 1,2-	9	0	NA	0.033
Dichloropropane, 1,2-	9	0	NA	0.033
Trimethylbenzene, 1,3,5-	9	0	NA	0.033
Dichlorobenzene, 1,3-(m-DCB)	9	0	NA	0.033
Dichloropropane, 1,3-	9	0	NA	0.033
Dichlorobenzene, 1,4- (p-DCB)	9	0	NA	0.033
Dichloropropane, 2,2-	9	0	NA	0.033
Chlorotoluene, 2-	9	0	NA	0.033
Methyl butyl ketone (2-Hexanone)	9	0	NA	0.16
Isopropyltoluene, 2- (o-Cymene)	9	0	NA	0.033
Chlorotoluene, 4-	9	0	NA	0.033
Isopropyltoluene, 4- (p-Cymene)	9	0	NA	0.033
Methyl Isobutyl Ketone (4-Methyl-2-penta	9	0	NA	0.16
Acetone	9	0	NA	1.6
Acrylonitrile	9	0	NA	0.033
Benzene	9	0	NA	0.033
Bromobenzene	9	0	NA	0.033
Bromochloromethane	9	0	NA	0.033
Bromodichloromethane	9	0	NA	0.033
Bromoform	9	0	NA	0.033
Bromomethane	9	0	NA	0.033
Butylbenzene, n-	9	0	NA	0.033
Butylbenzene, sec-	9	0	NA	0.033

Table 1. Summary statistics of chemistry data for sediment samples in the Hockanum River at the Site

	Total No. Samples	Detects Count	Maximum Detected Conc. (mg/kg)	Maximum Reporting Limit (mg/kg)
Butylbenzene, tert-	9	0	NA	0.033
Carbon disulfide	9	0	NA	0.033
Carbon tetrachloride	9	0	NA	0.033
Chlorobenzene	9	0	NA	0.033
Chloroethane	9	0	NA	0.033
Chloroform	9	0	NA	0.033
Chloromethane	9	0	NA	0.033
Dichloroethene, cis-1,2-	9	0	NA	0.033
Dichloropropene, cis-1,3-	9	0	NA	0.033
Dibromochloromethane	9	0	NA	0.02
Dibromomethane	9	0	NA	0.033
Dichlorodifluoromethane	9	0	NA	0.033
Ethylbenzene	9	0	NA	0.033
Ethylene Dibromide (EDB)	9	0	NA	0.033
Hexachlorobutadiene	9	0	NA	0.033
Isopropylbenzene (cumene)	9	0	NA	0.033
Xylene, m,p-	9	0	NA	0.033
Methyl ethyl ketone	9	0	NA	0.2
Methyl Tert-Butyl Ether (MTBE)	9	0	NA	0.065
Methylene Chloride (Dichloromethane)	9	0	NA	0.065
Propylbenzene, n-	9	0	NA	0.033
Xylene, o-	9	0	NA	0.033
Styrene	9	0	NA	0.033
Tetrachloroethylene (PCE)	9	0	NA	0.033
Tetrahydrofuran	9	0	NA	0.065
Toluene	9	1	0.24	0.0065
Dichloroethene, trans-1,2-	9	0	NA	0.033
Dichloropropene, trans-1,3-	9	0	NA	0.033
Dichloro-2-butene, trans-1,4-	9	0	NA	0.065
Trichloroethylene (TCE)	9	0	NA	0.033
Trichlorofluoromethane	9	0	NA	0.033
Vinyl Chloride	9	0	NA	0.033
Xylene (Total)	9	0	NA	0.033

Notes:

Conc. - concentration

mg/kg - milligram per killogram

NA - not available

Table 2. Summary statistics of chemistry data for surface water samples in the Hockanum River at the Site

	Total No. Samples	Detects Count	Maximum Detected Conc (ug/L)	Maximum Reporting Limit (ug/L)
CT ETPH	4	0	NA	70
Antimony (Total)	4	0	NA	5
Antimony (Dissolved)	4	0	NA	5
Arsenic (Total)	4	0	NA	4
Arsenic (Dissolved)	4	0	NA	4
Barium (Total)	4	4	53	NA
Barium (Dissolved)	4	4	56	NA
Beryllium (Total)	4	0	NA	1
Beryllium (Dissolved)	4	0	NA	1
Cadmium (Total)	4	0	NA	1
Cadmium (Dissolved	4	0	NA	1
Chromium (Total)	4	0	NA	1
Chromium (Dissolved)	4	2	1	1
Copper (Total)	4	0	NA	5
Copper (Dissolved)	4	0	NA	5
Lead (Total)	4	0	NA	2
Lead (Dissolved)	4	0	NA	2
Mercury (Total)	4	0	NA	0.2
Mercury (Dissolved)	4	0	NA	0.2
Nickel (Total)	4	0	NA	1
Nickel (Dissolved)	4	0	NA	1
Selenium (Total)	4	0	NA	10
Selenium (Dissolved)	4	0	NA	11
Silver (Total)	4	0	NA	1
Silver (Dissolved)	4	0	NA	1
Thallium (Total)	4	0	NA	1
Thallium (Dissolved)	4	0	NA	2
Vanadium (Total)	4	0	NA	2
Vanadium (Dissolved)	4	0	NA	2
Zinc (Total)	4	1	2.5	2
Zinc (Dissolved)	4	4	6	NA
Cyanide (Total)	4	0	NA	10
Tetrachlorobenzene, 1,2,4,5-	4	0	NA	0.49
Diphenylhydrazine, 1,2-	4	0	NA	4.9
Trichlorophenol, 2,4,5-	4	0	NA	0.99
Trichlorophenol, 2,4,6-	4	0	NA	0.99
Dichlorophenol, 2,4-	4	0	NA	0.99
Dimethylphenol, 2,4-	4	0	NA	0.99
Dinitrophenol, 2,4-	4	0	NA	0.99
Dinitrotoluene, 2,4-	4	0	NA	4.9
Dinitrotoluene, 2,6-	4	0	NA	4.9
Chloronaphthalene, 2-	4	0	NA	4.9
Chlorophenol, 2-	4	0	NA	0.99
Methylnaphthalene, 2-	4	0	NA	0.99
Methylphenol, 2-	4	0	NA	0.99
Nitroaniline, 2-	4	0	NA	4.9
Nitrophenol, 2-	4	0	NA	0.99

Table 2. Summary statistics of chemistry data for surface water samples in the Hockanum River at the Site

	Total No. Samples	Detects Count	Maximum Detected Conc (ug/L)	Maximum Reporting Limit (ug/L)
Methylphenol, 3&4 (Cresol, m&p-)	4	0	NA	9.9
Dichlorobenzidine, 3,3-	4	0	NA	4.9
Nitroaniline, 3-	4	0	NA	4.9
Dinitro-2-methylphenol, 4,6-	4	0	NA	0.99
Bromophenyl Phenyl Ether, 4-	4	0	NA	4.9
Chloro-3-methylphenol, 4-	4	0	NA	0.99
Chloroanilne, p- (4-Chloroaniline)	4	0	NA	4.9
Chlorophenyl-phenylether, 4-	4	0	NA	0.99
Nitroaniline, 4-	4	0	NA	4.9
Nitrophenol, 4-	4	0	NA	0.99
Acenaphthene	4	0	NA	0.05
Acenaphthylene	4	0	NA	0.05
Acetophenone	4	0	NA	4.9
Aniline	4	0	NA	4.9
Anthracene	4	0	NA	0.05
Benzo(a)anthracene	4	0	NA	0.05
Benzidine	4	0	NA	4.9
Benzo(a)pyrene	4	0	NA	0.05
Benzo(b)fluoranthene	4	0	NA	0.05
Benzo(g,h,i)perylene	4	0	NA	0.2
Benzo(k)fluoranthene	4	0	NA	0.05
Benzoic acid	4	0	NA	49
bis(2-Chloroethoxy)methane	4	0	NA	4.9
bis(2-Chloroethyl)ether	4	0	NA	0.99
bis(2-Chloroisopropyl)ether	4	0	NA	4.9
bis(2-Ethylhexyl)phthalate	4	0	NA	0.49
Butyl benzyl phthalate	4	0	NA	4.9
Carbazole	4	0	NA	4.9
Chrysene	4	0	NA	0.05
Dibenz(a,h)anthracene	4	0	NA	0.01
Dibenzofuran	4	0	NA	0.05
Diethylphthalate	4	0	NA	4.9
Dimethyl phthalate	4	0	NA	4.9
Di-N-Butyl Phthalate	4	0	NA	4.9
Di-N-Octyl Phthalate	4	0	NA	4.9
Fluoranthene	4	0	NA	0.05
Fluorene	4	0	NA	0.1
Hexachlorobenzene	4	0	NA	0.05
Hexachlorocyclopentadiene	4	0	NA	0.05
Hexachloroethane	4	0	NA	0.49
Indeno(1,2,3-cd)pyrene	4	0	NA	0.05
Isophorone	4	0	NA	4.9
Nitrobenzene	4	0	NA	0.1
N-Nitrosodimethylamine	4	0	NA	4.9
N-Nitroso-di-N-propylamine	4	0	NA	4.9
N-Nitrosodiphenylamine	4	0	NA	4.9
Pentachloronitrobenzene	4	0	NA	0.10

Table 2. Summary statistics of chemistry data for surface water samples in the Hockanum River at the Site

	Total No. Samples	Detects Count	Maximum Detected Conc (ug/L)	Maximum Reporting Limit (ug/L)
Pentachlorophenol	4	0	NA	0.79
Phenanthrene	4	0	NA	0.05
Phenol	4	0	NA	0.99
Pyrene	4	0	NA	0.05
Pyridine	4	0	NA	0.49
Naphthalene	4	0	NA	0.10
Tetrachloroethane, 1,1,1,2-	4	0	NA	1.0
Trichloroethane, 1,1,1-	4	0	NA	1.0
Tetrachloroethane, 1,1,2,2-	4	0	NA	0.5
Trichlorotrifluoroethane, 1,1,2-	4	0	NA	1.0
Trichloroethane, 1,1,2-	4	0	NA	1.0
Dichloroethane, 1,1-	4	0	NA	1.0
Dichloroethene, 1,1-	4	0	NA	1.0
Dichloropropene, 1,1-	4	0	NA	1.0
Trichlorobenzene, 1,2,3-	4	0	NA	1.0
Trichloropropane, 1,2,3-	4	0	NA	1.0
Trichlorobenzene,1,2,4-	4	0	NA	4.7
Trimethylbenzene, 1,2,4-	4	0	NA	1.0
Dibromo-3-chloropropane,1,2-	4	0	NA	1.0
Dichlorobenzene, 1,2- (o-DCB)	4	0	NA	2.5
Dichloroethane, 1,2-	4	0	NA	0.6
Dichloropropane, 1,2-	4	0	NA	1.0
Trimethylbenzene, 1,3,5-	4	0	NA	1.0
Dichlorobenzene, 1,3-(m-DCB)	4	0	NA	2.5
Dichloropropane, 1,3-	4	0	NA	1.0
Dichlorobenzene, 1,4- (p-DCB)	4	0	NA	2.5
Dichloropropane, 2,2-	4	0	NA	1.0
Chlorotoluene, 2-	4	0	NA	1.0
Methyl butyl ketone (2-Hexanone)	4	0	NA	5.0
Isopropyltoluene, 2- (o-Cymene)	4	0	NA	1.0
Chlorotoluene, 4-	4	0	NA	1.0
Isopropyltoluene, 4- (p-Cymene)	4	0	NA	1.0
Methyl Isobutyl Ketone (4-Methyl-2-penta	4	0	NA	5.0
Acetone	4	0	NA	25
Acrylonitrile	4	0	NA	5.0

Table 2. Summary statistics of chemistry data for surface water samples in the Hockanum River at the Site

	Total No. Samples	Detects Count	Maximum Detected Conc (ug/L)	Maximum Reporting Limit (ug/L)
Benzene	4	0	NA	0.7
Bromobenzene	4	0	NA	1.0
Bromochloromethane	4	0	NA	1.0
Bromodichloromethane	4	0	NA	0.5
Bromoform	4	0	NA	1.0
Bromomethane	4	0	NA	1.0
Butylbenzene, n-	4	0	NA	1.0
Butylbenzene, sec-	4	0	NA	1.0
Butylbenzene, tert-	4	0	NA	1.0
Carbon disulfide	4	0	NA	5.0
Carbon tetrachloride	4	0	NA	1.0
Chlorobenzene	4	0	NA	1.0
Chloroethane	4	0	NA	1.0
Chloroform	4	0	NA	1.0
Chloromethane	4	0	NA	1.0
Dichloroethene, cis-1,2-	4	0	NA	1.0
Dichloropropene, cis-1,3-	4	0	NA	0.4
Dibromochloromethane	4	0	NA	0.5
Dibromomethane	4	0	NA	1.0
Dichlorodifluoromethane	4	0	NA	1.0
Ethylbenzene	4	0	NA	1.0
Ethylene Dibromide (EDB)	4	0	NA	1.0
Hexachlorobutadiene	4	0	NA	0.49
Isopropylbenzene (cumene)	4	0	NA	1.0
Xylene, m,p-	4	0	NA	1.0
Methyl ethyl ketone	4	0	NA	5.0
Methyl Tert-Butyl Ether (MTBE)	4	0	NA	1.0
Methylene Chloride (Dichloromethane)	4	0	NA	1.0
Propylbenzene, n-	4	0	NA	1.0
Xylene, o-	4	0	NA	1.0
Styrene	4	0	NA	1.0
Tetrachloroethylene (PCE)	4	0	NA	1.0
Tetrahydrofuran	4	0	NA	2.5
Toluene	4	0	NA	1.0
Dichloroethene, trans-1,2-	4	0	NA	1.0
Dichloropropene, trans-1,3-	4	0	NA	0.4
Dichloro-2-butene, trans-1,4-	4	0	NA	5.0
Trichloroethylene (TCE)	4	0	NA	1.0
Trichlorofluoromethane	4	0	NA	1.0
Vinyl Chloride	4	0	NA	1.0
Xylene (Total)	4	0	NA	1.0

Notes:

Conc. - concentration

ug/L - microgram per liter

NA - not available

Table 3. Ecological screening levels selected for freshwater sediments

Analyte	Sediment Screening Level (mg/kg)	Source, Value
CT ETPH	NR	
Antimony	0.16	Buchman 2008, bkg
Arsenic	9.79	Buchman 2008, TEC
Barium	0.7	Buchman 2008, bkg
Beryllium	NR	
Cadmium	0.99	Buchman 2008, TEC
Chromium (Total)	43.4	Buchman 2008, TEC
Copper	31.6	Buchman 2008, TEC
Lead	35.8	Buchman 2008, TEC
Mercury	0.18	Buchman 2008, TEC
Nickel	22.7	Buchman 2008, TEC
Selenium	2	BTAG RIII 2006, SLV
Silver	1	BTAG RIII 2006, SLV
Thallium	NR	
Vanadium	50	Buchman 2008, bkg
Zinc	121	Buchman 2008, TEC
Cyanide (Total)	0.1	BTAG RIII 2006, SLV
Aroclor-1016	NR	
Aroclor-1221	NR	
Aroclor-1232	NR	
Aroclor-1242	NR	
Aroclor-1248	NR	
Aroclor-1254	0.06	Buchman 2008, TEL
Aroclor-1260	NR	
Aroclor-1262	NR	
Aroclor-1268	NR	
PCBs (Total)	0.0598	Buchman 2008, TEC
Tetrachlorobenzene, 1,2,4,5-	1.09	BTAG RIII 2006, SLV
Diphenylhydrazine, 1,2-	NR	
Trichlorophenol, 2,4,5-	NR	
Trichlorophenol, 2,4,6-	0.213	BTAG RIII 2006, SLV
Dichlorophenol, 2,4-	0.117	BTAG RIII 2006, SLV
Dimethylphenol, 2,4-	0.029	BTAG RIII 2006, SLV
Dinitrophenol, 2,4-	0.00621	EPA 2003, R5 ESL
Dinitrotoluene, 2,4-	0.0416	BTAG RIII 2006, SLV
Dinitrotoluene, 2,6-	0.0398	EPA 2003, R5 ESL
Chloronaphthalene, 2-	0.417	EPA 2003, R5 ESL
Chlorophenol, 2-	0.0312	BTAG RIII 2006, SLV
Methylnaphthalene, 2-	0.0202	BTAG RIII 2006, SLV
Methylphenol, 2-	0.0554	EPA 2003, R5 ESL
Nitroaniline, 2-	NR	
Nitrophenol, 2-	NR	
Methylphenol, 3&4 (Cresol, m&p-)	0.67	BTAG RIII 2006, SLV
Dichlorobenzidine, 3,3-	0.127	BTAG RIII 2006, SLV
Nitroaniline, 3-	NR	
Dinitro-2-methylphenol, 4,6-	0.104	EPA 2003, R5 ESL

Table 3. Ecological screening levels selected for freshwater sediments

Analyte	Sediment Screening Level (mg/kg)	Source, Value
Bromophenyl Phenyl Ether, 4-	1.23	BTAG RIII 2006, SLV
Chloro-3-methylphenol, 4-	0.388	EPA 2003, R5 ESL
Chloroanilne, p- (4-Chloroaniline)	0.146	EPA 2003, R5 ESL
Chlorophenyl-phenylether, 4-	NR	
Nitroaniline, 4-	NR	
Nitrophenol, 4-	0.0133	EPA 2003, R5 ESL
Acenaphthene	0.0067	BTAG RIII 2006, SLV
Acenaphthylene	0.0059	BTAG RIII 2006, SLV
Acetophenone	NR	
Aniline	0.00031	EPA 2003, R5 ESL
Anthracene	0.0572	Buchman 2008, TEC
Benzo(a)anthracene	0.108	Buchman 2008, TEC
Benzidine	NR	
Benzo(a)pyrene	0.15	Buchman 2008, TEC
Benzo(b)fluoranthene	10.4	EPA 2003, R5 ESL
Benzo(g,h,i)perylene	0.17	BTAG RIII 2006, SLV
Benzo(k)fluoranthene	0.0272	Buchman 2008, TEL-H
Benzoic acid	0.65	BTAG RIII 2006, SLV
bis(2-Chloroethoxy)methane	NR	
bis(2-Chloroethyl)ether	3.52	EPA 2003, R5 ESL
bis(2-Chloroisopropyl)ether	NR	
bis(2-Ethylhexyl)phthalate	0.18	BTAG RIII 2006, SLV
Butyl benzyl phthalate	11	EPA 1996, ET
Carbazole	NR	
Chrysene	0.166	Buchman 2008, TEC
Dibenz(a,h)anthracene	0.033	Buchman 2008, TEC
Dibenzofuran	2	EPA 1996, ET
Diethylphthalate	0.63	EPA 1996, ET
Dimethyl phthalate	NR	
Di-N-Butyl Phthalate	11	EPA 1996, ET
Di-N-Octyl Phthalate	40.6	EPA 2003, R5 ESL
Fluoranthene	0.423	Buchman 2008, TEC
Fluorene	0.0774	Buchman 2008, TEC
Hexachlorobenzene	0.02	BTAG RIII 2006, SLV
Hexachlorocyclopentadiene	0.901	EPA 2003, R5 ESL
Hexachloroethane	1.0	EPA 1996, ET
Indeno(1,2,3-cd)pyrene	0.0173	Buchman 2008, TEL-H
Isophorone	0.432	EPA 2003, R5 ESL
Nitrobenzene	0.145	EPA 2003, R5 ESL
N-Nitrosodimethylamine	NR	
N-Nitroso-di-N-propylamine	NR	
N-Nitrosodiphenylamine	2.68	BTAG RIII 2006, SLV
Pentachloronitrobenzene	NR	
Pentachlorophenol	0.504	BTAG RIII 2006, SLV
Phenanthrene	0.204	Buchman 2008, TEC
Phenol	0.42	BTAG RIII 2006, SLV

Table 3. Ecological screening levels selected for freshwater sediments

Analyte	Sediment Screening Level (mg/kg)	Source, Value
Pyrene	0.195	Buchman 2008, TEC
Pyridine	0.106	EPA 2003, R5 ESL
Naphthalene	0.176	Buchman 2008, TEC
Trichlorobenzene,1,2,4-	9.2	EPA 1996, ET
Dichlorobenzene, 1,2- (o-DCB)	0.34	EPA 1996, ET
Dichlorobenzene, 1,3-(m-DCB)	1.7	EPA 1996, ET
Dichlorobenzene, 1,4- (p-DCB)	0.35	EPA 1996, ET
Hexachlorobutadiene	0.0265	EPA 2003, R5 ESL
Naphthalene	0.176	Buchman 2008, TEC
Tetrachloroethane, 1,1,1,2-	NR	
Trichloroethane, 1,1,1-	0.17	EPA 1996, ET
Tetrachloroethane, 1,1,2,2-	0.94	EPA 1996, ET
Trichlorotrifluoroethane, 1,1,2-	NR	
Trichloroethane, 1,1,2-	1.24	BTAG RIII 2006, SLV
Dichloroethane, 1,1-	0.000575	EPA 2003, R5 ESL
Dichloroethene, 1,1-	0.031	BTAG RIII 2006, SLV
Dichloropropene, 1,1-	NR	
Trichlorobenzene, 1,2,3-	0.858	BTAG RIII 2006, SLV
Trichloropropane, 1,2,3-	NR	
Trichlorobenzene,1,2,4-	9.2	EPA 1996, ET
Trimethylbenzene, 1,2,4-	NR	
Dibromo-3-chloropropane,1,2-	NR	
Dichlorobenzene, 1,2- (o-DCB)	0.34	EPA 1996, ET
Dichloroethane, 1,2-	0.26	EPA 2003, R5 ESL
Dichloropropane, 1,2-	0.333	EPA 2003, R5 ESL
Trimethylbenzene, 1,3,5-	NR	
Dichlorobenzene, 1,3-(m-DCB)	1.7	EPA 1996, ET
Dichloropropane, 1,3-	NR	
Dichlorobenzene, 1,4- (p-DCB)	0.35	EPA 1996, ET
Dichloropropane, 2,2-	NR	
Chlorotoluene, 2-	NR	
Methyl butyl ketone (2-Hexanone)	NR	
Isopropyltoluene, 2- (o-Cymene)	NR	
Chlorotoluene, 4-	NR	
Isopropyltoluene, 4- (p-Cymene)	NR	
Methyl Isobutyl Ketone (4-Methyl-2-pentanone)	NR	
Acetone	0.0099	EPA 2003, R5 ESL
Acrylonitrile	0.0012	EPA 2003, R5 ESL
Benzene	0.142	EPA 2003, R5 ESL
Bromobenzene	NR	
Bromochloromethane	NR	
Bromodichloromethane	NR	
Bromoform	0.654	BTAG RIII 2006, SLV
Bromomethane	0.00137	EPA 2003, R5 ESL
Butylbenzene, n-	NR	
Butylbenzene, sec-	NR	

Table 3. Ecological screening levels selected for freshwater sediments

Analyte	Sediment Screening Level (mg/kg)	Source, Value
Butylbenzene, tert-	NR	
Carbon disulfide	0.000851	BTAG RIII 2006, SLV
Carbon tetrachloride	0.0642	BTAG RIII 2006, SLV
Chlorobenzene	0.82	EPA 1996, ET
Chloroethane	NR	
Chloroform	0.121	EPA 2003, R5 ESL
Chloromethane	NR	
Dichloroethene, cis-1,2-	NR	
Dichloropropene, cis-1,3-	0.0000509	BTAG RIII 2006, SLV
Dibromochloromethane	NR	
Dibromomethane	NR	
Dichlorodifluoromethane	NR	
Ethylbenzene	3.6	EPA 1996, ET
Ethylene Dibromide (EDB)	NR	
Hexachlorobutadiene	0.0265	EPA 2003, R5 ESL
Isopropylbenzene (cumene)	0.086	BTAG RIII 2006, SLV
Xylene, m,p-	0.0252	BTAG RIII 2006, SLV
Methyl ethyl ketone	0.0424	EPA 2003, R5 ESL
Methyl Tert-Butyl Ether (MTBE)	NR	
Methylene Chloride (Dichloromethane)	0.159	EPA 2003, R5 ESL
Propylbenzene, n-	NR	
Xylene, o-	NR	
Styrene	0.559	BTAG RIII 2006, SLV
Tetrachloroethylene (PCE)	0.53	EPA 1996, ET
Tetrahydrofuran	NR	
Toluene	0.67	EPA 1996, ET
Dichloroethene, trans-1,2-	1.05	BTAG RIII 2006, SLV
Dichloropropene, trans-1,3-	0.0000509	BTAG RIII 2006, SLV
Dichloro-2-butene, trans-1,4-	NR	
Trichloroethylene (TCE)	1.6	EPA 1996, ET
Trichlorofluoromethane	NR	
Vinyl Chloride	0.202	EPA 2003, R5 ESL
Xylene (Total)	0.433	EPA 2003, R5 ESL

Notes:

bkg - background

ESL - ecological screening level

ET - ecotox threshold

NR - not reported

SLV - screening level value

TEC - threshold effect concentration

TEL - threshold effect level

TEL-H - ARCS threshold level (*Hyalella azteca*)

Table 4. Summary of chemicals of potential ecological concern for sediment

Chemical	Class	BCC (Y/N)	MDC > SL (Y/N)	Other Reason for CoPEC Selection
Detected CoPECs				
CT EPH	Hydrocarbon	B	N	No SL, but is a BCC
Arsenic	Metal	B	N	Is a BCC
Barium	Metal		Y	
Cadmium	Metal		Y	
Chromium (Total)	Metal		Y	
Copper	Metal		Y	
Lead	Metal		Y	
Mercury	Metal		Y	
Nickel	Metal		Y	
Vanadium	Metal		Y	
Zinc	Metal		Y	
Methylnaphthalene, 2-	PAH		Y	
Acenaphthene	PAH		Y	
Acenaphthylene	PAH		Y	
Anthracene	PAH		Y	
Benzo(a)anthracene	PAH		Y	
Benzo(a)pyrene	PAH		Y	
Benzo(b)fluoranthene	PAH	B	N	Is a BCC
Benzo(g,h,i)perylene	PAH		Y	
Benzo(k)fluoranthene	PAH		Y	
Chrysene	PAH		Y	
Dibenz(a,h)anthracene	PAH		Y	
Fluoranthene	PAH		Y	
Fluorene	PAH		Y	
Indeno(1,2,3-cd)pyrene	PAH		Y	
Phenanthrene	PAH		Y	
Pyrene	PAH		Y	
Naphthalene	PAH		Y	

Non-Detected CoPECS (MRL > SL)	
Metals	3 (Antimony, Selenium, Silver)
Inorganic	1 (Cyanide)
SVOCs	35 (Tetrachlorobenzene, 1,2,4,5-; Trichlorophenol, 2,4,6-; Dichlorophenol, 2,4-; Dimethylphenol, 2,4-; Dinitrophenol, 2,4-; Dinitrotoluene, 2,4-; Dinitrotoluene, 2,6-; Chloronaphthalene, 2-; Chlorophenol, 2-; Methylphenol, 2-; Methylphenol, 3&4 (Cresol, m&p-); Dichlorobenzidine, 3,3-; Dinitro-2-methylphenol, 4,6-; Bromophenyl Phenyl Ether, 4-; Chloro-3-methylphenol, 4-; Chloroanilne, p- (4-Chloroaniline); Nitrophenol, 4-; Aniline; Benzoic acid; bis(2-Chloroethyl)ether; bis(2-Ethylhexyl)phthalate; Diethylphthalate; Hexachlorobenzene; Hexachlorocyclopentadiene; Hexachloroethane; Isophorone; Nitrobenzene; N-Nitrosodiphenylamine; Pentachlorophenol; Phenol; Pyridine; Dichlorobenzene, 1,2- (o-DCB); Dichlorobenzene, 1,3-(m-DCB); Dichlorobenzene, 1,4- (p-DCB); Hexachlorobutadiene)
VOCs	11 (Dichloroethane, 1,1-; Dichloroethene, 1,1-; Acetone; Acrylonitrile; Bromobenzene; Carbon disulfide; Dichloropropene, cis-1,3-; Hexachlorobutadiene; Xylene, m,p-; Methyl ethyl ketone; Dichloropropene, trans-1,3-)

Notes:
Refer to Appendix A for the complete summary of CoPECs.
CoPEC are based on exceedance of the freshwater sediment screening level.
Detected CoPEC are evaluated quantitatively; non-detected CoPEC evaluated in the uncertatiny analysis.
MDC - maximum detected concentration
MRL - maximum reporting limit
SL - screening level
BCC - bioaccumulative chemical compound
PAHs - polycyclic aromatic hydrocarbons
VOCs - volatile organic compound
SVOCs - semivolatile organic compound

Table 5. Ecological screening levels selected for freshwater

Analyte	Surface Water Screening Level (ug/L)	Source, Value
CT ETPH	NR	
Arsenic	150	CTDEEP 2011, CWQS
Arsenic	150	CTDEEP 2011, CWQS
Cadmium	0.125	CTDEEP 2011, CWQS*
Cadmium	0.125	CTDEEP 2011, CWQS*
Chromium (Total)	11	CTDEEP 2011, CWQS
Chromium (Total)	11	CTDEEP 2011, CWQS
Copper	4.8	CTDEEP 2011, CWQS*
Copper	4.8	CTDEEP 2011, CWQS*
Lead	1.2	CTDEEP 2011, CWQS*
Lead	1.2	CTDEEP 2011, CWQS*
Mercury	0.77	CTDEEP 2011, CWQS
Mercury	0.77	CTDEEP 2011, CWQS
Nickel	28.9	CTDEEP 2011, CWQS*
Nickel	28.9	CTDEEP 2011, CWQS*
Selenium	5	CTDEEP 2011, CWQS
Selenium	5	CTDEEP 2011, CWQS
Zinc	65	CTDEEP 2011, CWQS*
Zinc	65	CTDEEP 2011, CWQS*
Cyanide (Total)	5.2	CTDEEP 2011, CWQS
Pentachlorophenol	15	CTDEEP 2011, CWQS

Notes:

AWQC - ambient water quality criteria

CCC - criteria chronic concentration

CMC - criteria maximum concentration

CTDEEP - Connecticut Department of Energy and Environmental Protection

CWQS - Connecticut water quality standard

ESL - ecological screening level

ET - ecotox threshold

FCV - final chronic value

NR - not reported

SCV - secondary chronic value

SLV - screening level value

* - The criterion for this metal is hardness-dependent; data are screened with values in this source.

Table 6. Summary of chemicals of potential ecological concern for surface water

Chemical	Class	BCC	MDC > SL (Y/N)	Other Reason for CoPEC Selection
Detected CoPECs				
Barium (Total)	Metal		Y	
Barium (Dissolved)	Metal		Y	
Zinc (Total)	Metal	B	N	Is a BCC
Zinc (Dissolved)	Metal	B	N	Is a BCC
Non-Detected CoPECS (MRL > SL)				
Metals	6 (Beryllium; Cadmium; Copper; Lead; Selenium; Silver)[1]			
Inorganics	1 (Cyanide)			
PAHs	3 (Benzo(a)anthracene; Benzo(a)pyrene; Pyrene)			
SVOCs	9 (Chloronaphthalene, 2-; Dichlorobenzidine, 3,3-; Bromophenyl Phenyl Ether, 4-; Chloro-3-methylphenol, 4-; Aniline; Benzidine; Benzoic acid; Dimethyl phthalate; Hexachlorobenzene)			
VOCs	3 (Carbon disulfide; Dichloropropene, cis-1,3-; Dichloropropene, trans-1,3-)			

Notes:

Refer to Appendix A for the complete summary of CoPECs.

CoPEC are based on exceedance of the surface water screening level.

Detected CoPEC are evaluated quantitatively; non-detected CoPEC evaluated in the uncertatiny analysis.

MDC - maximum detected concentration

MRL - maximum reporting limit

SL - screening level

BCC - bioaccumulative chemical compound

PAHs - polycyclic aromatic hydrocarbons

VOCs - volatile organic compounds

SVOCs - semivolatile organic compounds

[1]Metals category of Non-Detected CoPECs refer to both the total and dissolved forms of the metals listed.

Table 7. Combined list of chemicals of potential ecological concern

Chemical	CoPEC	Comment
CT ETPH	X	This will be evaluated through individual compounds in PAH list.
Arsenic	X	
Barium	X	
Cadmium	X	
Chromium (Total)	X	
Copper	X	
Lead	X	
Mercury	X	
Nickel	X	
Vanadium	X	
Zinc	X	
Methylnaphthalene, 2-	X	
Acenaphthene	X	
Acenaphthylene	X	
Anthracene	X	
Benzo(a)anthracene	X	
Benzo(a)pyrene	X	
Benzo(b)fluoranthene	X	
Benzo(g,h,i)perylene	X	
Benzo(k)fluoranthene	X	
Chrysene	X	
Dibenz(a,h)anthracene	X	
Fluoranthene	X	
Fluorene	X	
Indeno(1,2,3-cd)pyrene	X	
Phenanthrene	X	
Pyrene	X	
Naphthalene	X	

Note:

Total polycyclic aromatic hydrocarbons (PAHs) will also be evaluated as a CoPEC because several TRVs are available as the sum of individual PAHs (or Total PAHs).

Table 8. Exposure profiles for wildlife receptors

	Mallard *Anas platyrhynchos* Avian herbivore		Great Blue Heron *Ardea herodias* Avian Omnivore		Raccoon *Procyon lotor* Mammalian Omnivore	
	Value	Source	Value	Source	Value	Source
Body Weight (BW) (kilograms)	1.043	Nelson and Martin (1983, as cited by U.S. EPA 1993)	2.2	Hartman (1961 as cited in U.S. EPA 1993)	6.0	Sanderson (1984, as cited by U.S. EPA 1993)
BW-normalized Food Ingestion Rate ($NFIR_{dry}$) (kg/kg bw-day, dry wt.)	0.050	Estimated from Nagy (2001) for omnnivorous birds	0.038	Estimated from Nagy (2001) for omnnivorous birds	0.026	Estimated from Nagy (2001) for omnivorous mammals
BW-normalized Food Ingestion Rate ($NFIR_{wet}$) (kg/kg bw-day, wet wt.)	0.16	Estimated from Nagy (2001) for omnnivorous birds	0.12	Estimated from Nagy (2001) for omnnivorous birds	0.082	Estimated from Nagy (2001) for omnivorous mammals
Fraction Soil/Sediment of Diet (FSD)	0.033	Beyer et al. (1994)	0.014	Estimated from Pascoe et al. 1996	0.094	Beyer et al. (1994)
Normalized Soil/Sediment Ingestion Rate (NSIR) (kg/kg bw-day, dry wt.)	0.0017	Calculated (product of $NFIR_{dry}$ and FSD)	0.00053	Calculated (product of $NFIR_{dry}$ and FSD)	0.0025	Calculated (product of $NFIR_{dry}$ and FSD)
BW-normalized Water Ingestion Rate (NWIR) (L/kg bw-day)	0.058	Estimated from Calder and Braun (1983)	0.045	Estimated from Calder and Braun (1983)	0.083	Estimated from Calder and Braun (1983)
Dietary Components	Grass, rice, snails, insects, annelids, crustaceans	U.S.EPA (1993)	Mostly fish, aquatic invertebrates, some small mammals	U.S.EPA (1993)	Aquatic invertebrates, some fish, insects, earthworms, vegetation	U.S.EPA (1993)
Assumed Diets for Food Chain Models	100% Plants		50% Fish; 50% Benthic Invertebrates		50% Fish; 50% Benthic Invertebrates	
Foraging Range (FR) (units vary)	1,334 acres	Kirby et al. (1985, as cited in U.S. EPA 1993)	3.1 km shoreline	Dowd and Flake (1985, as cited by U.S. EPA 1993)	267 acres	Stuewer (1943, as cited in U.S. EPA 1993)

Table 9. Exposure point concentrations for sediment and surface water

	Sediment		Surface Water	
CoPEC	Value Used (mg/kg)	Basis	Value Used (mg/L)	Basis
Arsenic	7.3	MDC	0.004	MRL
Barium	324	MDC	0.056	MDC
Cadmium	2.9	MDC	0.001	MRL
Chromium (Total)	66.4	MDC	0.001	MRL
Copper	2190	MDC	0.005	MRL
Lead	267	MDC	0.002	MRL
Mercury	0.21	MDC	0.0002	MRL
Nickel	41.6	MDC	0.001	MRL
Vanadium	109	MDC	0.002	MRL
Zinc	606	MDC	0.006	MDC
Methylnaphthalene, 2-	0.79	MDC	0.00099	MRL
Acenaphthene	1.3	MDC	0.00005	MRL
Acenaphthylene	1.4	MDC	0.00005	MRL
Anthracene	3.3	MDC	0.00005	MRL
Benzo(a)anthracene	7.2	MDC	0.00005	MRL
Benzo(a)pyrene	6.1	MDC	0.00005	MRL
Benzo(b)fluoranthene	5.3	MDC	0.00005	MRL
Benzo(g,h,i)perylene	3.3	MDC	0.0002	MRL
Benzo(k)fluoranthene	5.4	MDC	0.00005	MRL
Chrysene	7.6	MDC	0.00005	MRL
Dibenz(a,h)anthracene	0.80	MDC	0.00001	MRL
Fluoranthene	19	MDC	0.00005	MRL
Fluorene	2.2	MDC	0.0001	MRL
Indeno(1,2,3-cd)pyrene	3.9	MDC	0.00005	MRL
Naphthalene	0.77	MDC	0.0001	MRL
Phenanthrene	19	MDC	0.00005	MRL
Pyrene	16	MDC	0.00005	MRL
Total PAHs	100	MDC	0.002	MRL

Notes:

CoPEC - contaminant of potential ecological concern

MDC - maximum detected concentration

MRL - maximum reporting limit

For metal EPCs in surface water the maximum value between the dissolved and total measurement was used.

PAHs - polycyclic aromatic hydrocarbons

Table 10. Exposure point concentrations for plants, invertebrates, and fishes

	Plant EPC Calculation			Invertebrate EPC Calculation			Fish EPC Calculation		
CoPEC	Sediment-Plant BAF	Max. Sediment Conc. EPC (mg/kg)	Estimated Plant Conc. (mg/kg ww)	Sediment-Invertebrate BAF	Max. Sediment Conc. EPC (mg/kg)	Estimated Invertebrate Conc. (mg/kg ww)	Trophic Transfer Factor	Estimated Invertebrate Conc. (mg/kg ww)	Estimated Fish Conc. (mg/kg ww)
Arsenic	=(0.2*0.03752*Sed Conc.)	7.3	0.055	=(0.3*(10^(0.754*log(Sed Conc.)-0.292)))	7.3	0.69	2.2	0.69	1.51
Barium	=(0.2*0.156*Sed Conc.)	324	10.1	=(0.3*0.091*Sed Conc.)	324	8.85	1 [a]	8.85	8.85
Cadmium	=(0.2*(EXP(0.546*LN(Sed Conc.)-0.475)))	2.9	0.22	=(0.3*(10^(0.692*log(Sed Conc.)+0.0395)))	2.9	0.69	5.0	0.69	3.43
Chromium	=(0.2*0.041*Sed Conc.)	66.4	0.54	=(0.3*(10^(0.365*log(Sed Conc.)+0.2092)))	66.4	2.25	0.10	2.25	0.22
Copper	=(0.2*(EXP(0.394*LN(Sed Conc.)+0.668)))	2190	8.08	=(0.3*(10^(0.278*log(Sed Conc.)+0.1.089)))	2190	31.2	0.5	31.2	15.6
Lead	=(0.2*(EXP(0.561*LN(Sed Conc.)-1.328)))	267	1.22	=(0.3*(10^(0.801*log(Sed Conc.)-0.776)))	267	4.41	0.3	4.41	1.32
Mercury	=(0.2*(EXP(0.544*LN(Sed Conc.)-0.996)))	0.21	0.032	=(0.3*(10^(0.327*log(Sed Conc.)-0.67)))	0.21	0.039	8	0.039	0.31
Nickel	=(0.2*(EXP(0.748*LN(Sed Conc.)-2.223)))	41.6	0.35	=(0.3*(10^(-0.425*log(Sed Conc.)+1.48)))	41.6	1.86	1.5	1.86	2.79
Vanadium	=(0.2*0.00485*Sed Conc.)	109	0.11	=(0.3*0.042*Sed Conc.)	109	1.37	0.4	1.37	0.55
Zinc	=(0.2*(EXP(0.554*LN(Sed Conc.)+1.575)))	606	33.6	=(0.3*(10^(0.208*log(Sed Conc.)+1.8)))	606	71.8	1.0	71.8	71.8
2-Methylnaphthalene	=(0.2*12.2*Sed Conc.)	0.79	1.9	--	0.79		--		
Acenaphthene	=(0.2*(EXP(-0.8556*LN(Sed Conc.)-5.562)))	1.3	0.0006	--	1.3		--		
Acenaphthylene	=(0.2*(EXP(0.791*LN(Sed Conc.)-1.144)))	1.4	0.08	--	1.4		--		
Anthracene	=(0.2*(EXP(0.7784*LN(Sed Conc.)-0.9887)))	3.3	0.19	--	3.3		--		
Benzo[a]anthracene	=(0.2*(EXP(0.5944*LN(Sed Conc.)-2.7078)))	7.2	0.043	--	7.2		--		
Benzo[a]pyrene	=(0.2*(EXP(0.975*LN(Sed Conc.)-2.0615)))	6.1	0.15	--	6.1		--		
Benzo[b]fluoranthene	=(0.2*0.31*Sed Conc.)	5.3	0.33	--	5.3		--		
Benzo[g,h,i]perylene	=(0.2*(EXP(1.1829*LN(Sed Conc.)-0.9313)))	3.3	0.32	--	3.3		--		
Benzo[k]fluoranthene	=(0.2*(EXP(0.8595*LN(Sed Conc.)-2.1579)))	5.4	0.10	--	5.4		--		
Chrysene	=(0.2*(EXP(0.5944*LN(Sed Conc.)-2.7078)))	7.6	0.045	--	7.6		--		
Dibenz[a,h]anthracene	=(0.2*0.13*Sed Conc.)	0.80	0.02	--	0.80		--		
Fluoranthene	=(0.2*0.5*Sed Conc.)	19	1.9	--	19		--		
Fluorene	=(0.2*(EXP(-0.8556*LN(Sed Conc.)-5.562)))	2.2	0.00039	--	2.2		--		
Indeno[1,2,3-cd]pyrene	=(0.2*0.11*Sed Conc.)	3.9	0.086	--	3.9		--		
Naphthalene	=(0.2*12.2*Sed Conc.)	0.77	1.9	--	0.77		--		
Phenanthrene	=(0.2*(EXP(0.6203*LN(Sed Conc.)-0.1665)))	19	1.05	--	19		--		
Pyrene	=(0.2*0.72*Sed Conc.)	16	2.3	--	16		--		
Total PAHs	NA	100	10.4	1 [a]	100	30.1	0.5	30.1	15.1

Notes:

Sediment to plant tissue BAFs are literature-based bioaccumulation factors (BAFs) for plants and a dry-to-wet conversion factor of 0.2 since plant tissues are typically 20% solids. Sources of literature BAFs for plants were USEPA 2007 and Bechtel Jacobs Company LLC 1998. BAFs are expressed as either regression equation between sediment and tissue concentrations or as a factor applied to the sediment concentration, as provided in the source. These BAFs for plants were taken from terrestrial plant studies since BAFs are not widely available for aquatic plants.

Sediment to invertebrate tissue BAFs are literature-based bioaccumulation factors (BAFs) for invertebrates and a dry-to-wet conversion factor of 0.3 since plant tissues are typically 30% solids. Sources of literature BAFs for invertebrates were USEPA 2007 and Bechtel Jacobs Company LLC 1998. BAFs are expressed as either regression equation between soil and tissue concentrations or as a factor applied to the soil concentration, as provided in the source.

Trophic transfer factors for fish were reported in Dillon et al. (1995) and the maximum values are shown here.

[a] BAF for PAHs and a trophic transfer factor for barium were not available and a value of 1 is used as a surrogate because it is unlikely that these chemicals biomagnify.

Table 11. Toxicity reference values for benthic invertebrates, amphibians, and fishes

	Sediment		Surface Water			
CoPEC	Benthic Invertebrate Sediment SL (mg/kg)	Source	Amphibian Value (mg/L)	Source	Fish Surface Water SL (mg/L)	Source
Arsenic	9.79	Buchman 2008, bkg	0.04	Birge 1978	0.15	CTDEEP 2011, CWQS
Barium	0.7	Buchman 2008, bkg	244	Dowden et al. 1965	0.0039	EPA 1996, ET (Tier II)
Cadmium	0.99	Buchman 2008, TEC	0.019	Ranatunge et al. 2012	0.000125	CTDEEP 2011, CWQS*
Chromium (Total)	43.4	Buchman 2008, TEC	0.03	Birge 1978	0.011	CTDEEP 2011, CWQS
Copper	31.6	Buchman 2008, TEC	0.015	Horne and Dunson 1995	0.0048	CTDEEP 2011, CWQS*
Lead	35.8	Buchman 2008, TEC	0.04	Birge 1978	0.0012	CTDEEP 2011, CWQS*
Mercury	0.18	Buchman 2008, TEC	0.001	Birge 1978	0.00077	CTDEEP 2011, CWQS
Nickel	22.7	Buchman 2008, TEC	0.05	Birge 1978	0.0289	CTDEEP 2011, CWQS*
Vanadium	50	Buchman 2008, bkg	0.25	Birge 1978	0.019	EPA 1996, ET (Tier II)
Zinc	121	Buchman 2008, TEC	0.01	Birge 1979	0.065	CTDEEP 2011, CWQS*
Methylnaphthalene, 2-	0.0202	BTAG RIII 2006, SLV	NR	NA	0.0047	BTAG RIII 2006, SLV
Acenaphthene	0.0067	BTAG RIII 2006, SLV	NR	NA	0.023	EPA 1996, ET (AWQC or FCV)
Acenaphthylene	0.0059	BTAG RIII 2006, SLV	NR	NA	4.84	Buchman 2008, CCC
Anthracene	0.0572	Buchman 2008, TEC	0.025	Kagan et al. 1984	0.00073	Buchman 2008, CCC
Benzo(a)anthracene	0.108	Buchman 2008, TEC	NR	NA	0.000027	Suter and Tsao, 1996 Tier II SCV
Benzo(a)pyrene	0.15	Buchman 2008, TEC	3.33	Saka et al. 2004	0.000014	Suter and Tsao, 1996 Tier II SCV
Benzo(b)fluoranthene	10.4	EPA 2003, R5 ESL	NR	NA	0.00907	EPA 2003, R5 ESL
Benzo(g,h,i)perylene	0.17	BTAG RIII 2006, SLV	NR	NA	0.00764	Buchman 2008, CCC
Benzo(k)fluoranthene	0.0272	Buchman 2008, TEL-H	NR	NA	NR	NA
Chrysene	0.166	Buchman 2008, TEC	NR	NA	NR	NA
Dibenz(a,h)anthracene	0.033	Buchman 2008, TEC	NR	NA	NR	NA
Fluoranthene	0.423	Buchman 2008, TEC	0.052	Hatch 1998	0.0081	EPA 1996, ET (AWQC or FCV)
Fluorene	0.0774	Buchman 2008, TEC	NR	NA	0.0039	EPA 1996, ET (Tier II)
Indeno(1,2,3-cd)pyrene	0.0173	Buchman 2008, TEL-H	NR	NA	0.00431	EPA 2003, R5 ESL
Naphthalene	0.176	Buchman 2008, TEC	2.1	Edmisten and Bantle 1982	0.024	EPA 1996, ET (Tier II)
Phenanthrene	0.204	Buchman 2008, TEC	NR	NA	0.0063	EPA 1996, ET (AWQC or FCV)
Pyrene	0.195	Buchman 2008, TEC	0.14	Kagan et al. 1987	0.000025	BTAG RIII 2006, SLV
Total PAHs	1.61	Buchman 2008, TEC	NR	NA	NR	NA

Notes:
NR - not reported
NA - not applicable
SL-screening level
PAHs - polycyclic aromatic hydrocarbons
See Tables 3 and 5 for source abbreviations.

Table 12. Toxicity reference values for avian wildlife

CoPEC	Test Species	Body Weight (kg)	Exposure Route	No-Effects Dose Concentration	Lowest Observed Effects Dose Concentration	Ingestion Rate	Endpoint	Duration of Study	Uncertainty Factor	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	References[g]
Arsenic as Arsenate	Mallard	1.043 [a]	oral in food	100 ppm	400 ppm	0.1 kg/day	reproduction	4 weeks	--	10	38	Stanley et al. (1994)
Barium	Chicks	0.121 [b]	oral in food	2,000 ppm	4,000 ppm	0.0126 kg/day[a]	mortality	4 weeks	0.1 [c]	21	42	Johnson et al. (1960)
Cadmium	Mallard	1.153	oral in food	15.2 ppm	210 ppm	0.110 kg/day	reproduction	90 days	--	1.45	20	White and Finley (1978)
Chromium 3+	Black duck	1.25	oral in food	10 ppm	50 ppm	0.15 kg/kg/day[d]	reproduction	10 months	--	1.5	7.5	Haseltine et al. (1985) as cited in Sample et al. (1996)
Copper	Mallard	0.8	oral in food	218.5 ppm	420 ppm	0.26 kg/kg/day	growth	35 days	--	5.68	10.9	Foster (1999)
Lead	American kestrels	0.144	oral in food	50 ppm	--	0.01 kg/day[e]	reproduction	7 months	--	3.75	25.5	Pattee (1984); Eco-SSL (2005)
Mercury, methyl	Various	--	dietary	--	--	--	reproduction	Chronic	--	0.05	0.5	Fuchsman et al. (2017)
Nickel	Mallard ducklings	0.782	oral in food	176 ppm	774 ppm	0.17 kg/kg/day	mortality	90 days	--	31	135	Cain and Pafford (1981)
Vanadium	Mallard	1.17	oral in food	110 ppm	--	0.10 kg/kg/day	mortality, growth	12 weeks	--	11	n/a	White and Dieter (1978)
Zinc	Mallard	1.043 [a]	oral in food	--	3000 ppm	0.03 kg/kg/day	reproduction	60 days	0.1 [f]	10.2	102	Gasaway and Buss (1974)
Total PAHs	European starling	0.055	gavage	2 mg/kg/day	20 mg/kg/day	--	growth	5 days	0.1 [c]	0.2	2	Trust et al. (1994)

Note: Dose concentrations and ingestion rates are expressed in wet weight unless otherwise noted.

bw - body weight
dw - dry weight
LOAEL - lowest-observed-adverse-effect level
NOAEL - no-observed-adverse-effect level
PAH - polycyclic aromatic hydrocarbon
TRV - toxicity reference value
UF - uncertainty factor
ww - wet weight

[a] U.S. EPA (1993).

[b] U.S. EPA (1988), mean at 5 weeks.

[c] Subchronic to Chronic UF (0.1); Acute to Chronic UF (0.01).

[d] Nagy (2001)

[e] Sample et al. (1996).

[f] LOAEL to NOAEL UF of 0.1.

[g] See Appendix D for full citations.

Table 13. Toxicity reference values for mammalian wildlife

	Test Organism Information											Raccoon[i]	
CoPEC	Test Species	Body Weight (kg)	Exposure Route	No-Effects Dose Concentration	Lowest Observed Effects Dose Concentration	Ingestion Rate	Endpoint	Duration of Study	Uncertainty Factor	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	References[h]	Body Weight (kg)	Final NOAEL (mg/kg/d)
Arsenic as Arsenate	Rabbit	4.4	oral in food	--	--	--	reproduction	18 days during gestation	--	0.75	3.0	Nemec et al. (1998)	6	0.69
Barium	Mouse	0.307	oral inwater	61 mg/kg/day	121 mg/kg/day	--	growth	92 days	0.1 [c]	6.1	12	Dietz et al. (1992)	6	2.9
Cadmium	Rat	0.303	oral gavage	1 mg/kg bw/day	10 mg/kg bw/day	--	reproduction	6 weeks through gestation	--	1.0	10	Sutou et al. (1980)	6	0.47
Chromium 3+	Mouse	0.0249	oral in food	--	100 ppm; 38.02% Cr3+ by MW	0.16 kg/kg/day	reproduction	35 days	0.1 [b]	0.60	5.96	Zahid et al. (1990)	6	0.15
Copper	Mink	1.0 [d]	oral in food	25 ppm and 60.5 ppm in food	50 ppm and 60.5 ppm in food	0.137 kg/kg bw-day[e]	kit mortality	357 days	--	12	15	Aulerich et al. (1982)	6	7.5
Lead	Rat	0.35 [f]	oral in food	141 ppm	1130 ppm	0.08 kg/kg/day	weight of weanlings and kidney histology	3 generations	--	11	90	Azar et al. (1973)	6	5.6
Mercury, methyl	Rat	0.35 [f]	oral in food	0.5 ppm	2.5 ppm	0.028 kg/day[g]	reproduction	3 generations	--	0.032	0.16	Verschuuren et al. (1976)	6	0.02
Nickel	Rat	0.35 [a]	oral in food	500 ppm; 22% Ni by MW	1,000 ppm; 22% Ni by MW	0.028 kg/day[g]	offspring body weight	3 generations	--	9	18	Ambrose et al. (1976)	6	4.4
Vanadium	Rat	0.35 [f]	oral in food	1.03 mg/kg/day	5.11 mg/kg/day	--	growth	10 weeks	0.1 [c]	0.103	0.511	Daniel and Lillie (1938)	6	0.05
Zinc	Sprague-Dawley rat	0.35 [a]	oral in diet	2,000 ppm	4,000 ppm	0.028 kg/day[g]	reproduction	16 days during gestation	--	160	320	Schlicker and Cox (1968)	6	79
Total PAHs	Mouse	0.038	oral in food	5 ppm	25 ppm	0.15 kg/kg/day	growth, mortality	2 years	--	0.8	3.8	Culp et al. (1998)	6	0.23

Note: Dose concentrations and ingestion rates are expressed in wet weight unless otherwise noted.

bw - body weight
dw - dry weight
LOAEL - lowest-observed-adverse-effect level
NOAEL - no-observed-adverse-effect level
PAH - polycyclic aromatic hydrocarbon
TRV - toxicity reference value
UF - uncertainty factor
ww - wet weight

[a] U.S. EPA (1988).
[b] LOAEL to NOAEL UF of 0.1.
[c] Subchronic to Chronic UF of 0.1.
[d] U.S. EPA (1993)
[e] Based on the observations of Bleavins and Aulerich (1981).
[f] U.S. EPA (1995).
[g] Calculated used allometric equation from U.S. EPA (1988).
[h] See Appendix D for full citations.
[i] TRVs for the raccoon are adjusted for differences in body weight between the test organisms and the raccoon (see report text for details).

Table 14. Benthic invertebrate assessment endpoint results - hazard quotients using sediment toxicity reference values

CoPEC	Units	MDC	Sediment Screening Level	HQ	Comment
Arsenic	mg/kg	7.3	9.79	0.7	Results do not indicate a potential risk
Barium	mg/kg	324	0.7	463	Results indicate a potential risk
Cadmium	mg/kg	2.9	0.99	3	Results indicate a potential risk
Chromium (Total)	mg/kg	66	43.4	2	Results indicate a potential risk
Copper	mg/kg	2190	31.6	69	Results indicate a potential risk
Lead	mg/kg	267	35.8	7	Results indicate a potential risk
Mercury	mg/kg	0.21	0.18	1	Results indicate a potential risk
Nickel	mg/kg	41.6	22.7	2	Results indicate a potential risk
Vanadium	mg/kg	109	50	2	Results indicate a potential risk
Zinc	mg/kg	606	121	5	Results indicate a potential risk
Methylnaphthalene, 2-	mg/kg	0.79	0.0202	39	Results indicate a potential risk
Acenaphthene	mg/kg	1.3	0.0067	194	Results indicate a potential risk
Acenaphthylene	mg/kg	1.4	0.0059	237	Results indicate a potential risk
Anthracene	mg/kg	3.3	0.0572	58	Results indicate a potential risk
Benzo(a)anthracene	mg/kg	7.2	0.108	67	Results indicate a potential risk
Benzo(a)pyrene	mg/kg	6.1	0.15	41	Results indicate a potential risk
Benzo(b)fluoranthene	mg/kg	5.3	10.4	0.5	Results do not indicate a potential risk
Benzo(g,h,i)perylene	mg/kg	3.3	0.17	19	Results indicate a potential risk
Benzo(k)fluoranthene	mg/kg	5.4	0.0272	199	Results indicate a potential risk
Chrysene	mg/kg	7.6	0.166	46	Results indicate a potential risk
Dibenz(a,h)anthracene	mg/kg	0.80	0.033	24	Results indicate a potential risk
Fluoranthene	mg/kg	19	0.423	45	Results indicate a potential risk
Fluorene	mg/kg	2.2	0.0774	28	Results indicate a potential risk
Indeno(1,2,3-cd)pyrene	mg/kg	3.9	0.0173	225	Results indicate a potential risk
Naphthalene	mg/kg	0.77	0.176	4	Results indicate a potential risk
Phenanthrene	mg/kg	19	0.204	93	Results indicate a potential risk
Pyrene	mg/kg	16	0.195	82	Results indicate a potential risk
Total PAHs	mg/kg	100	1.61	62	Results indicate a potential risk

Notes:
MDC - maximum detected concentration
HQ>1 are highlighted in yellow, indicating a potential risk.
PAHs - polycyclic aromatic hydrocarbons

Table 15. Amphibian and fish assessment endpoints results - hazard quotients for aquatic life using surface water toxicity reference values

CoPEC	Units	MDC/MRL[1]	Fish Surface Water SL	Fish Surface Water SL HQ	Amphibian Value	Amphibian Value HQ	Comment
Arsenic	mg/L	0.004	0.15	0.03	0.04	0.1	Results do not indicate a potential risk
Barium	mg/L	0.056	0.0039	14	244	0.0002	Results indicate a potential risk
Cadmium	mg/L	0.001	0.000125	8	0.019	0.05	Results indicate a potential risk
Chromium (Total)	mg/L	0.001	0.011	0.09	0.03	0.03	Results do not indicate a potential risk
Copper	mg/L	0.005	0.0048	1	0.015	0.3	Results indicate a potential risk
Lead	mg/L	0.002	0.0012	2	0.04	0.05	Results indicate a potential risk
Mercury	mg/L	0.0002	0.00077	0.3	0.001	0.2	Results do not indicate a potential risk
Nickel	mg/L	0.001	0.0289	0.03	0.05	0.02	Results do not indicate a potential risk
Vanadium	mg/L	0.002	0.019	0.1	0.25	0.008	Results do not indicate a potential risk
Zinc	mg/L	0.006	0.065	0.09	0.01	0.6	Results do not indicate a potential risk
Methylnaphthalene, 2-	mg/L	0.00099	0.0047	0.2	NR	NA	Results do not indicate a potential risk
Acenaphthene	mg/L	0.00005	0.023	0.002	NR	NA	Results do not indicate a potential risk
Acenaphthylene	mg/L	0.00005	4.84	0.00001	NR	NA	Results do not indicate a potential risk
Anthracene	mg/L	0.00005	0.00073	0.07	0.025	0.002	Results do not indicate a potential risk
Benzo(a)anthracene	mg/L	0.00005	0.000027	2	NR	NA	Results indicate a potential risk
Benzo(a)pyrene	mg/L	0.00005	0.000014	4	3.33	2E-05	Results indicate a potential risk
Benzo(b)fluoranthene	mg/L	0.00005	0.00907	0.006	NR	NA	Results do not indicate a potential risk
Benzo(g,h,i)perylene	mg/L	0.0002	0.00764	0.03	NR	NA	Results do not indicate a potential risk
Benzo(k)fluoranthene	mg/L	0.00005	NR	NA	NR	NA	No values to compute HQs
Chrysene	mg/L	0.00005	NR	NA	NR	NA	No values to compute HQs
Dibenz(a,h)anthracene	mg/L	0.00001	NR	NA	NR	NA	No values to compute HQs
Fluoranthene	mg/L	0.00005	0.0081	0.006	0.052	0.001	Results do not indicate a potential risk
Fluorene	mg/L	0.0001	0.0039	0.03	NR	NA	Results do not indicate a potential risk
Indeno(1,2,3-cd)pyrene	mg/L	0.00005	0.00431	0.01	NR	NA	Results do not indicate a potential risk
Naphthalene	mg/L	0.0001	0.024	0.004	2.1	5E-05	Results do not indicate a potential risk
Phenanthrene	mg/L	0.00005	0.0063	0.008	NR	NA	Results do not indicate a potential risk
Pyrene	mg/L	0.00005	0.000025	2	0.14	0.0004	Results indicate a potential risk
Total PAHs	mg/L	0.002	NR	NA	NR	NA	No values to compute HQs

Notes:
MDC - maximum detected concentration
MRL - maximum reporting limit
NR - not reported
NA - not applicable
HQ>1 are highlighted in yellow, indicating a potential risk.

[1] The MDC was used for barium and zinc, and the MRL was used for all other chemicals because they were non-detected CoPECs.

Table 16. Wildlife assessment endpoint results – hazard quotients for the mallard, great blue heron, and raccoon

	Mallard (aquatic plant consumer)		Great Blue Heron (fish and invertebrate consumer)		Raccoon (fish and invertebrate consumer)		
CoPEC	Total Chemical Intake (mg/kg/day)	HQ (unitless)	Total Chemical Intake (mg/kg/day)	HQ (unitless)	Total Chemical Intake (mg/kg/day)	HQ (unitless)	Comment
Arsenic	2.09E-02	0.002	1.34E-01	0.01	1.08E-01	0.2	Results do not indicate a potential risk
Barium	2.12E+00	0.1	1.22E+00	0.06	1.53E+00	0.5	Results do not indicate a potential risk
Cadmium	3.97E-02	0.03	2.46E-01	0.2	1.76E-01	0.4	Results do not indicate a potential risk
Chromium (Total)	1.95E-01	0.1	1.82E-01	0.1	2.65E-01	2	Results indicate a potential risk
Copper	4.89E+00	0.9	3.94E+00	0.7	7.32E+00	0.98	Results do not indicate a potential risk
Lead	6.33E-01	0.2	4.82E-01	0.1	8.93E-01	0.2	Results do not indicate a potential risk
Mercury	5.31E-03	0.1	2.07E-02	0.4	1.47E-02	0.9	Results do not indicate a potential risk
Nickel	1.24E-01	0.004	2.98E-01	0.01	2.93E-01	0.07	Results do not indicate a potential risk
Vanadium	1.97E-01	0.02	1.72E-01	0.02	3.48E-01	7	Results indicate a potential risk
Zinc	6.27E+00	0.6	8.84E+00	0.9	7.36E+00	0.09	Results do not indicate a potential risk
Total PAHs	1.80E+00	9	2.73E+00	14	2.09E+00	9	Results indicate a potential risk

Notes:

PAHs - polycyclic aromatic hydrocarbons

PAHs were evaluated as the sum of individual PAHs or total PAHs.

HQ>1 are highlighted in yellow, indicating a potential risk.

Table 17. Results of benthic invertebrates, aquatic life, and wildlife assessments using Site concentration data

	Benthic Invertebrates		Aquatic Life			Wildlife			
CoPEC	Sediment HQ	Comment	Fish Surface Water SL HQ	Amphibian Value HQ	Comment	Mallard HQ	Great Blue Heron HQ	Raccoon HQ	Comment
Arsenic	0.7	Results do not indicate a potential risk	0.03	0.1	Results do not indicate a potential risk	0.002	0.01	0.2	Results do not indicate a potential risk
Barium	463	Results indicate a potential risk	14	0.0002	Results indicate a potential risk	0.1	0.06	0.5	Results do not indicate a potential risk
Cadmium	3	Results indicate a potential risk	8	0.05	Results indicate a potential risk	0.03	0.2	0.4	Results do not indicate a potential risk
Chromium (Total)	2	Results indicate a potential risk	0.09	0.03	Results do not indicate a potential risk	0.1	0.1	2	Results indicate a potential risk
Copper	69	Results indicate a potential risk	1	0.3	Results indicate a potential risk	0.9	0.7	1	Results do not indicate a potential risk
Lead	7	Results indicate a potential risk	2	0.05	Results indicate a potential risk	0.2	0.1	0.2	Results do not indicate a potential risk
Mercury	1	Results indicate a potential risk	0.3	0.2	Results do not indicate a potential risk	0.1	0.4	0.9	Results do not indicate a potential risk
Nickel	2	Results indicate a potential risk	0.03	0.02	Results do not indicate a potential risk	0.004	0.01	0.07	Results do not indicate a potential risk
Vanadium	2	Results indicate a potential risk	0.1	0.008	Results do not indicate a potential risk	0.02	0.02	7	Results indicate a potential risk
Zinc	5	Results indicate a potential risk	0.09	0.6	Results do not indicate a potential risk	0.6	0.9	0.09	Results do not indicate a potential risk
Methylnaphthalene, 2-	39	Results indicate a potential risk	0.2	NA	Results do not indicate a potential risk				
Acenaphthene	194	Results indicate a potential risk	0.002	NA	Results do not indicate a potential risk				
Acenaphthylene	237	Results indicate a potential risk	0.00001	NA	Results do not indicate a potential risk				
Anthracene	58	Results indicate a potential risk	0.07	0.002	Results do not indicate a potential risk				
Benzo(a)anthracene	67	Results indicate a potential risk	2	NA	Results indicate a potential risk				
Benzo(a)pyrene	41	Results indicate a potential risk	4	2E-05	Results indicate a potential risk				
Benzo(b)fluoranthene	0.5	Results do not indicate a potential risk	0.01	NA	Results do not indicate a potential risk				
Benzo(g,h,i)perylene	19	Results indicate a potential risk	0.03	NA	Results do not indicate a potential risk				
Benzo(k)fluoranthene	199	Results indicate a potential risk	NA	NA	No values to compute HQs				evaluated as Total PAHs
Chrysene	46	Results indicate a potential risk	NA	NA	No values to compute HQs				
Dibenz(a,h)anthracene	24	Results indicate a potential risk	NA	NA	No values to compute HQs				
Fluoranthene	45	Results indicate a potential risk	0.006	0.001	Results do not indicate a potential risk				
Fluorene	28	Results indicate a potential risk	0.03	NA	Results do not indicate a potential risk				
Indeno(1,2,3-cd)pyrene	225	Results indicate a potential risk	0.01	NA	Results do not indicate a potential risk				
Naphthalene	4	Results indicate a potential risk	0.004	5E-05	Results do not indicate a potential risk				
Phenanthrene	93	Results indicate a potential risk	0.01	NA	Results do not indicate a potential risk				
Pyrene	82	Results indicate a potential risk	2	0.0004	Results indicate a potential risk				
Total PAHs	62	Results indicate a potential risk	NA	NA	No values to compute HQs	9	14	9	Results indicate a potential risk

Notes:
HQ>1 are highlighted in yellow, indicating a potential risk.
PAHs - polycyclic aromatic hydrocarbons

Table 18. Summary statistics of chemistry data for sediment samples in the Hockanum River upstream of the Site

	Total No. Samples	Detects Count	Maximum Detected Conc. (mg/kg)	Maximum Reporting Limit (mg/kg)
CT ETPH	5	5	890	NA
Antimony	5	0	NA	1.2
Arsenic	5	2	1.4	1.2
Barium	5	5	26	NA
Beryllium	5	0	NA	0.5
Cadmium	5	0	NA	1.2
Chromium (Total)	5	5	18	NA
Copper	5	5	24	NA
Lead	5	5	57	NA
Mercury	5	0	NA	0.02
Nickel	5	5	7.6	7.6
Selenium	5	0	NA	1.6
Silver	5	0	NA	1.2
Thallium	5	0	NA	0.5
Vanadium	5	5	35	NA
Zinc	5	5	150	NA
Methylnaphthalene, 2-	5	5	0.091	NA
Acenaphthene	5	5	0.15	NA
Acenaphthylene	5	5	0.89	NA
Anthracene	5	5	0.79	NA
Benzo(a)anthracene	5	5	2.3	NA
Benzo(a)pyrene	5	5	2.1	NA
Benzo(b)fluoranthene	5	5	2.5	NA
Benzo(g,h,i)perylene	5	5	1.7	NA
Benzo(k)fluoranthene	5	5	0.81	NA
Chrysene	5	5	2.3	NA
Dibenz(a,h)anthracene	5	5	0.51	NA
Fluoranthene	5	5	5.1	NA
Fluorene	5	5	0.34	NA
Indeno(1,2,3-cd)pyrene	5	5	1.5	NA
Phenanthrene	5	5	3.3	NA
Pyrene	5	5	4.7	NA
Naphthalene	5	5	0.43	NA

Notes:
Conc. - concentration
mg/kg - milligram per killogram
NA - not available

Table 19. Summary statistics of chemistry data for surface water samples in the Hockanum River upstream of the Site

	Total No. Samples	Detects Count	Maximum Detected Conc (ug/L)	Maximum Reporting Limit (ug/L)
CT ETPH	2	0	NA	75
Antimony (Total)	2	0	NA	2
Antimony (Dissolved)	2	0	NA	2
Arsenic (Total)	2	0	NA	2
Arsenic (Dissolved)	2	0	NA	2
Barium (Total)	2	2	58	NA
Barium (Dissolved)	2	2	54	NA
Beryllium (Total)	2	0	NA	0.8
Beryllium (Dissolved)	2	0	NA	0.8
Cadmium (Total)	2	0	NA	2
Cadmium (Dissolved	2	0	NA	2
Chromium (Total)	2	0	NA	4
Chromium (Dissolved)	2	0	NA	4
Copper (Total)	2	0	NA	4
Copper (Dissolved)	2	0	NA	4
Lead (Total)	2	0	NA	1.2
Lead (Dissolved)	2	0	NA	1.2
Mercury (Total)	2	0	NA	0.20
Mercury (Dissolved)	2	0	NA	0.20
Nickel (Total)	2	0	NA	4
Nickel (Dissolved)	2	0	NA	4
Selenium (Total)	2	0	NA	2.5
Selenium (Dissolved)	2	0	NA	2.5
Silver (Total)	2	0	NA	2
Silver (Dissolved)	2	0	NA	2
Thallium (Total)	2	0	NA	0.8
Thallium (Dissolved)	2	0	NA	0.8
Vanadium (Total)	2	0	NA	4
Vanadium (Dissolved)	2	0	NA	4
Zinc (Total)	2	0	NA	16
Zinc (Dissolved)	2	0	NA	16
Methylnaphthalene, 2-	2	0	NA	0.05
Acenaphthene	2	0	NA	0.05
Acenaphthylene	2	0	NA	0.05
Anthracene	2	0	NA	0.05
Benzo(a)anthracene	2	0	NA	0.05
Benzo(a)pyrene	2	0	NA	0.05
Benzo(b)fluoranthene	2	0	NA	0.05
Benzo(g,h,i)perylene	2	0	NA	0.05
Benzo(k)fluoranthene	2	0	NA	0.05
Chrysene	2	0	NA	0.05
Dibenz(a,h)anthracene	2	0	NA	0.05
Fluoranthene	2	0	NA	0.05
Fluorene	2	0	NA	0.05

Table 19. Summary statistics of chemistry data for surface water samples in the Hockanum River upstream of the Site

	Total No. Samples	Detects Count	Maximum Detected Conc (ug/L)	Maximum Reporting Limit (ug/L)
Indeno(1,2,3-cd)pyrene	2	0	NA	0.05
Phenanthrene	2	0	NA	0.05
Pyrene	2	0	NA	0.05
Naphthalene	2	0	NA	0.2

Notes:
Conc. - concentration
ug/L - microgram per liter
NA - not available

Table 20. Comparison of Site exposure point concentrations and upstream exposure point concentrations

	Site				Upstream			
	Sediment		Surface Water		Sediment		Surface Water	
CoPEC	Value Used (mg/kg)	Basis	Value Used (mg/L)	Basis	Value Used (mg/kg)	Basis	Value Used (mg/L)	Basis
Arsenic	7.3	MDC	0.004	MRL	1.4	MDC	0.002	MRL
Barium	324	MDC	0.056	MDC	26	MDC	0.058	MDC
Cadmium	2.9	MDC	0.001	MRL	1.2	MRL	0.002	MRL
Chromium (Total)	66.4	MDC	0.001	MRL	18	MDC	0.004	MRL
Copper	2190	MDC	0.005	MRL	24	MDC	0.004	MRL
Lead	267	MDC	0.002	MRL	57	MDC	0.0012	MRL
Mercury	0.21	MDC	0.0002	MRL	0.02	MRL	0.0002	MRL
Nickel	41.6	MDC	0.001	MRL	7.6	MDC	0.004	MRL
Vanadium	109	MDC	0.002	MRL	35	MDC	0.004	MRL
Zinc	606	MDC	0.006	MDC	150	MDC	0.016	MRL
Methylnaphthalene, 2-	0.79	MDC	0.00099	MRL	0.091	MDC	0.00005	MRL
Acenaphthene	1.3	MDC	0.00005	MRL	0.15	MDC	0.00005	MRL
Acenaphthylene	1.4	MDC	0.00005	MRL	0.89	MDC	0.00005	MRL
Anthracene	3.3	MDC	0.00005	MRL	0.79	MDC	0.00005	MRL
Benzo(a)anthracene	7.2	MDC	0.00005	MRL	2.3	MDC	0.00005	MRL
Benzo(a)pyrene	6.1	MDC	0.00005	MRL	2.1	MDC	0.00005	MRL
Benzo(b)fluoranthene	5.3	MDC	0.00005	MRL	2.5	MDC	0.00005	MRL
Benzo(g,h,i)perylene	3.3	MDC	0.0002	MRL	1.7	MDC	0.00005	MRL
Benzo(k)fluoranthene	5.4	MDC	0.00005	MRL	0.81	MDC	0.00005	MRL
Chrysene	7.6	MDC	0.00005	MRL	2.3	MDC	0.00005	MRL
Dibenz(a,h)anthracene	0.80	MDC	0.00001	MRL	0.51	MDC	0.00005	MRL
Fluoranthene	19	MDC	0.00005	MRL	5.1	MDC	0.00005	MRL
Fluorene	2.2	MDC	0.0001	MRL	0.34	MDC	0.00005	MRL
Indeno(1,2,3-cd)pyrene	3.9	MDC	0.00005	MRL	1.5	MDC	0.00005	MRL
Naphthalene	0.77	MDC	0.0001	MRL	0.43	MDC	0.0002	MRL
Phenanthrene	19	MDC	0.00005	MRL	3.3	MDC	0.00005	MRL
Pyrene	16	MDC	0.00005	MRL	4.7	MDC	0.00005	MRL
Total PAHs	100	MDC	0.002	MRL	28	MDC	0.002	MRL

Notes:

CoPEC - contaminant of potential ecological concern

MDC - maximum detected concentration

MRL - maximum reporting limit

For metal EPCs in surface water the maximum value between the dissolved and total measurement was used.

PAHs - polycyclic aromatic hydrocarbons

Table 21. Results of benthic invertebrates, aquatic life, and wildlife assessments using upstream concentration data

	Benthic Invertebrates		Aquatic Life			Wildlife			
CoPEC	Sediment HQ	Comment	Fish Surface Water SL HQ	Amphibian Value HQ	Comment	Mallard HQ	Great Blue Heron HQ	Raccoon HQ	Comment
Arsenic	0.1	Results do not indicate a potential risk	0.01	0.05	Results do not indicate a potential risk	0.0004	0.004	0.04	Results do not indicate a potential risk
Barium	37	Results indicate a potential risk	15	0.0002	Results indicate a potential risk	0.008	0.005	0.04	Results do not indicate a potential risk
Cadmium	1	Results indicate a potential risk	16	0.1	Results indicate a potential risk	0.02	0.09	0.2	Results do not indicate a potential risk
Chromium (Total)	0.4	Results do not indicate a potential risk	0.4	0.1	Results do not indicate a potential risk	0.04	0.07	0.7	Results do not indicate a potential risk
Copper	0.8	Results do not indicate a potential risk	0.8	0.3	Results do not indicate a potential risk	0.04	0.1	0.08	Results do not indicate a potential risk
Lead	2	Results indicate a potential risk	1.0	0.03	Results do not indicate a potential risk	0.05	0.03	0.04	Results do not indicate a potential risk
Mercury	0.1	Results do not indicate a potential risk	0.3	0.2	Results do not indicate a potential risk	0.03	0.2	0.4	Results do not indicate a potential risk
Nickel	0.3	Results do not indicate a potential risk	0.1	0.08	Results do not indicate a potential risk	0.0009	0.02	0.09	Results do not indicate a potential risk
Vanadium	0.7	Results do not indicate a potential risk	0.2	0.02	Results do not indicate a potential risk	0.006	0.005	2	Results indicate a potential risk
Zinc	1	Results indicate a potential risk	0.2	2	Results indicate a potential risk	0.3	0.6	0.06	Results do not indicate a potential risk
Methylnaphthalene, 2-	5	Results indicate a potential risk	0.01	NA	Results do not indicate a potential risk				
Acenaphthene	22	Results indicate a potential risk	0.002	NA	Results do not indicate a potential risk				
Acenaphthylene	151	Results indicate a potential risk	1E-05	NA	Results do not indicate a potential risk				
Anthracene	14	Results indicate a potential risk	0.07	0.002	Results do not indicate a potential risk				
Benzo(a)anthracene	21	Results indicate a potential risk	2	NA	Results indicate a potential risk				
Benzo(a)pyrene	14	Results indicate a potential risk	4	2E-05	Results indicate a potential risk				
Benzo(b)fluoranthene	0.2	Results do not indicate a potential risk	0.006	NA	Results do not indicate a potential risk				
Benzo(g,h,i)perylene	10	Results indicate a potential risk	0.007	NA	Results do not indicate a potential risk				
Benzo(k)fluoranthene	30	Results indicate a potential risk	NA	NA	No values to compute HQs				evaluated as Total PAHs
Chrysene	14	Results indicate a potential risk	NA	NA	No values to compute HQs				
Dibenz(a,h)anthracene	15	Results indicate a potential risk	NA	NA	No values to compute HQs				
Fluoranthene	12	Results indicate a potential risk	0.006	0.001	Results do not indicate a potential risk				
Fluorene	4	Results indicate a potential risk	0.01	NA	Results do not indicate a potential risk				
Indeno(1,2,3-cd)pyrene	87	Results indicate a potential risk	0.01	NA	Results do not indicate a potential risk				
Naphthalene	2	Results indicate a potential risk	0.008	1E-04	Results do not indicate a potential risk				
Phenanthrene	16	Results indicate a potential risk	0.008	NA	Results do not indicate a potential risk				
Pyrene	24	Results indicate a potential risk	2	0.0004	Results indicate a potential risk				
Total PAHs	18	Results indicate a potential risk	NA	NA	No values to compute HQs	3	4	3	Results indicate a potential risk

Notes:
HQ>1 are highlighted in yellow, indicating a potential risk.
PAHs - polycyclic aromatic hydrocarbons

Appendix A

Analytical Data used in the Screening-Level Ecological Risk Assessment

Table A-1. Current sediment data for the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SED-01	SED-02	SED-DUP-02	SED-03	SED-04	SED-05	SED-06	SED-06A	SED-06B	SED-06C	SED-07	SED-DUP-07	SED-08	SED-09	SED-201	SED-202
Sample Date	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17	8/28/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018	2/24/2021	2/24/2021
Lab Sample ID	BZ40749	BZ40750	BZ40755	BZ40751	BZ40752	BZ40753	BZ40754	CB20637	CB20638	CB20639	CB20634	CB20640	CB20635	CB20636	460-228733-1	460-228733-2
Hydrocarbon (mg/Kg)																
CT ETPH	170	310	250	<290	<290	330	1,100	NM	NM	NM	91	79	100	630	540	1,400
Metals (mg/Kg)																
Antimony	<4	<4.4	<4.1	<3.8	<3.5	<4.6	<4.6	NM	NM	NM	<3.6	<3.9	<4.3	<22	<1.1	<1.4
Arsenic	<0.79	2.26	1.35	1.5	2.1	1.26	3.95	NM	NM	NM	<0.73	<0.77	<0.85	7.3	2.5	1.9
Barium	29	49.5	36.3	27.5	40.6	29.6	24.5	NM	NM	NM	30.3	27.5	23.7	324	28	52
Beryllium	<0.32	<0.36	<0.33	<0.3	<0.28	<0.37	<0.37	NM	NM	NM	<0.29	<0.31	<0.34	<1.8	<0.43	<0.57
Cadmium	<0.4	<0.44	<0.41	0.4	0.89	<0.46	0.94	NM	NM	NM	<0.36	<0.39	<0.43	2.9	<1.1	<1.4
Chromium (Total)	9.22	17.5	10.1	10.2	14.6	11.3	17.4	NM	NM	NM	7.1	7.83	6.61	66.4	12	16
Copper	16.1	26.1	28.4	27.6	46.4	20	2,190	22.1	28.9	83.7	13.2	9.5	10	149	54	38
Lead	37.7	64.1	46.1	26.1	78.2	28.8	153	NM	NM	NM	43.7	33.1	22.2	267	33	72
Mercury	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.1	NM	NM	NM	<0.03	<0.03	<0.03	0.21	<0.019	0.049
Nickel	6.81	8.7	7.25	7.53	9.02	7.97	12.2	NM	NM	NM	7.6	5.25	6.37	41.6	8.9	7.7
Selenium	<1.6	<1.8	<1.6	<1.5	<1.4	<1.8	<1.8	NM	NM	NM	<1.5	<1.5	<1.7	<8.9	<1.3	<1.8
Silver	<0.4	<0.44	<0.41	<0.38	<0.35	<0.46	<0.46	NM	NM	NM	<0.36	<0.39	<0.43	<2.2	<1.1	<1.4
Thallium	<3.6	<4	<3.7	<3.4	<3.2	<4.1	<4.1	NM	NM	NM	<3.3	<3.5	<3.8	<20	<0.43	<0.57
Vanadium	21.7	37.3	29.5	31.9	41.5	31.7	26.5	NM	NM	NM	16	16.6	15.2	109	19	24
Zinc	53.2	77.4	86.8	77.6	88.5	70.9	292	NM	NM	NM	57.9	60.8	45.5	606	61	100
Inorganics (mg/Kg)																
Cyanide (Total)	<0.61	<0.68	<0.59	<0.59	<0.57	<0.61	<0.59	NM	NM	NM	NM	NM	NM	NM	NM	NM
PCBs (mg/Kg)																
Aroclor-1016	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
Aroclor-1221	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
Aroclor-1232	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
Aroclor-1242	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
Aroclor-1248	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
Aroclor-1254	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
Aroclor-1260	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
Aroclor-1262	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
Aroclor-1268	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
PCBs (Total)	<0.44	<0.45	<0.42	<0.39	<0.38	<0.43	<0.43	NM	NM	NM	<0.4	<0.41	<0.43	<0.43	<0.081	<0.11
Semi-Volatile Organic Compounds (ug/Kg)																
Tetrachlorobenzene, 1,2,4,5-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Diphenylhydrazine, 1,2-	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Trichlorophenol, 2,4,5-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Trichlorophenol, 2,4,6-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Dichlorophenol, 2,4-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Dimethylphenol, 2,4-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Dinitrophenol, 2,4-	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Dinitrotoluene, 2,4-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Dinitrotoluene, 2,6-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Chloronaphthalene, 2-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Chlorophenol, 2-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Methylnaphthalene, 2-	420	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	790	<160
Methylphenol, 2-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Nitroaniline, 2-	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Nitrophenol, 2-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Methylphenol, 3&4 (Cresol, m&p-)	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Dichlorobenzidine, 3,3-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Nitroaniline, 3-	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Dinitro-2-methylphenol, 4,6-	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Bromophenyl Phenyl Ether, 4-	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Chloro-3-methylphenol, 4-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Chloroanilne, p- (4-Chloroaniline)	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Chlorophenyl-phenylether, 4-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Nitroaniline, 4-	<710	<710	<680	<610	<590	<700	<6900	NM	NM	NM	<650	<660	<700	<3500	NM	NM
Nitrophenol, 4-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Acenaphthene	1,300	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	1200	73
Acenaphthylene	380	420	490	580	290	410	<3000	NM	NM	NM	<280	<290	330	<1500	1400	660
Acetophenone	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Aniline	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Anthracene	3,300	900	790	880	<260	590	<3000	NM	NM	NM	<280	<290	600	<1500	2900	530
Benzo(a)anthracene	7,200	3,000	2,700	4,000	1,000	1,900	3,900	NM	NM	NM	700	710	2,400	<1500	3800	1600
Benzidine	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Benzo(a)pyrene	6,100	2,700	2,400	3,600	1,100	1,800	3,600	NM	NM	NM	770	840	2,400	1,900	3200	2100

Table A-1. Current sediment data for the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SED-01	SED-02	SED-DUP-02	SED-03	SED-04	SED-05	SED-06	SED-06A	SED-06B	SED-06C	SED-07	SED-DUP-07	SED-08	SED-09	SED-201	SED-202
Sample Date	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17	8/28/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018	2/24/2021	2/24/2021
Lab Sample ID	BZ40749	BZ40750	BZ40755	BZ40751	BZ40752	BZ40753	BZ40754	CB20637	CB20638	CB20639	CB20634	CB20640	CB20635	CB20636	460-228733-1	460-228733-2
Benzo(b)fluoranthene	5,300	2,800	2,200	3,100	890	1,700	<3000	NM	NM	NM	1,200	1,400	4,100	3,700	3400	2700
Benzo(g,h,i)perylene	3,300	1,600	1,400	1,800	780	1,100	<3000	NM	NM	NM	<280	<290	<300	<1500	2000	1800
Benzo(k)fluoranthene	5,400	2,600	2,100	3,400	1,000	1,700	3,400	NM	NM	NM	420	530	1,400	<1500	1200	670
Benzoic acid	<880	<890	<850	<760	<740	<870	<8600	NM	NM	NM	<810	<820	<870	<4400	NM	NM
bis(2-Chloroethoxy)methane	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
bis(2-Chloroethyl)ether	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
bis(2-Chloroisopropyl)ether	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
bis(2-Ethylhexyl)phthalate	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Butyl benzyl phthalate	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Carbazole	1,500	660	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Chrysene	7,600	3,500	3,000	4,100	1,200	2,100	4,700	NM	NM	NM	790	840	2,600	2,200	3700	2100
Dibenz(a,h)anthracene	800	<310	<300	430	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	550	450
Dibenzofuran	1,100	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Diethylphthalate	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Dimethyl phthalate	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Di-N-Butyl Phthalate	<880	<890	<850	<760	<740	<870	<8600	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Di-N-Octyl Phthalate	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Fluoranthene	19,000	7,100	6,100	6,600	1,500	3,400	7,000	NM	NM	NM	1,600	1,700	5,200	3,600	9300	3800
Fluorene	1,400	350	350	310	<260	320	<3000	NM	NM	NM	<280	<290	<300	<1500	2200	130
Hexachlorobenzene	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Hexachlorocyclopentadiene	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Hexachloroethane	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Indeno(1,2,3-cd)pyrene	3,900	1,700	1,500	2,000	770	1,100	<3000	NM	NM	NM	<280	<290	440	<1500	1700	1500
Isophorone	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Nitrobenzene	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
N-Nitrosodimethylamine	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
N-Nitroso-di-N-propylamine	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
N-Nitrosodiphenylamine	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Pentachloronitrobenzene	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Pentachlorophenol	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Phenanthrene	19,000	4,300	3,800	2,500	810	2,200	5,500	NM	NM	NM	1,200	960	2,800	<1500	12000	1600
Phenol	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Pyrene	16,000	5,600	5,000	6,300	1,600	3,100	8,300	NM	NM	NM	1,500	1,600	4,300	3,200	8800	3900
Pyridine	<440	<440	<430	<380	<370	<440	<4300	NM	NM	NM	<400	<410	<440	<2200	NM	NM
Naphthalene	770	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	370	<160
Trichlorobenzene,1,2,4-	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Dichlorobenzene, 1,2- (o-DCB)	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Dichlorobenzene, 1,3-(m-DCB)	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Dichlorobenzene, 1,4- (p-DCB)	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Hexachlorobutadiene	<310	<310	<300	<270	<260	<310	<3000	NM	NM	NM	<280	<290	<300	<1500	NM	NM
Volatile Organic Compounds (ug/Kg)																
Naphthalene	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Tetrachloroethane, 1,1,1,2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Trichloroethane, 1,1,1-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Tetrachloroethane, 1,1,2,2-	<2.9	<3.9	<4.2	<3.2	<3.9	<3.7	<3.5	NM	NM	NM	<3.7	<4	<3.6	<20	NM	NM
Trichlorotrifluoroethane, 1,1,2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<12	<13	<12	<65	NM	NM
Trichloroethane, 1,1,2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloroethane, 1,1-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloroethene, 1,1-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloropropene, 1,1-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Trichlorobenzene, 1,2,3-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Trichloropropane, 1,2,3-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Trichlorobenzene,1,2,4-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Trimethylbenzene, 1,2,4-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dibromo-3-chloropropane,1,2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichlorobenzene, 1,2- (o-DCB)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloroethane, 1,2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloropropane, 1,2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Trimethylbenzene, 1,3,5-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichlorobenzene, 1,3-(m-DCB)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloropropane, 1,3-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichlorobenzene, 1,4- (p-DCB)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloropropane, 2,2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Chlorotoluene, 2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Methyl butyl ketone (2-Hexanone)	<24	<33	<35	<27	<32	<31	<29	NM	NM	NM	<31	<33	<30	<160	NM	NM

Table A-1. Current sediment data for the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SED-01	SED-02	SED-DUP-02	SED-03	SED-04	SED-05	SED-06	SED-06A	SED-06B	SED-06C	SED-07	SED-DUP-07	SED-08	SED-09	SED-201	SED-202
Sample Date	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17	8/28/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018	8/28/2018	2/24/2021	2/24/2021
Lab Sample ID	BZ40749	BZ40750	BZ40755	BZ40751	BZ40752	BZ40753	BZ40754	CB20637	CB20638	CB20639	CB20634	CB20640	CB20635	CB20636	460-228733-1	460-228733-2
Isopropyltoluene, 2- (o-Cymene)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Chlorotoluene, 4-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Isopropyltoluene, 4- (p-Cymene)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Methyl Isobutyl Ketone (4-Methyl-2-pentanone)	<24	<33	<35	<27	<32	<31	<29	NM	NM	NM	<31	<33	<30	<160	NM	NM
Acetone	<240	<330	<350	<270	<320	<310	<290	NM	NM	NM	<310	<330	<300	<1600	NM	NM
Acrylonitrile	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Benzene	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Bromobenzene	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Bromochloromethane	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Bromodichloromethane	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Bromoform	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Bromomethane	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Butylbenzene, n-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Butylbenzene, sec-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Butylbenzene, tert-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Carbon disulfide	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Carbon tetrachloride	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Chlorobenzene	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Chloroethane	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Chloroform	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Chloromethane	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloroethene, cis-1,2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloropropene, cis-1,3-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dibromochloromethane	<2.9	<3.9	<4.2	<3.2	<3.9	<3.7	<3.5	NM	NM	NM	<3.7	<4	<3.6	<20	NM	NM
Dibromomethane	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichlorodifluoromethane	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Ethylbenzene	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Ethylene Dibromide (EDB)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Hexachlorobutadiene	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Isopropylbenzene (cumene)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Xylene, m,p-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Methyl ethyl ketone	<29	<39	<42	<32	<39	<37	<35	NM	NM	NM	<37	<40	<36	<200	NM	NM
Methyl Tert-Butyl Ether (MTBE)	<9.6	<13	<14	<11	<13	<12	<12	NM	NM	NM	<12	<13	<12	<65	NM	NM
Methylene Chloride (Dichloromethane)	<9.6	<13	<14	<11	<13	<12	<12	NM	NM	NM	<12	<13	<12	<65	NM	NM
Propylbenzene, n-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Xylene, o-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Styrene	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Tetrachloroethylene (PCE)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Tetrahydrofuran	<9.6	<13	<14	<11	<13	<12	<12	NM	NM	NM	<12	<13	<12	<65	NM	NM
Toluene	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	240	NM	NM
Dichloroethene, trans-1,2-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloropropene, trans-1,3-	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Dichloro-2-butene, trans-1,4-	<9.6	<13	<14	<11	<13	<12	<12	NM	NM	NM	<12	<13	<12	<65	NM	NM
Trichloroethylene (TCE)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Trichlorofluoromethane	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Vinyl Chloride	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Xylene (Total)	<4.8	<6.5	<7	<5.4	<6.4	<6.1	<5.8	NM	NM	NM	<6.2	<6.6	<6.1	<33	NM	NM
Other (mg/Kg)																
Total Organic Carbon	19,000	17,000	25,000	5,100	6,200	10,000	24,000	NM	NM	NM	NM	NM	NM	NM	NM	NM

Notes:
NM - not measured
ug/Kg - microgram per kilogram
mg/Kg - milligram per kilogram

Table A-2. Current surface water data for the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SW-01	SW-DUP-01	SW-02	SW-03	SW-04
Sample Date	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17
Lab Sample ID	BZ40757	BZ40761	BZ40758	BZ40759	BZ40760
Hydrocarbon (mg/L)					
CT ETPH	<0.066	<0.066	<0.068	<0.068	<0.070
Metals (ug/L)					
Antimony	<5	<5	<5	<5	<5
Antimony (Dissolved)	<5	<5	<5	<5	<5
Arsenic	<4	<4	<4	<4	<4
Arsenic (Dissolved)	<4	<4	<4	<4	<4
Barium	50	51	53	47	49
Barium (Dissolved)	46	46	56	47	48
Beryllium	<1	<1	<1	<1	<1
Beryllium (Dissolved)	<1	<1	<1	<1	<1
Cadmium	<1	<1	<1	<1	<1
Cadmium (Dissolved)	<1	<1	<1	<1	<1
Chromium	<1	<1	<1	<1	<1
Chromium (Dissolved)	1	<1	1	<1	<1
Copper	<5	<5	<5	<5	<5
Copper (Dissolved)	<5	<5	<5	<5	<5
Lead	<2	<2	<2	<2	<2
Lead (Dissolved)	<2	<2	<2	<2	<2
Mercury	<0.200	<0.200	<0.200	<0.200	<0.200
Mercury (Dissolved)	<0.200	<0.200	<0.200	<0.200	<0.200
Nickel	<1	<1	<1	<1	<1
Nickel (Dissolved)	<1	<1	<1	<1	<1
Selenium	<10	<10	<10	<10	<10
Selenium (Dissolved)	<11	<11	<11	<11	<11
Silver	<1	<1	<1	<1	<1
Silver (Dissolved)	<1	<1	<1	<1	<1
Thallium	<1	<1	<1	<1	<1
Thallium (Dissolved)	<2	<2	<2	<2	<2
Vanadium	<2	<2	<2	<2	<2
Vanadium (Dissolved)	<2	<2	<2	<2	<2
Zinc	2	3	<2	<2	<2
Zinc (Dissolved)	4	3	4	3	6
Inorganics (mg/L)					
Cyanide (Total)	<0.010	<0.010	<0.010	<0.010	<0.010
Semi-Volatile Organic Compounds (ug/L)					
Tetrachlorobenzene, 1,2,4,5-	<0.47	<0.47	<0.49	<0.49	<0.49
Diphenylhydrazine, 1,2-	<4.7	<4.7	<4.9	<4.9	<4.9
Trichlorophenol, 2,4,5-	<0.94	<0.94	<0.97	<0.98	<0.99
Trichlorophenol, 2,4,6-	<0.94	<0.94	<0.97	<0.98	<0.99
Dichlorophenol, 2,4-	<0.94	<0.94	<0.97	<0.98	<0.99
Dimethylphenol, 2,4-	<0.94	<0.94	<0.97	<0.98	<0.99
Dinitrophenol, 2,4-	<0.94	<0.94	<0.97	<0.98	<0.99
Dinitrotoluene, 2,4-	<4.7	<4.7	<4.9	<4.9	<4.9
Dinitrotoluene, 2,6-	<4.7	<4.7	<4.9	<4.9	<4.9
Chloronaphthalene, 2-	<4.7	<4.7	<4.9	<4.9	<4.9
Chlorophenol, 2-	<0.94	<0.94	<0.97	<0.98	<0.99
Methylnaphthalene, 2-	<0.94	<0.94	<0.97	<0.98	<0.99

Table A-2. Current surface water data for the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SW-01	SW-DUP-01	SW-02	SW-03	SW-04
Sample Date	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17
Lab Sample ID	BZ40757	BZ40761	BZ40758	BZ40759	BZ40760
Methylphenol, 2-	<0.94	<0.94	<0.97	<0.98	<0.99
Nitroaniline, 2-	<4.7	<4.7	<4.9	<4.9	<4.9
Nitrophenol, 2-	<0.94	<0.94	<0.97	<0.98	<0.99
Methylphenol, 3&4 (Cresol, m&p-)	<9.4	<9.4	<9.7	<9.8	<9.9
Dichlorobenzidine, 3,3-	<4.7	<4.7	<4.9	<4.9	<4.9
Nitroaniline, 3-	<4.7	<4.7	<4.9	<4.9	<4.9
Dinitro-2-methylphenol, 4,6-	<0.94	<0.94	<0.97	<0.98	<0.99
Bromophenyl Phenyl Ether, 4-	<4.7	<4.7	<4.9	<4.9	<4.9
Chloro-3-methylphenol, 4-	<0.94	<0.94	<0.97	<0.98	<0.99
Chloroanilne, p- (4-Chloroaniline)	<4.7	<4.7	<4.9	<4.9	<4.9
Chlorophenyl-phenylether, 4-	<0.94	<0.94	<0.97	<0.98	<0.99
Nitroaniline, 4-	<4.7	<4.7	<4.9	<4.9	<4.9
Nitrophenol, 4-	<0.94	<0.94	<0.97	<0.98	<0.99
Acenaphthene	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	<0.05	<0.05	<0.05	<0.05	<0.05
Acetophenone	<4.7	<4.7	<4.9	<4.9	<4.9
Aniline	<4.7	<4.7	<4.9	<4.9	<4.9
Anthracene	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)anthracene	<0.05	<0.05	<0.05	<0.05	<0.05
Benzidine	<4.7	<4.7	<4.9	<4.9	<4.9
Benzo(a)pyrene	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	<0.19	<0.19	<0.19	<0.20	<0.20
Benzo(k)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05
Benzoic acid	<47	<47	<49	<49	<49
bis(2-Chloroethoxy)methane	<4.7	<4.7	<4.9	<4.9	<4.9
bis(2-Chloroethyl)ether	<0.94	<0.94	<0.97	<0.98	<0.99
bis(2-Chloroisopropyl)ether	<4.7	<4.7	<4.9	<4.9	<4.9
bis(2-Ethylhexyl)phthalate	<0.47	<0.47	<0.49	<0.49	<0.49
Butyl benzyl phthalate	<4.7	<4.7	<4.9	<4.9	<4.9
Carbazole	<4.7	<4.7	<4.9	<4.9	<4.9
Chrysene	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzofuran	<0.05	<0.05	<0.05	<0.05	<0.05
Diethylphthalate	<4.7	<4.7	<4.9	<4.9	<4.9
Dimethyl phthalate	<4.7	<4.7	<4.9	<4.9	<4.9
Di-N-Butyl Phthalate	<4.7	<4.7	<4.9	<4.9	<4.9
Di-N-Octyl Phthalate	<4.7	<4.7	<4.9	<4.9	<4.9
Fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	<0.09	<0.09	<0.10	<0.10	<0.10
Hexachlorobenzene	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorocyclopentadiene	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachloroethane	<0.47	<0.47	<0.49	<0.49	<0.49
Indeno(1,2,3-cd)pyrene	<0.05	<0.05	<0.05	<0.05	<0.05
Isophorone	<4.7	<4.7	<4.9	<4.9	<4.9
Nitrobenzene	<0.09	<0.09	<0.10	<0.10	<0.10
N-Nitrosodimethylamine	<4.7	<4.7	<4.9	<4.9	<4.9
N-Nitroso-di-N-propylamine	<4.7	<4.7	<4.9	<4.9	<4.9

Table A-2. Current surface water data for the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SW-01	SW-DUP-01	SW-02	SW-03	SW-04
Sample Date	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17
Lab Sample ID	BZ40757	BZ40761	BZ40758	BZ40759	BZ40760
N-Nitrosodiphenylamine	<4.7	<4.7	<4.9	<4.9	<4.9
Pentachloronitrobenzene	<0.09	<0.09	<0.10	<0.10	<0.10
Pentachlorophenol	<0.75	<0.75	<0.78	<0.78	<0.79
Phenanthrene	<0.05	<0.05	<0.05	<0.05	<0.05
Phenol	<0.94	<0.94	<0.97	<0.98	<0.99
Pyrene	<0.05	<0.05	<0.05	<0.05	<0.05
Pyridine	<0.47	<0.47	<0.49	<0.49	<0.49
Naphthalene	<1.0	<1.0	<1.0	<0.10	<0.10
Voaltile Organic Compounds (ug/L)					
Tetrachloroethane, 1,1,1,2-	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethane, 1,1,1-	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethane, 1,1,2,2-	<0.50	<0.50	<0.50	<0.50	<0.50
Trichlorotrifluoroethane, 1,1,2-	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethane, 1,1,2-	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloroethane, 1,1-	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloroethene, 1,1-	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloropropene, 1,1-	<1.0	<1.0	<1.0	<1.0	<1.0
Trichlorobenzene, 1,2,3-	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloropropane, 1,2,3-	<1.0	<1.0	<1.0	<1.0	<1.0
Trichlorobenzene,1,2,4-	<4.7	<4.7	<1.0	<1.0	<1.0
Trimethylbenzene, 1,2,4-	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromo-3-chloropropane,1,2-	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorobenzene, 1,2- (o-DCB)	<1.0	<1.0	<2.4	<1.0	<2.5
Dichloroethane, 1,2-	<0.60	<0.60	<0.60	<0.60	<0.60
Dichloropropane, 1,2-	<1.0	<1.0	<1.0	<1.0	<1.0
Trimethylbenzene, 1,3,5-	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorobenzene, 1,3-(m-DCB)	<2.3	<2.3	<1.0	<2.5	<1.0
Dichloropropane, 1,3-	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorobenzene, 1,4- (p-DCB)	<1.0	<1.0	<2.4	<2.5	<2.5
Dichloropropane, 2,2-	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorotoluene, 2-	<1.0	<1.0	<1.0	<1.0	<1.0
Methyl butyl ketone (2-Hexanone)	<5.0	<5.0	<5.0	<5.0	<5.0
Isopropyltoluene, 2- (o-Cymene)	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorotoluene, 4-	<1.0	<1.0	<1.0	<1.0	<1.0
Isopropyltoluene, 4- (p-Cymene)	<1.0	<1.0	<1.0	<1.0	<1.0
Methyl Isobutyl Ketone (4-Methyl-2-pentanone)	<5.0	<5.0	<5.0	<5.0	<5.0
Acetone	<25	<25	<25	<25	<25
Acrylonitrile	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	<0.70	<0.70	<0.70	<0.70	<0.70
Bromobenzene	<1.0	<1.0	<1.0	<1.0	<1.0
Bromochloromethane	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	<0.50	<0.50	<0.50	<0.50	<0.50
Bromoform	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	<1.0	<1.0	<1.0	<1.0	<1.0
Butylbenzene, n-	<1.0	<1.0	<1.0	<1.0	<1.0
Butylbenzene, sec-	<1.0	<1.0	<1.0	<1.0	<1.0
Butylbenzene, tert-	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon disulfide	<5.0	<5.0	<5.0	<5.0	<5.0

Table A-2. Current surface water data for the Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SW-01	SW-DUP-01	SW-02	SW-03	SW-04
Sample Date	11/13/17	11/13/17	11/13/17	11/13/17	11/13/17
Lab Sample ID	BZ40757	BZ40761	BZ40758	BZ40759	BZ40760
Carbon tetrachloride	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	<1.0	<1.0	<1.0	<1.0	<1.0
Chloromethane	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloroethene, cis-1,2-	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloropropene, cis-1,3-	<0.40	<0.40	<0.40	<0.40	<0.40
Dibromochloromethane	<0.50	<0.50	<0.50	<0.50	<0.50
Dibromomethane	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylene Dibromide (EDB)	<1.0	<1.0	<1.0	<1.0	<1.0
Hexachlorobutadiene	<0.40	<0.40	<0.49	<0.49	<0.49
Isopropylbenzene (cumene)	<1.0	<1.0	<1.0	<1.0	<1.0
Xylene, m,p-	<1.0	<1.0	<1.0	<1.0	<1.0
Methyl ethyl ketone	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl Tert-Butyl Ether (MTBE)	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride (Dichloromethane)	<1.0	<1.0	<1.0	<1.0	<1.0
Propylbenzene, n-	<1.0	<1.0	<1.0	<1.0	<1.0
Xylene, o-	<1.0	<1.0	<1.0	<1.0	<1.0
Styrene	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethylene (PCE)	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrahydrofuran	<2.5	<2.5	<2.5	<2.5	<2.5
Toluene	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloroethene, trans-1,2-	<1.0	<1.0	<1.0	<1.0	<1.0
Dichloropropene, trans-1,3-	<0.40	<0.40	<0.40	<0.40	<0.40
Dichloro-2-butene, trans-1,4-	<5.0	<5.0	<5.0	<5.0	<5.0
Trichloroethylene (TCE)	<1.0	<1.0	<1.0	<1.0	<1.0
Trichlorofluoromethane	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	<1.0	<1.0	<1.0	<1.0	<1.0
Xylene (Total)	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:
ug/L - microgram per liter
mg/L - milligram per liter

Table A-3. Current sediment data for the Hockanum River upstream of the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SED-101	SED-102	SED-103	SED-104	SED-105
Sample Date	10/21/20	10/21/20	10/21/20	10/21/20	10/21/20
Lab Sample ID	460-221363-1	460-221363-2	460-221363-3	460-221363-4	460-221363-5
Hydrocarbon (mg/Kg)					
CT ETPH	850	350	660	890	480
Metals (mg/Kg)					
Antimony	<1.2	<1.2	<1.2	<1.2	<1.1
Arsenic	<1.2	<1.2	1.2	1.4	<1.1
Barium	26	20	26	24	26
Beryllium	<0.50	<0.49	<0.48	<0.47	<0.46
Cadmium	<1.2	<1.2	<1.2	<1.2	<1.1
Chromium (Total)	7.8	18	8.2	7.6	8.2
Copper	16	19	24	20	16
Lead	26	57	54	26	33
Mercury	<0.020	<0.019	<0.020	<0.020	<0.020
Nickel	6.5	7.2	7	6.8	7.6
Selenium	<1.6	<1.5	<1.5	<1.5	<1.4
Silver	<1.2	<1.2	<1.2	<1.2	<1.1
Thallium	<0.50	<0.49	<0.48	<0.47	<0.46
Vanadium	18	27	35	23	22
Zinc	56	150	75	43	54
Polycyclic Aromatic Hydrocarbons (ug/Kg)					
Methylnaphthalene, 2-	47	56	44	25	91
Acenaphthene	120	130	150	60	83
Acenaphthylene	890	570	450	260	410
Anthracene	790	730	660	320	470
Benzo(a)anthracene	2300	1600	1600	890	1400
Benzo(a)pyrene	2100	1400	1300	760	1100
Benzo(b)fluoranthene	2500	1600	1500	940	1300
Benzo(g,h,i)perylene	1700	1200	950	530	780
Benzo(k)fluoranthene	810	410	580	330	490
Chrysene	2300	1500	1500	870	1200
Dibenz(a,h)anthracene	510	370	360	170	250
Fluoranthene	5100	3900	3700	2000	2800
Fluorene	250	340	250	120	160
Indeno(1,2,3-cd)pyrene	1500	1000	880	510	710
Phenanthrene	2600	3300	2600	1300	1700
Pyrene	4700	3800	3300	1900	2500
Naphthalene	65	96	47	34	430
Other (mg/Kg)					
Carbon (Total Organic)	7,400	<120	2,100	1,300	3,100

Notes:
ug/Kg - microgram per kilogram
mg/Kg - milligram per kilogram

Table A-4. Current surface water data for the Hockanum River upstream of the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SW-100	SW-101
Sample Date	10/21/2020	10/21/2020
Lab Sample ID	460-221363-6	460-221363-7
Hydrocarbon (mg/L)		
CT ETPH	<0.075	<0.075
Metals (ug/L)		
Antimony (Total)	**<2**	**<2**
Antimony (Dissolved)	<2	<2
Arsenic (Total)	<2	<2
Arsenic (Dissolved)	<2	<2
Barium (Total)	51	58
Barium (Dissolved)	54	53
Beryllium (Total)	<0.8	<0.8
Beryllium (Dissolved)	<0.8	<0.8
Cadmium (Total)	<2	<2
Cadmium (Dissolved	<2	<2
Chromium (Total)	<4	<4
Chromium (Dissolved)	<4	<4
Copper (Total)	<4	<4
Copper (Dissolved)	<4	<4
Lead (Total)	<1.2	<1.2
Lead (Dissolved)	<1.2	<1.2
Mercury (Total)	<0.20	<0.20
Mercury (Dissolved)	<0.20	<0.20
Nickel (Total)	<4	<4
Nickel (Dissolved)	<4	<4
Selenium (Total)	<2.5	<2.5
Selenium (Dissolved)	<2.5	<2.5
Silver (Total)	<2	<2
Silver (Dissolved)	<2	<2
Thallium (Total)	<0.8	<0.8
Thallium (Dissolved)	<0.8	<0.8
Vanadium (Total)	<4	<4
Vanadium (Dissolved)	<4	<4
Zinc (Total)	<16	<16
Zinc (Dissolved)	<16	<16
Polycyclic Aromatic Hydrocarbons (ug/L)		
Methylnaphthalene, 2-	<0.05	<0.05
Acenaphthene	<0.05	<0.05

Table A-4. Current surface water data for the Hockanum River upstream of the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Station Name	SW-100	SW-101
Sample Date	10/21/2020	10/21/2020
Lab Sample ID	460-221363-6	460-221363-7
Acenaphthylene	<0.05	<0.05
Anthracene	<0.05	<0.05
Benzo(a)anthracene	<0.05	<0.05
Benzo(a)pyrene	<0.05	<0.05
Benzo(b)fluoranthene	<0.05	<0.05
Benzo(g,h,i)perylene	<0.05	<0.05
Benzo(k)fluoranthene	<0.05	<0.05
Chrysene	<0.05	<0.05
Dibenz(a,h)anthracene	<0.05	<0.05
Fluoranthene	<0.05	<0.05
Fluorene	<0.05	<0.05
Indeno(1,2,3-cd)pyrene	<0.05	<0.05
Phenanthrene	<0.05	<0.05
Pyrene	<0.05	<0.05
Naphthalene	<0.2	<0.2

Notes:
ug/L - microgram per liter
mg/L - milligram per liter

Appendix B

Supporting Tables for the Chemicals of Potential Ecological Concern Selection

Table B-1. Selection of chemicals of potential ecological concern-sediment, Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Chemical	Class	BCC	Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Detected Conc. (mg/kg)	Maximum Reporting Limit (mg/kg)	Sediment SL (mg/kg)	Historical evidence (Y/N)	CoPEC Determination
CT ETPH	Hydrocarbon	B	11	9	81.8	1400	290	NR	Y	CoPEC:Detected and no SL, but is a BCC
Antimony	Metal		11	0	0	NA	22	0.16	Y	ND CoPEC: MRL>SL and historical use
Arsenic	Metal	B	11	8	72.7	7.3	0.85	9.79	Y	CoPEC: MDC<SL and is a BCC
Barium	Metal		11	11	100	324	NA	0.7	Y	CoPEC:MDC>SL
Beryllium	Metal		11	0	0	NA	1.8	NR	Y	Not a CoPEC: Not detected and No SL
Cadmium	Metal	B	11	4	36.4	2.9	1.4	0.99	Y	CoPEC:MDC>SL
Chromium (Total)	Metal		11	11	100	66.4	NA	43.4	Y	CoPEC:MDC>SL
Copper	Metal	B	14	14	100	2190	NA	31.6	Y	CoPEC:MDC>SL
Lead	Metal	B	11	11	100	267	NA	35.8	Y	CoPEC:MDC>SL
Mercury	Metal	B	11	3	27.3	0.21	0.03	0.18	Y	CoPEC:MDC>SL
Nickel	Metal	B	11	11	100	41.6	NA	22.7	Y	CoPEC:MDC>SL
Selenium	Metal	B	11	0	0	NA	8.9	2	Y	ND CoPEC: MRL>SL and historical use
Silver	Metal	B	11	0	0	NA	2.2	1	Y	ND CoPEC: MRL>SL and historical use
Thallium	Metal		11	0	0	NA	20	NR	Y	Not a CoPEC: Not detected and No SL
Vanadium	Metal		11	11	100	109	NA	50	Y	CoPEC:MDC>SL
Zinc	Metal	B	11	11	100	606	NA	121	Y	CoPEC:MDC>SL
Cyanide (Total)	Inorganic		6	0	0	NA	0.61	0.1	Y	ND CoPEC: MRL>SL and historical use
Aroclor-1016	PCBs	B	11	0	0	NA	0.44	NR	N	Not a CoPEC: Not detected and No SL
Aroclor-1221	PCBs	B	11	0	0	NA	0.44	NR	N	Not a CoPEC: Not detected and No SL
Aroclor-1232	PCBs	B	11	0	0	NA	0.44	NR	N	Not a CoPEC: Not detected and No SL
Aroclor-1242	PCBs	B	11	0	0	NA	0.44	NR	N	Not a CoPEC: Not detected and No SL
Aroclor-1248	PCBs	B	11	0	0	NA	0.44	NR	N	Not a CoPEC: Not detected and No SL
Aroclor-1254	PCBs	B	11	0	0	NA	0.44	0.06	N	Not a CoPEC: MRL>SL and no historical use
Aroclor-1260	PCBs	B	11	0	0	NA	0.44	NR	N	Not a CoPEC: Not detected and No SL
Aroclor-1262	PCBs	B	11	0	0	NA	0.44	NR	N	Not a CoPEC: Not detected and No SL
Aroclor-1268	PCBs	B	11	0	0	NA	0.44	NR	N	Not a CoPEC: Not detected and No SL
PCBs (Total)	PCBs	B	11	0	0	NA	0.44	0.0598	N	Not a CoPEC: MRL>SL and no historical use
Tetrachlorobenzene, 1,2,4,5-	SVOC	B	9	0	0	NA	3	1.09	Y	ND CoPEC: MRL>SL and historical use
Diphenylhydrazine, 1,2-	SVOC		9	0	0	NA	4.3	NR	Y	Not a CoPEC: Not detected and No SL
Trichlorophenol, 2,4,5-	SVOC		9	0	0	NA	3	NR	Y	Not a CoPEC: Not detected and No SL
Trichlorophenol, 2,4,6-	SVOC		9	0	0	NA	3	0.213	Y	ND CoPEC: MRL>SL and historical use
Dichlorophenol, 2,4-	SVOC		9	0	0	NA	3	0.117	Y	ND CoPEC: MRL>SL and historical use
Dimethylphenol, 2,4-	SVOC		9	0	0	NA	3	0.029	Y	ND CoPEC: MRL>SL and historical use
Dinitrophenol, 2,4-	SVOC		9	0	0	NA	4.3	0.00621	Y	ND CoPEC: MRL>SL and historical use
Dinitrotoluene, 2,4-	SVOC		9	0	0	NA	3	0.0416	Y	ND CoPEC: MRL>SL and historical use
Dinitrotoluene, 2,6-	SVOC		9	0	0	NA	3	0.0398	Y	ND CoPEC: MRL>SL and historical use
Chloronaphthalene, 2-	SVOC		9	0	0	NA	3	0.417	Y	ND CoPEC: MRL>SL and historical use
Chlorophenol, 2-	SVOC		9	0	0	NA	3	0.0312	Y	ND CoPEC: MRL>SL and historical use
Methylnaphthalene, 2-	PAH		11	2	18.2	0.79	3	0.0202	Y	CoPEC:MDC>SL
Methylphenol, 2-	SVOC		9	0	0	NA	3	0.0554	Y	ND CoPEC: MRL>SL and historical use
Nitroaniline, 2-	SVOC		9	0	0	NA	4.3	NR	Y	Not a CoPEC: Not detected and No SL
Nitrophenol, 2-	SVOC		9	0	0	NA	3	NR	Y	Not a CoPEC: Not detected and No SL
Methylphenol, 3&4 (Cresol, m&p-)	SVOC		9	0	0	NA	4.3	0.67	Y	ND CoPEC: MRL>SL and historical use
Dichlorobenzidine, 3,3-	SVOC		9	0	0	NA	3	0.127	Y	ND CoPEC: MRL>SL and historical use
Nitroaniline, 3-	SVOC		9	0	0	NA	4.3	NR	Y	Not a CoPEC: Not detected and No SL
Dinitro-2-methylphenol, 4,6-	SVOC		9	0	0	NA	4.3	0.104	Y	ND CoPEC: MRL>SL and historical use
Bromophenyl Phenyl Ether, 4-	SVOC	B	9	0	0	NA	4.3	1.23	Y	ND CoPEC: MRL>SL and historical use
Chloro-3-methylphenol, 4-	SVOC		9	0	0	NA	3	0.388	Y	ND CoPEC: MRL>SL and historical use
Chloroanilne, p- (4-Chloroaniline)	SVOC		9	0	0	NA	3	0.146	Y	ND CoPEC: MRL>SL and historical use
Chlorophenyl-phenylether, 4-	SVOC	B	9	0	0	NA	3	NR	Y	Not a CoPEC: Not detected and No SL

Table B-1. Selection of chemicals of potential ecological concern-sediment, Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Chemical	Class	BCC	Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Detected Conc. (mg/kg)	Maximum Reporting Limit (mg/kg)	Sediment SL (mg/kg)	Historical evidence (Y/N)	CoPEC Determination
Nitroaniline, 4-	SVOC		9	0	0	NA	6.9	NR	Y	Not a CoPEC: Not detected and No SL
Nitrophenol, 4-	SVOC		9	0	0	NA	3	0.0133	Y	ND CoPEC: MRL>SL and historical use
Acenaphthene	PAH	B	11	3	27.3	1.3	3	0.0067	Y	CoPEC:MDC>SL
Acenaphthylene	PAH	B	11	8	72.7	1.4	3	0.0059	Y	CoPEC:MDC>SL
Acetophenone	SVOC		9	0	0	NA	3	NR	Y	Not a CoPEC: Not detected and No SL
Aniline	SVOC		9	0	0	NA	4.3	0.00031	Y	ND CoPEC: MRL>SL and historical use
Anthracene	PAH	B	11	7	63.6	3.3	3	0.0572	Y	CoPEC:MDC>SL
Benzo(a)anthracene	PAH	B	11	10	90.9	7.2	1.5	0.108	Y	CoPEC:MDC>SL
Benzidine	SVOC		9	0	0	NA	3	NR	Y	Not a CoPEC: Not detected and No SL
Benzo(a)pyrene	PAH	B	11	11	100	6.1	NA	0.15	Y	CoPEC:MDC>SL
Benzo(b)fluoranthene	PAH	B	11	10	90.9	5.3	3	10.4	Y	CoPEC: MDC<SL and is a BCC
Benzo(g,h,i)perylene	PAH	B	11	7	63.6	3.3	3	0.17	Y	CoPEC:MDC>SL
Benzo(k)fluoranthene	PAH	B	11	10	90.9	5.4	1.5	0.0272	Y	CoPEC:MDC>SL
Benzoic acid	SVOC		9	0	0	NA	8.6	0.65	Y	ND CoPEC: MRL>SL and historical use
bis(2-Chloroethoxy)methane	SVOC		9	0	0	NA	3	NR	Y	Not a CoPEC: Not detected and No SL
bis(2-Chloroethyl)ether	SVOC		9	0	0	NA	4.3	3.52	Y	ND CoPEC: MRL>SL and historical use
bis(2-Chloroisopropyl)ether	SVOC		9	0	0	NA	3	NR	Y	Not a CoPEC: Not detected and No SL
bis(2-Ethylhexyl)phthalate	SVOC		9	0	0	NA	3	0.18	Y	ND CoPEC: MRL>SL and historical use
Butyl benzyl phthalate	SVOC		9	0	0	NA	3	11	Y	Not a CoPEC: Not detected and MRL<SL
Carbazole	SVOC		9	2	22.2	1.5	4.3	NR	Y	Not a CoPEC: Detected and no SL, but is not a BCC
Chrysene	PAH	B	11	11	100.0	7.6	NA	0.166	Y	CoPEC:MDC>SL
Dibenz(a,h)anthracene	PAH	B	11	4	36.4	0.80	3	0.033	Y	CoPEC:MDC>SL
Dibenzofuran	SVOC		9	1	11.1	1.1	3	2	Y	Not a CoPEC: MDC<SL and is not a BCC
Diethylphthalate	SVOC		9	0	0	NA	3	0.63	Y	ND CoPEC: MRL>SL and historical use
Dimethyl phthalate	SVOC		9	0	0	NA	3	NR	Y	Not a CoPEC: Not detected and No SL
Di-N-Butyl Phthalate	SVOC		9	0	0	NA	8.6	11	Y	Not a CoPEC: Not detected and MRL<SL
Di-N-Octyl Phthalate	SVOC		9	0	0	NA	3	40.6	Y	Not a CoPEC: Not detected and MRL<SL
Fluoranthene	PAH	B	11	11	100	19	NA	0.423	Y	CoPEC:MDC>SL
Fluorene	PAH	B	11	6	54.5	2.2	3	0.0774	Y	CoPEC:MDC>SL
Hexachlorobenzene	SVOC	B	9	0	0	NA	3	0.02	Y	ND CoPEC: MRL>SL and historical use
Hexachlorocyclopentadiene	SVOC	B	9	0	0	NA	3	0.901	Y	ND CoPEC: MRL>SL and historical use
Hexachloroethane	SVOC	B	9	0	0	NA	3	1	Y	ND CoPEC: MRL>SL and historical use
Indeno(1,2,3-cd)pyrene	PAH	B	11	8	72.7	3.9	3	0.0173	Y	CoPEC:MDC>SL
Isophorone	SVOC		9	0	0	NA	3	0.432	Y	ND CoPEC: MRL>SL and historical use
Nitrobenzene	SVOC		9	0	0	NA	3	0.145	Y	ND CoPEC: MRL>SL and historical use
N-Nitrosodimethylamine	SVOC		9	0	0	NA	4.3	NR	Y	Not a CoPEC: Not detected and No SL
N-Nitroso-di-N-propylamine	SVOC		9	0	0	NA	3	NR	Y	Not a CoPEC: Not detected and No SL
N-Nitrosodiphenylamine	SVOC		9	0	0	NA	4.3	2.68	Y	ND CoPEC: MRL>SL and historical use
Pentachloronitrobenzene	SVOC		9	0	0	NA	4.3	NR	Y	Not a CoPEC: Not detected and No SL
Pentachlorophenol	SVOC		9	0	0	NA	4.3	0.504	Y	ND CoPEC: MRL>SL and historical use
Phenanthrene	PAH	B	11	10	90.9	19	1.5	0.204	Y	CoPEC:MDC>SL
Phenol	SVOC	B	9	0	0	NA	3	0.42	Y	ND CoPEC: MRL>SL and historical use
Pyrene	PAH	B	11	11	100	16	NA	0.195	Y	CoPEC:MDC>SL
Pyridine	SVOC		9	0	0	NA	4.3	0.106	Y	ND CoPEC: MRL>SL and historical use
Naphthalene	PAH		11	2	18.2	0.77	3	0.176	Y	CoPEC:MDC>SL
Trichlorobenzene,1,2,4-	SVOC		9	0	0	NA	3	9.2	Y	Not a CoPEC: Not detected and MRL<SL
Dichlorobenzene, 1,2- (o-DCB)	SVOC	B	9	0	0	NA	3	0.34	Y	ND CoPEC: MRL>SL and historical use
Dichlorobenzene, 1,3-(m-DCB)	SVOC	B	9	0	0	NA	3	1.7	Y	ND CoPEC: MRL>SL and historical use
Dichlorobenzene, 1,4- (p-DCB)	SVOC	B	9	0	0	NA	3	0.35	Y	ND CoPEC: MRL>SL and historical use
Hexachlorobutadiene	SVOC	B	9	0	0	NA	3	0.0265	Y	ND CoPEC: MRL>SL and historical use

Table B-1. Selection of chemicals of potential ecological concern-sediment, Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Chemical	Class	BCC	Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Detected Conc. (mg/kg)	Maximum Reporting Limit (mg/kg)	Sediment SL (mg/kg)	Historical evidence (Y/N)	CoPEC Determination
Naphthalene	VOC		9	0	0	NA	0.033	0.176	Y	Not a CoPEC: Not detected and MRL<SL
Tetrachloroethane, 1,1,1,2-	VOC	B	9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Trichloroethane, 1,1,1-	VOC		9	0	0	NA	0.033	0.17	Y	Not a CoPEC: Not detected and MRL<SL
Tetrachloroethane, 1,1,2,2-	VOC	B	9	0	0	NA	0.02	0.94	Y	Not a CoPEC: Not detected and MRL<SL
Trichlorotrifluoroethane, 1,1,2-	VOC		9	0	0	NA	0.065	NR	Y	Not a CoPEC: Not detected and No SL
Trichloroethane, 1,1,2-	VOC		9	0	0	NA	0.033	1.24	Y	Not a CoPEC: Not detected and MRL<SL
Dichloroethane, 1,1-	VOC		9	0	0	NA	0.033	0.000575	Y	ND CoPEC: MRL>SL and historical use
Dichloroethene, 1,1-	VOC		9	0	0	NA	0.033	0.031	Y	ND CoPEC: MRL>SL and historical use
Dichloropropene, 1,1-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Trichlorobenzene, 1,2,3-	VOC		9	0	0	NA	0.033	0.858	Y	Not a CoPEC: Not detected and MRL<SL
Trichloropropane, 1,2,3-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Trichlorobenzene,1,2,4-	VOC	B	9	0	0	NA	0.033	9.2	Y	Not a CoPEC: Not detected and MRL<SL
Trimethylbenzene, 1,2,4-	VOC	B	9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Dibromo-3-chloropropane,1,2-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Dichlorobenzene, 1,2- (o-DCB)	VOC	B	9	0	0	NA	0.033	0.34	Y	Not a CoPEC: Not detected and MRL<SL
Dichloroethane, 1,2-	VOC		9	0	0	NA	0.033	0.26	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropane, 1,2-	VOC		9	0	0	NA	0.033	0.333	Y	Not a CoPEC: Not detected and MRL<SL
Trimethylbenzene, 1,3,5-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Dichlorobenzene, 1,3-(m-DCB)	VOC	B	9	0	0	NA	0.033	1.7	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropane, 1,3-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Dichlorobenzene, 1,4- (p-DCB)	VOC	B	9	0	0	NA	0.033	0.35	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropane, 2,2-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Chlorotoluene, 2-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Methyl butyl ketone (2-Hexanone)	VOC		9	0	0	NA	0.16	NR	Y	Not a CoPEC: Not detected and No SL
Isopropyltoluene, 2- (o-Cymene)	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Chlorotoluene, 4-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Isopropyltoluene, 4- (p-Cymene)	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Methyl Isobutyl Ketone (4-Methyl-2-pentanone)	VOC		9	0	0	NA	0.16	NR	Y	Not a CoPEC: Not detected and No SL
Acetone	VOC		9	0	0	NA	1.6	0.0099	Y	ND CoPEC: MRL>SL and historical use
Acrylonitrile	VOC		9	0	0	NA	0.033	0.0012	Y	ND CoPEC: MRL>SL and historical use
Benzene	VOC		9	0	0	NA	0.033	0.142	Y	Not a CoPEC: Not detected and MRL<SL
Bromobenzene	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Bromochloromethane	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Bromodichloromethane	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Bromoform	VOC		9	0	0	NA	0.033	0.654	Y	Not a CoPEC: Not detected and MRL<SL
Bromomethane	VOC		9	0	0	NA	0.033	0.00137	Y	ND CoPEC: MRL>SL and historical use
Butylbenzene, n-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Butylbenzene, sec-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Butylbenzene, tert-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Carbon disulfide	VOC		9	0	0	NA	0.033	0.000851	Y	ND CoPEC: MRL>SL and historical use
Carbon tetrachloride	VOC		9	0	0	NA	0.033	0.0642	Y	Not a CoPEC: Not detected and MRL<SL
Chlorobenzene	VOC		9	0	0	NA	0.033	0.82	Y	Not a CoPEC: Not detected and MRL<SL
Chloroethane	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Chloroform	VOC		9	0	0	NA	0.033	0.121	Y	Not a CoPEC: Not detected and MRL<SL
Chloromethane	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Dichloroethene, cis-1,2-	VOC	B	9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Dichloropropene, cis-1,3-	VOC		9	0	0	NA	0.033	5.09E-05	Y	ND CoPEC: MRL>SL and historical use
Dibromochloromethane	VOC		9	0	0	NA	0.02	NR	Y	Not a CoPEC: Not detected and No SL
Dibromomethane	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Dichlorodifluoromethane	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL

Table B-1. Selection of chemicals of potential ecological concern-sediment, Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Chemical	Class	BCC	Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Detected Conc. (mg/kg)	Maximum Reporting Limit (mg/kg)	Sediment SL (mg/kg)	Historical evidence (Y/N)	CoPEC Determination
Ethylbenzene	VOC		9	0	0	NA	0.033	3.6	Y	Not a CoPEC: Not detected and MRL<SL
Ethylene Dibromide (EDB)	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Hexachlorobutadiene	VOC	B	9	0	0	NA	0.033	0.0265	Y	ND CoPEC: MRL>SL and historical use
Isopropylbenzene (cumene)	VOC		9	0	0	NA	0.033	0.086	Y	Not a CoPEC: Not detected and MRL<SL
Xylene, m,p-	VOC		9	0	0	NA	0.033	0.0252	Y	ND CoPEC: MRL>SL and historical use
Methyl ethyl ketone	VOC		9	0	0	NA	0.2	0.0424	Y	ND CoPEC: MRL>SL and historical use
Methyl Tert-Butyl Ether (MTBE)	VOC		9	0	0	NA	0.065	NR	Y	Not a CoPEC: Not detected and No SL
Methylene Chloride (Dichloromethane)	VOC		9	0	0	NA	0.065	0.159	Y	Not a CoPEC: Not detected and MRL<SL
Propylbenzene, n-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Xylene, o-	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Styrene	VOC		9	0	0	NA	0.033	0.559	Y	Not a CoPEC: Not detected and MRL<SL
Tetrachloroethylene (PCE)	VOC		9	0	0	NA	0.033	0.53	Y	Not a CoPEC: Not detected and MRL<SL
Tetrahydrofuran	VOC		9	0	0	NA	0.065	NR	Y	Not a CoPEC: Not detected and No SL
Toluene	VOC		9	1	11.1	0.24	0.0065	0.67	Y	Not a CoPEC: MDC<SL and is not a BCC
Dichloroethene, trans-1,2-	VOC		9	0	0	NA	0.033	1.05	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropene, trans-1,3-	VOC		9	0	0	NA	0.033	5.09E-05	Y	ND CoPEC: MRL>SL and historical use
Dichloro-2-butene, trans-1,4-	VOC		9	0	0	NA	0.065	NR	Y	Not a CoPEC: Not detected and No SL
Trichloroethylene (TCE)	VOC		9	0	0	NA	0.033	1.6	Y	Not a CoPEC: Not detected and MRL<SL
Trichlorofluoromethane	VOC		9	0	0	NA	0.033	NR	Y	Not a CoPEC: Not detected and No SL
Vinyl Chloride	VOC		9	0	0	NA	0.033	0.202	Y	Not a CoPEC: Not detected and MRL<SL
Xylene (Total)	VOC		9	0	0	NA	0.033	0.433	Y	Not a CoPEC: Not detected and MRL<SL

Notes:
BCC - bioaccumulative chemical compound
CoPEC - chemical of potential ecological concern
MDC - maximum detected concentration
mg/kg - milligram per kilogram
MRL - maximum reporting limit
NA - not available
ND - not detected
NR - not reported
PAHs - polycyclic aromatic hydrocarbons
PCBs - polychlorinated biphenyls
SL - screening level
SVOC - semi-volatile organic compound
VOC - volatile organic compound

Table B-2. Selection of chemicals of potential ecological concern-surface water, Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Chemical	Class	BCC	Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Detected Conc. (ug/L)	Maximum Reporting Limit (ug/L)	Surface Water SL (ug/L)	Historical evidence (Y/N)	CoPEC Determination
CT ETPH	Hydrocarbon	B	4	0	0	NA	70	NR	Y	Not a CoPEC: Not detected and No SL
Antimony (Total)	Metal		4	0	0	NA	5	30	Y	Not a CoPEC: Not detected and MRL<SL
Antimony (Dissolved)	Metal		4	0	0	NA	5	30	Y	Not a CoPEC: Not detected and MRL<SL
Arsenic (Total)	Metal	B	4	0	0	NA	4	150	Y	Not a CoPEC: Not detected and MRL<SL
Arsenic (Dissolved)	Metal	B	4	0	0	NA	4	150	Y	Not a CoPEC: Not detected and MRL<SL
Barium (Total)	Metal		4	4	100	53	NA	3.9	Y	CoPEC:MDC>SL
Barium (Dissolved)	Metal		4	4	100	56	NA	3.9	Y	CoPEC:MDC>SL
Beryllium (Total)	Metal		4	0	0	NA	1	0.66	Y	ND CoPEC: MRL>SL and historical use
Beryllium (Dissolved)	Metal		4	0	0	NA	1	0.66	Y	ND CoPEC: MRL>SL and historical use
Cadmium (Total)	Metal	B	4	0	0	NA	1	0.125	Y	ND CoPEC: MRL>SL and historical use
Cadmium (Dissolved)	Metal	B	4	0	0	NA	1	0.125	Y	ND CoPEC: MRL>SL and historical use
Chromium (Total)	Metal		4	0	0	NA	1	11	Y	Not a CoPEC: Not detected and MRL<SL
Chromium (Dissolved)	Metal		4	2	50	1	1	11	Y	Not a CoPEC: MDC<SL and is not a BCC
Copper (Total)	Metal	B	4	0	0	NA	5	4.8	Y	ND CoPEC: MRL>SL and historical use
Copper (Dissolved)	Metal	B	4	0	0	NA	5	4.8	Y	ND CoPEC: MRL>SL and historical use
Lead (Total)	Metal	B	4	0	0	NA	2	1.2	Y	ND CoPEC: MRL>SL and historical use
Lead (Dissolved)	Metal	B	4	0	0	NA	2	1.2	Y	ND CoPEC: MRL>SL and historical use
Mercury (Total)	Metal	B	4	0	0	NA	0.2	0.77	Y	Not a CoPEC: Not detected and MRL<SL
Mercury (Dissolved)	Metal	B	4	0	0	NA	0.2	0.77	Y	Not a CoPEC: Not detected and MRL<SL
Nickel (Total)	Metal	B	4	0	0	NA	1	28.9	Y	Not a CoPEC: Not detected and MRL<SL
Nickel (Dissolved)	Metal	B	4	0	0	NA	1	28.9	Y	Not a CoPEC: Not detected and MRL<SL
Selenium (Total)	Metal	B	4	0	0	NA	10	5	Y	ND CoPEC: MRL>SL and historical use
Selenium (Dissolved)	Metal	B	4	0	0	NA	11	5	Y	ND CoPEC: MRL>SL and historical use
Silver (Total)	Metal	B	4	0	0	NA	1	0.36	Y	ND CoPEC: MRL>SL and historical use
Silver (Dissolved)	Metal	B	4	0	0	NA	1	0.36	Y	ND CoPEC: MRL>SL and historical use
Thallium (Total)	Metal		4	0	0	NA	1	12	Y	Not a CoPEC: Not detected and MRL<SL
Thallium (Dissolved)	Metal		4	0	0	NA	2	12	Y	Not a CoPEC: Not detected and MRL<SL
Vanadium (Total)	Metal		4	0	0	NA	2	19	Y	Not a CoPEC: Not detected and MRL<SL
Vanadium (Dissolved)	Metal		4	0	0	NA	2	19	Y	Not a CoPEC: Not detected and MRL<SL
Zinc (Total)	Metal	B	4	1	25	2.5	2	65	Y	CoPEC: MDC<SL and is a BCC
Zinc (Dissolved)	Metal	B	4	4	100	6	NA	65	Y	CoPEC: MDC<SL and is a BCC
Cyanide (Total)	Inorganic		4	0	0	NA	10	5.2	Y	ND CoPEC: MRL>SL and historical use
Tetrachlorobenzene, 1,2,4,5-	SVOC	B	4	0	0	NA	0.49	50	Y	Not a CoPEC: Not detected and MRL<SL
Diphenylhydrazine, 1,2-	SVOC		4	0	0	NA	4.9	27	Y	Not a CoPEC: Not detected and MRL<SL
Trichlorophenol, 2,4,5-	SVOC		4	0	0	NA	0.99	63	Y	Not a CoPEC: Not detected and MRL<SL
Trichlorophenol, 2,4,6-	SVOC		4	0	0	NA	0.99	4.9	Y	Not a CoPEC: Not detected and MRL<SL
Dichlorophenol, 2,4-	SVOC		4	0	0	NA	0.99	11	Y	Not a CoPEC: Not detected and MRL<SL
Dimethylphenol, 2,4-	SVOC		4	0	0	NA	0.99	21.2	Y	Not a CoPEC: Not detected and MRL<SL
Dinitrophenol, 2,4-	SVOC		4	0	0	NA	0.99	19	Y	Not a CoPEC: Not detected and MRL<SL
Dinitrotoluene, 2,4-	SVOC		4	0	0	NA	4.9	44	Y	Not a CoPEC: Not detected and MRL<SL
Dinitrotoluene, 2,6-	SVOC		4	0	0	NA	4.9	81	Y	Not a CoPEC: Not detected and MRL<SL
Chloronaphthalene, 2-	SVOC		4	0	0	NA	4.9	0.396	Y	ND CoPEC: MRL>SL and historical use
Chlorophenol, 2-	SVOC		4	0	0	NA	0.99	24	Y	Not a CoPEC: Not detected and MRL<SL
Methylnaphthalene, 2-	PAH		4	0	0	NA	0.99	4.7	Y	Not a CoPEC: Not detected and MRL<SL
Methylphenol, 2-	SVOC		4	0	0	NA	0.99	13	Y	Not a CoPEC: Not detected and MRL<SL
Nitroaniline, 2-	SVOC		4	0	0	NA	4.9	NR	Y	Not a CoPEC: Not detected and No SL
Nitrophenol, 2-	SVOC		4	0	0	NA	0.99	1920	Y	Not a CoPEC: Not detected and MRL<SL
Methylphenol, 3&4 (Cresol, m&p-)	SVOC		4	0	0	NA	9.9	543	Y	Not a CoPEC: Not detected and MRL<SL
Dichlorobenzidine, 3,3-	SVOC		4	0	0	NA	4.9	4.5	Y	ND CoPEC: MRL>SL and historical use
Nitroaniline, 3-	SVOC		4	0	0	NA	4.9	NR	Y	Not a CoPEC: Not detected and No SL
Dinitro-2-methylphenol, 4,6-	SVOC		4	0	0	NA	0.99	2.3	Y	Not a CoPEC: Not detected and MRL<SL
Bromophenyl Phenyl Ether, 4-	SVOC	B	4	0	0	NA	4.9	1.5	Y	ND CoPEC: MRL>SL and historical use
Chloro-3-methylphenol, 4-	SVOC		4	0	0	NA	0.99	0.3	Y	ND CoPEC: MRL>SL and historical use
Chloroanilne, p- (4-Chloroaniline)	SVOC		4	0	0	NA	4.9	232	Y	Not a CoPEC: Not detected and MRL<SL
Chlorophenyl-phenylether, 4-	SVOC	B	4	0	0	NA	0.99	NR	Y	Not a CoPEC: Not detected and No SL
Nitroaniline, 4-	SVOC		4	0	0	NA	4.9	NR	Y	Not a CoPEC: Not detected and No SL

Table B-2. Selection of chemicals of potential ecological concern-surface water, Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Chemical	Class	BCC	Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Detected Conc. (ug/L)	Maximum Reporting Limit (ug/L)	Surface Water SL (ug/L)	Historical evidence (Y/N)	CoPEC Determination
Nitrophenol, 4-	SVOC		4	0	0	NA	0.99	60	Y	Not a CoPEC: Not detected and MRL<SL
Acenaphthene	PAH	B	4	0	0	NA	0.05	23	Y	Not a CoPEC: Not detected and MRL<SL
Acenaphthylene	PAH	B	4	0	0	NA	0.05	4840	Y	Not a CoPEC: Not detected and MRL<SL
Acetophenone	SVOC		4	0	0	NA	4.9	NR	Y	Not a CoPEC: Not detected and No SL
Aniline	SVOC		4	0	0	NA	4.9	2.2	Y	ND CoPEC: MRL>SL and historical use
Anthracene	PAH	B	4	0	0	NA	0.05	0.73	Y	Not a CoPEC: Not detected and MRL<SL
Benzo(a)anthracene	PAH	B	4	0	0	NA	0.05	0.027	Y	ND CoPEC: MRL>SL and historical use
Benzidine	SVOC		4	0	0	NA	4.9	3.9	Y	ND CoPEC: MRL>SL and historical use
Benzo(a)pyrene	PAH	B	4	0	0	NA	0.05	0.014	Y	ND CoPEC: MRL>SL and historical use
Benzo(b)fluoranthene	PAH	B	4	0	0	NA	0.05	9.07	Y	Not a CoPEC: Not detected and MRL<SL
Benzo(g,h,i)perylene	PAH	B	4	0	0	NA	0.2	7.64	Y	Not a CoPEC: Not detected and MRL<SL
Benzo(k)fluoranthene	PAH	B	4	0	0	NA	0.05	NR	Y	Not a CoPEC: Not detected and No SL
Benzoic acid	SVOC		4	0	0	NA	49	42	Y	ND CoPEC: MRL>SL and historical use
bis(2-Chloroethoxy)methane	SVOC		4	0	0	NA	4.9	NR	Y	Not a CoPEC: Not detected and No SL
bis(2-Chloroethyl)ether	SVOC		4	0	0	NA	0.99	1900	Y	Not a CoPEC: Not detected and MRL<SL
bis(2-Chloroisopropyl)ether	SVOC		4	0	0	NA	4.9	NR	Y	Not a CoPEC: Not detected and No SL
bis(2-Ethylhexyl)phthalate	SVOC		4	0	0	NA	0.49	32	Y	Not a CoPEC: Not detected and MRL<SL
Butyl benzyl phthalate	SVOC		4	0	0	NA	4.9	19	Y	Not a CoPEC: Not detected and MRL<SL
Carbazole	SVOC		4	0	0	NA	4.9	NR	Y	Not a CoPEC: Not detected and No SL
Chrysene	PAH	B	4	0	0	NA	0.05	NR	Y	Not a CoPEC: Not detected and No SL
Dibenz(a,h)anthracene	PAH	B	4	0	0	NA	0.01	NR	Y	Not a CoPEC: Not detected and No SL
Dibenzofuran	SVOC		4	0	0	NA	0.05	3.7	Y	Not a CoPEC: Not detected and MRL<SL
Diethylphthalate	SVOC		4	0	0	NA	4.9	220	Y	Not a CoPEC: Not detected and MRL<SL
Dimethyl phthalate	SVOC		4	0	0	NA	4.9	3	Y	ND CoPEC: MRL>SL and historical use
Di-N-Butyl Phthalate	SVOC		4	0	0	NA	4.9	19	Y	Not a CoPEC: Not detected and MRL<SL
Di-N-Octyl Phthalate	SVOC		4	0	0	NA	4.9	22	Y	Not a CoPEC: Not detected and MRL<SL
Fluoranthene	PAH	B	4	0	0	NA	0.05	8.1	Y	Not a CoPEC: Not detected and MRL<SL
Fluorene	PAH	B	4	0	0	NA	0.1	3.9	Y	Not a CoPEC: Not detected and MRL<SL
Hexachlorobenzene	SVOC	B	4	0	0	NA	0.05	0.0003	Y	ND CoPEC: MRL>SL and historical use
Hexachlorocyclopentadiene	SVOC	B	4	0	0	NA	0.05	5.2	Y	Not a CoPEC: Not detected and MRL<SL
Hexachloroethane	SVOC	B	4	0	0	NA	0.49	12	Y	Not a CoPEC: Not detected and MRL<SL
Indeno(1,2,3-cd)pyrene	PAH	B	4	0	0	NA	0.05	4.31	Y	Not a CoPEC: Not detected and MRL<SL
Isophorone	SVOC		4	0	0	NA	4.9	920	Y	Not a CoPEC: Not detected and MRL<SL
Nitrobenzene	SVOC		4	0	0	NA	0.1	220	Y	Not a CoPEC: Not detected and MRL<SL
N-Nitrosodimethylamine	SVOC		4	0	0	NA	4.9	117	Y	Not a CoPEC: Not detected and MRL<SL
N-Nitroso-di-N-propylamine	SVOC		4	0	0	NA	4.9	NR	Y	Not a CoPEC: Not detected and No SL
N-Nitrosodiphenylamine	SVOC		4	0	0	NA	4.9	210	Y	Not a CoPEC: Not detected and MRL<SL
Pentachloronitrobenzene	SVOC		4	0	0	NA	0.1	NR	Y	Not a CoPEC: Not detected and No SL
Pentachlorophenol	SVOC	B	4	0	0	NA	0.79	15	Y	Not a CoPEC: Not detected and MRL<SL
Phenanthrene	PAH	B	4	0	0	NA	0.05	6.3	Y	Not a CoPEC: Not detected and MRL<SL
Phenol	SVOC	B	4	0	0	NA	0.99	4	Y	Not a CoPEC: Not detected and MRL<SL
Pyrene	PAH	B	4	0	0	NA	0.05	0.025	Y	ND CoPEC: MRL>SL and historical use
Pyridine	SVOC		4	0	0	NA	0.49	2380	Y	Not a CoPEC: Not detected and MRL<SL
Naphthalene	PAH		4	0	0	NA	0.1	24	Y	Not a CoPEC: Not detected and MRL<SL
Tetrachloroethane, 1,1,1,2-	VOC	B	4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Trichloroethane, 1,1,1-	VOC		4	0	0	NA	1	62	Y	Not a CoPEC: Not detected and MRL<SL
Tetrachloroethane, 1,1,2,2-	VOC	B	4	0	0	NA	0.5	420	Y	Not a CoPEC: Not detected and MRL<SL
Trichlorotrifluoroethane, 1,1,2-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Trichloroethane, 1,1,2-	VOC		4	0	0	NA	1	1200	Y	Not a CoPEC: Not detected and MRL<SL
Dichloroethane, 1,1-	VOC		4	0	0	NA	1	47	Y	Not a CoPEC: Not detected and MRL<SL
Dichloroethene, 1,1-	VOC		4	0	0	NA	1	25	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropene, 1,1-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Trichlorobenzene, 1,2,3-	VOC		4	0	0	NA	1	8	Y	Not a CoPEC: Not detected and MRL<SL
Trichloropropane, 1,2,3-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Trichlorobenzene,1,2,4-	VOC	B	4	0	0	NA	4.7	24	Y	Not a CoPEC: Not detected and MRL<SL
Trimethylbenzene, 1,2,4-	VOC	B	4	0	0	NA	1	33	Y	Not a CoPEC: Not detected and MRL<SL

Table B-2. Selection of chemicals of potential ecological concern-surface water, Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Chemical	Class	BCC	Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Detected Conc. (ug/L)	Maximum Reporting Limit (ug/L)	Surface Water SL (ug/L)	Historical evidence (Y/N)	CoPEC Determination
Dibromo-3-chloropropane,1,2-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Dichlorobenzene, 1,2- (o-DCB)	VOC	B	4	0	0	NA	2.5	14	Y	Not a CoPEC: Not detected and MRL<SL
Dichloroethane, 1,2-	VOC		4	0	0	NA	0.6	910	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropane, 1,2-	VOC		4	0	0	NA	1	5700	Y	Not a CoPEC: Not detected and MRL<SL
Trimethylbenzene, 1,3,5-	VOC		4	0	0	NA	1	71	Y	Not a CoPEC: Not detected and MRL<SL
Dichlorobenzene, 1,3-(m-DCB)	VOC	B	4	0	0	NA	2.5	71	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropane, 1,3-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Dichlorobenzene, 1,4- (p-DCB)	VOC	B	4	0	0	NA	2.5	15	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropane, 2,2-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Chlorotoluene, 2-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Methyl butyl ketone (2-Hexanone)	VOC		4	0	0	NA	5	99	Y	Not a CoPEC: Not detected and MRL<SL
Isopropyltoluene, 2- (o-Cymene)	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Chlorotoluene, 4-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Isopropyltoluene, 4- (p-Cymene)	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Methyl Isobutyl Ketone (4-Methyl-2-pentanone)	VOC		4	0	0	NA	5	170	Y	Not a CoPEC: Not detected and MRL<SL
Acetone	VOC		4	0	0	NA	25	1500	Y	Not a CoPEC: Not detected and MRL<SL
Acrylonitrile	VOC		4	0	0	NA	5	2600	Y	Not a CoPEC: Not detected and MRL<SL
Benzene	VOC		4	0	0	NA	0.7	46	Y	Not a CoPEC: Not detected and MRL<SL
Bromobenzene	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Bromochloromethane	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Bromodichloromethane	VOC		4	0	0	NA	0.5	11000	Y	Not a CoPEC: Not detected and MRL<SL
Bromoform	VOC		4	0	0	NA	1	320	Y	Not a CoPEC: Not detected and MRL<SL
Bromomethane	VOC		4	0	0	NA	1	16	Y	Not a CoPEC: Not detected and MRL<SL
Butylbenzene, n-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Butylbenzene, sec-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Butylbenzene, tert-	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Carbon disulfide	VOC		4	0	0	NA	5	0.92	Y	ND CoPEC: MRL>SL and historical use
Carbon tetrachloride	VOC		4	0	0	NA	1	9.8	Y	Not a CoPEC: Not detected and MRL<SL
Chlorobenzene	VOC		4	0	0	NA	1	130	Y	Not a CoPEC: Not detected and MRL<SL
Chloroethane	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Chloroform	VOC		4	0	0	NA	1	28	Y	Not a CoPEC: Not detected and MRL<SL
Chloromethane	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Dichloroethene, cis-1,2-	VOC		4	0	0	NA	1	590	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropene, cis-1,3-	VOC		4	0	0	NA	0.4	0.055	Y	ND CoPEC: MRL>SL and historical use
Dibromochloromethane	VOC		4	0	0	NA	0.5	NR	Y	Not a CoPEC: Not detected and No SL
Dibromomethane	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Dichlorodifluoromethane	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Ethylbenzene	VOC		4	0	0	NA	1	290	Y	Not a CoPEC: Not detected and MRL<SL
Ethylene Dibromide (EDB)	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL
Hexachlorobutadiene	VOC	B	4	0	0	NA	0.49	1.3	Y	Not a CoPEC: Not detected and MRL<SL
Isopropylbenzene (cumene)	VOC		4	0	0	NA	1	2.6	Y	Not a CoPEC: Not detected and MRL<SL
Xylene, m,p-	VOC		4	0	0	NA	1	1.8	Y	Not a CoPEC: Not detected and MRL<SL
Methyl ethyl ketone	VOC		4	0	0	NA	5	14000	Y	Not a CoPEC: Not detected and MRL<SL
Methyl Tert-Butyl Ether (MTBE)	VOC		4	0	0	NA	1	11070	Y	Not a CoPEC: Not detected and MRL<SL
Methylene Chloride (Dichloromethane)	VOC		4	0	0	NA	1	2200	Y	Not a CoPEC: Not detected and MRL<SL
Propylbenzene, n-	VOC		4	0	0	NA	1	128	Y	Not a CoPEC: Not detected and MRL<SL
Xylene, o-	VOC		4	0	0	NA	1	13	Y	Not a CoPEC: Not detected and MRL<SL
Styrene	VOC		4	0	0	NA	1	72	Y	Not a CoPEC: Not detected and MRL<SL
Tetrachloroethylene (PCE)	VOC		4	0	0	NA	1	120	Y	Not a CoPEC: Not detected and MRL<SL
Tetrahydrofuran	VOC		4	0	0	NA	2.5	NR	Y	Not a CoPEC: Not detected and No SL
Toluene	VOC		4	0	0	NA	1	9.8	Y	Not a CoPEC: Not detected and MRL<SL
Dichloroethene, trans-1,2-	VOC		4	0	0	NA	1	590	Y	Not a CoPEC: Not detected and MRL<SL
Dichloropropene, trans-1,3-	VOC		4	0	0	NA	0.4	0.055	Y	ND CoPEC: MRL>SL and historical use
Dichloro-2-butene, trans-1,4-	VOC		4	0	0	NA	5	NR	Y	Not a CoPEC: Not detected and No SL
Trichloroethylene (TCE)	VOC		4	0	0	NA	1	21	Y	Not a CoPEC: Not detected and MRL<SL
Trichlorofluoromethane	VOC		4	0	0	NA	1	NR	Y	Not a CoPEC: Not detected and No SL

Table B-2. Selection of chemicals of potential ecological concern-surface water, Hockanum River at the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Chemical	Class	BCC	Number of Samples	Number of Detections	Detection Frequency (%)	Maximum Detected Conc. (ug/L)	Maximum Reporting Limit (ug/L)	Surface Water SL (ug/L)	Historical evidence (Y/N)	CoPEC Determination
Vinyl Chloride	VOC		4	0	0	NA	1	930	Y	Not a CoPEC: Not detected and MRL<SL
Xylene (Total)	VOC		4	0	0	NA	1	13	Y	Not a CoPEC: Not detected and MRL<SL

Notes:
BCC - bioaccumulative chemical compound
CoPEC - chemical of potential ecological concern
MDC - maximum detected concentration
ug/L - microgram per liter
MRL - maximum reporting limit
NA - not available
ND - not detected
NR - not reported
PAHs - polycyclic aromatic hydrocarbons
SL - screening level
SVOC - semi-volatile organic compound
VOC - volatile organic compound

Appendix C

Amphibian Water Values

Table C-1. Amphibian water values

Chemical	Organism	Organism Common Name	Effect Conc	Unit	Type of Effect Level	Endpoint	Exposure Duration (Days)	Notes	Reference Cited in U.S. EPA's ECOTOX
Metals									
Arsenic	*Gastrophryne carolinensis*	Eastern Narrow-Mouthed Toad	40	µg/L	LC50	Mortality	7	Lowest of all relevant effect levels in ECOTOX	Birge 1978
Barium	Rana sp.	Frog	244300	µg/L	--	Development	<4	Lowest of all relevant effect levels in ECOTOX	Dowden et al. 1965
Cadmium	*Duttaphrynus melanostictus*	Asian Common Toad	19	µg/L	LOEC	Growth	5	Lowest of all relevant effect levels in ECOTOX	Ranatunge et al. 2012
Chromium	*Gastrophryne carolinensis*	Eastern Narrow-Mouthed Toad	30	µg/L	LC50	Mortality	7	ECOTOX contained 2 relevant studies; selected lowest effect level	Birge 1978
Copper	*Ambystoma jeffersonianum*	Jefferson's Salamander	15	µg/L	LC100	Mortality	n/r	Lowest of all relevant effect levels in ECOTOX	Horne and Dunson 1995
Lead	*Gastrophryne carolinensis*	Eastern Narrow-Mouthed Toad	40	µg/L	LC50	Mortality	7	Lowest of all relevant effect levels in ECOTOX	Birge 1978
Mercury	*Gastrophryne carolinensis*	Eastern Narrow-Mouthed Toad	1	µg/L	LC50	Mortality	7	Lowest of all relevant effect levels in ECOTOX	Birge 1978
Nickel	*Gastrophryne carolinensis*	Eastern Narrow-Mouthed Toad	50	µg/L	LC50	Mortality	7	Lowest of all relevant effect levels in ECOTOX	Birge 1978
Vanadium	*Gastrophryne carolinensis*	Eastern Narrow-Mouthed Toad	250	µg/L	LC50	Mortality	7	ECOTOX contained one relevant study	Birge 1978
Zinc	*Gastrophryne carolinensis*	Eastern Narrow-Mouthed Toad	10	µg/L	LC50	Mortality	7	ECOTOX contained 2 relevant studies; selected lowest effect level	Birge 1978
Semivolatile Organic Compounds									
2-Methylnaphthalene			n/a						
Dibenz[a,h]anthracene			n/a						
Acenaphthene			n/a						
Acenaphthylene			n/a						
Anthracene	*Lithobates pipiens*	Leopard Frog	25	µg/L	LC50	Mortality	0.2083	Lowest of all relevant effect levels in ECOTOX	Kagan et al. 1984
Benz[a]anthracene			n/a						
Benzo[a]pyrene	*Xenopus laevis*	African Clawed Frog	3330	µg/L	EC50	Development	4	Lowest of all relevant effect levels in ECOTOX	Saka et al. 2004
Benzo[b]fluoranthene			n/a						
Benzo[e]pyrene			n/a						
Benzo[ghi]perylene			n/a						
Benzo[k]fluoranthene			n/a						
Chrysene			n/a						
Fluoranthene	*Xenopus laevis*	African Clawed Frog	52	µg/L	EC50	Development	4	Lowest of all relevant effect levels in ECOTOX	Hatch 1998
Fluorene			n/a						
Indeno[1,2,3-cd]pyrene			n/a						
Naphthalene	*Xenopus laevis*	African Clawed Frog	2100	µg/L	LC50	Mortality	4	ECOTOX contained one relevant study; selected lowest effect level	Edmisten and Bantle 1982
Perylene			n/a						
Phenanthrene			n/a						
Pyrene	*Lithobates pipiens*	Leopard Frog	140	µg/L	LC50	Mortality	1	ECOTOX contained one relevant study	Kagan et al. 1987
Total PAHs			n/a						

Notes:
LC50 - lethal concentration for 50% of test organisms
LC100 - lethal concentration for 100% of test organisms
Only CoPECs are shown.
n/a = not available
PAHs - polycyclic aromatic hydrocarbons

Appendix D

Wildlife Toxicity Reference Values Development

Wildlife Toxicity Reference Value Development

Exponent developed wildlife toxicity reference values (TRVs) for those chemicals identified as chemicals of potential ecological concern (CoPECs). In accordance with U.S. EPA (1997, 1998) guidance for conducting environmental risk characterizations, TRVs are the no-observed-adverse-effect level (NOAEL) and the lowest-observed-adverse-effect level (LOAEL). NOAELs and LOAELs for the wildlife species are based on the results of laboratory studies reported in the literature. The NOAEL is the highest concentration of a particular contaminant at which no adverse effects are observed in the test species. The LOAEL is the lowest concentration of a particular contaminant at which adverse effects are observed in the test species. NOAELs and LOAELs are daily doses of COCs (mg of chemical/kg body weight/day [mg/kg/d]), which are compared to the exposure doses (mg/kg/d) calculated in wildlife exposure models.

Sources of the TRVs for avian and mammalian species include Sample et al. (1996), U.S. Environmental Protection Agency (EPA) Ecological Soil Screening Levels (EcoSSLs), [1] and various databases. EPA recently developed EcoSSLs for a number of metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, selenium, silver, vanadium, and zinc), DDT, dieldrin, PAHs, and pentachlorophenol. In developing the EcoSSLs, EPA reviewed the toxicological literature and selected studies to form the basis for wildlife TRVs. For those chemicals for which EPA developed EcoSSL TRVs for birds and mammals, Exponent reviewed the key studies for possible use in the development of the wildlife TRVs used in this assessment. Exponent also reviewed the studies used by Sample et al. (1996) for possible use in developing the avian and mammalian TRVs. For COCs not reviewed in the EPA EcoSSL documents or Sample et al. (1996), the Agency of Toxic Substances and Disease Registry (ATSDR), [2] the EPA's Integrated Risk Information System (IRIS)[3] and/or the scientific literature was searched for suitable studies to develop avian and mammalian TRVs.

A number of considerations were used when selecting a study for TRV derivation, including:

- Test species relevance to receptor species — Ideally, studies on wildlife species are preferred for TRV development; however, very few toxicological studies on wildlife species have been conducted. Therefore, studies on laboratory rodents (e.g., rats and mice) and common avian test species (e.g., Japanese quail) were reviewed and considered for TRV development. Where there are studies on these species or wildlife species, studies with domesticated species, such as chickens, cattle, pigs, and dogs, were not considered for TRV development.

- Relevant exposure route — The preferred oral route of exposure for TRV development is when the chemical has been added to the food of the test animal. This exposure in food provides a better estimate of wildlife exposure

[1] Online at http://www.epa.gov/ecotox/ecossl/.

[2] Online at http://www.atsdr.cdc.gov/toxpro2.html.

[3] Online at http://www.epa.gov/iris/.

to chemicals in the environment than exposure by gavage, oral capsule, or in drinking water. Inorganic and organic chemicals dissolved in drinking water or a capsule are typically in a form (e.g., inorganic salts) that is much more bioavailable than the forms in which a chemical would be found in the environment, and thus would not produce realistic assessments of potential environmental toxicity. Given that metals and organic chemicals partition from water to food, soil, or sediment in the environment, these exposure routes are not as relevant as in food.

- Study of adequate chronic duration — Studies of chronic duration are preferred over short-term studies for TRV development. For mammals, a study is considered chronic if the exposure was at least one-half of the test animal's lifespan or occurred during a critical life stage, such as reproduction and development. For birds, a study was considered chronic if the exposure was at least 10 weeks or occurred during reproduction or development.

- Provide adequate controls — Laboratory studies without adequate controls were not considered for TRV development. Laboratory studies with a control group exposed to an exposure medium without chemicals added were preferred over field studies where such controls do not exist.

- Adequate statistical methods — Studies conducted appropriate statistical analyses to determine the significant differences between the control and treatment groups were preferred.

- Adequate sample size — A sample size of three is required for consideration in the TRV development. Studies with larger sample sizes are preferred.

- Daily dose or adequate dosing information — Studies that report the effect concentrations as daily doses (e.g., milligram chemical/kilogram body weight/day) or information necessary to calculate the daily dose (e.g., test-animal ingestion rate or body weight and food consumed) were preferred over studies lacking this information.

- Reproductive, growth, or survival endpoints — Studies that report effects on ecologically relevant endpoints, reproduction, growth, and survival, were considered for TRV development. Behavioral, pathological, biochemical, or physiological endpoints were not considered for TRV development unless they were linked to the ecologically relevant endpoints. Reproductive endpoints were preferred to growth and survival.

- Absence of confounding factors — Studies that controlled for confounding factors are preferred. For example, studies that exposed test organisms to multiple chemicals were not used for TRV development.

- Provides a dose-response — Studies that demonstrate increasing chemical levels related to increasing severity of effect are preferred, because they provides evidence that the treatment is the cause of the observed effect.

- Reports both a NOAEL and a LOAEL — Studies that report both a NOAEL and LOAEL are preferred, because these studies (1) report the statistically-significant-effect level and (2) bound the adverse-effect level, thus reducing uncertainty in the use of the study to develop TRVs.

If only subchronic studies were available for selecting chronic TRVs, an acute-to-chronic ratio of 10 (Sample et al. 1996) was applied. If only a LOAEL was provided by the authors of the selected study, then the LOAEL was divided by a factor of 10 to derive the NOAEL benchmark.

Doses of metal salts and organic chemicals of less than 100% purity were adjusted by multiplying the dose by the percent molecular weight. This is consistent with the EcoSSL TRV development methodology.

No studies exist for the mammalian wildlife evaluated in this ERC (e.g., short-tailed shrew, meadow vole, raccoon, river otter); therefore, TRVs (either NOAEL or LOAEL) were derived from rat, mouse, rabbit, and mink studies using this allometric relationship described by Sample et al. (1996):

$$NOAEL_w = NOAEL_t \{bw_t/bw_w\}^{1/4}$$

where:

$NOAEL_w$ is the NOAEL for the wildlife species in question;

$NOAEL_t$ is the NOAEL for the test species;

bw_t is the body weight of the test species;

bw_w is the body weight of the wildlife species in question.

Note that smaller animals will have larger NOAELs because, according to Sample et al. (1996), the smaller animals tend to have higher metabolic rates and are more resistant to toxic chemicals. Table D-1 contains the information on the studies used to develop TRVs for mammalian receptors. Table D-2 contains the allometrically-adjusted TRVs for mammalian receptors used in this ERC.

Table D-3 provides the information on the studies used to develop TRVs for avian receptors. Allometric adjustments of TRVs are not recommended for avian receptors.

Below are descriptions of the studies used to develop the wildlife TRVs, and the rationale for using those studies to develop the wildlife TRVs.

Arsenic

Birds: The EPA EcoSSL TRV for arsenic (As) for birds is NOAEL = 2.24 mg/kg/d. There were no bounded LOAELs reported by EPA. EPA states that the NOAEL is based on the lowest

NOAEL for growth, survival, and reproduction. This value was derived from a study on chickens by Holcman and Stibilj (1997). This study was not considered in the TRV derivation process, because chickens are not the most appropriate surrogate species for wildlife receptors, and other studies on more suitable species are available. EPA listed two other studies with relevant endpoints that were conducted on mallards. These other mallard studies listed by EPA were eliminated from consideration as the basis for TRVs, because the one study by Hoffman et al. (1992) tested only one arsenic concentration (no dose-response), and the other by Camardese et al. (1990) showed only growth effects, which were inconsistent between sexes. EPA listed the study that is the basis for the TRVs used here (Stanley et al. 1994) as among those considered for their avian TRVs, but the data from Stanley et al. were not included in EPA's table of data extracted for avian TRV derivation.

The selected avian TRVs (NOAEL = 10 mg/kg/d, LOAEL = 38 mg/kg/d) for As (test chemical was sodium arsenate; As5+) are based on mallard reproductive effects, derived from the study by Stanley et al. (1994). In this study, mallards were fed feed mixed with sodium arsenate; results are presented as As, dry weight. The study found that duckling production (number of ducklings alive at day 14) was significantly reduced in the exposure group with 400 ppm As added to the diet. At 100 ppm, there was no effect on duckling production. One drawback to this study by Stanley et al. (1994) is that the ingestion rate and mallard body weight were not specified; therefore, these had to be derived from other literature for the purposes of TRV derivation. However, this study measured endpoints that are ecologically relevant in an appropriate test species and remains the most appropriate study for TRV derivation.

Mammals: The EPA EcoSSL TRVs for As for mammals are NOAEL =1.04 mg/kg/d, and LOAEL = 1.66 mg/kg/d. The EPA NOAEL is the highest bounded NOAEL that is lower than the lowest bounded LOAEL for reproduction, growth, and survival. These EPA TRVs, from a study by Neiger and Osweiler (1989) conducted on beagle dogs, are based on a growth endpoint (fraction of initial body weight). In this study, inorganic As (sodium arsenite; As3+) in feed resulted in feed rejection, and decreased feed intake resulted in reduced body weight.

A recent study by Nemec et al. (1998), studied the effects of As in mice and New Zealand White rabbits on both reproduction and survival during gestation days 0 through 18. Although the study duration was relatively short and dose was by gavage, the study is appropriate for TRV derivation, because it was conducted during a critical life stage and assessed both reproductive and survival endpoints in two mammalian species. Therefore, this study was considered more appropriate for TRV derivation than the study selected by EPA (Neiger and Osweiler 1989). Nemec et al. (1998) exposed mice and rabbits to arsenic acid, a form of organic As (As5+) during gestation and evaluated maternal mortality, pathology, and body weight, as well as reproductive effects including embryo/fetal effects. The NOAEL for maternal and reproductive effects in mice was 24 mg/kg/d, and the unbounded LOAEL was 48 mg/kg/d (for both maternal mortality and body weight, and reproductive effects). Rabbits were found to be more sensitive to As. Maternal mortality and fetal resorption occurred in rabbits exposed to the highest dose, 3 mg/kg/d (unbounded LOAEL), and there were no effects on rabbit mortality or reproduction at 0.75 mg/kg/d (NOAEL). Therefore, the selected mammalian TRVs for As are NOAEL = 0.75 mg/kg/d and LOAEL = 3.0 mg/kg/d.

Barium

Birds: EPA does not provide EcoSSL TRVs barium (Ba) for birds, and all of the studies except one (Johnson et al. 1960) were rejected for use in deriving an avian TRV. This study was used to develop the barium TRVs for birds in this evaluation. Johnson et al. (1960) fed 1-day-old chicks 0, 250, 500, 1000, 2000, 4000, 8000, 16000, or 32000 ppm Ba as barium hydroxide in feed to groups of twenty female chicks for four weeks. The 2000-ppm Ba diet had no effect on mortality. There was a slight depression in growth or chicks that ate the 2000-ppm Ba diet, but this was not significant. The 4000- to 32000-ppm diets resulted in 5% to 100% mortality. This study did not provide information needed to develop a daily dose, and body weight and ingestion rate were assumed (Table D-3). This study was four weeks long and considered to be a subchronic exposure, and a subchronic-to-chronic uncertainty factor of 0.1 was applied to the NOAEL and LOAEL. The resulting NOAEL TRV is 21 mg/kg/d, and the LOAEL TRV is 42 mg/kg/d.

Mammals: The EPA EcoSSL TRV for Ba for mammals is a NOAEL of 51.8 mg/kg/d. EPA states that the NOAEL is based on the geometric mean of NOAELs for reproduction and growth, and is lower than the lowest bounded NOAEL for reproduction, growth, and survival. The EPA EcoSSL is based on two studies: Borzelleca et al. (1988) and Dietz et al. (1992). Borzelleca et al. (1988) administered barium chloride to juvenile rats for 10 days and observed reduced survival at 209 mg/kg/d. Dietz et al. (1992) exposed juvenile rats to barium chloride by gavage for 92 days and observed reduced growth in developing male rats at 121 mg/kg/d. The study by Dietz et al. (1992) was selected to develop the TRVs, because it was a longer study and reported effects on a more sensitive endpoint than the study by Borzelleca et al. (1988). The study by Dietz et al. (1992) is considered subchronic, and an uncertainty factor of 0.1 is applied to the NOAEL and LOAEL. The resulting NOAEL is 6.1 mg/kg/d and the LOAEL is 12 mg/kg/d.

Cadmium

Birds: The EPA EcoSSL TRV for cadmium (Cd) for birds is a NOAEL of 1.47 mg/kg/d. EPA states that the NOAEL is based on the geometric mean of NOAELs for reproduction and growth, and most of these are chicken studies. The EPA LOAEL is also based on a chicken study (Leach et al. 1979). Chickens are not good surrogate species for mallard or other wildlife species (in some cases, chickens have been shown to be among the most sensitive of bird species). Therefore, chicken studies were eliminated from consideration in this TRV derivation process, when data for a more relevant species were available. The only other study from the EPA EcoSSL list that was relevant (i.e., for a relevant species—mallard—reported a NOAEL and LOAEL, and for a relevant endpoint—reproduction) was Di Giulio and Scanlon (1984). This study was eliminated from further consideration, because copper and zinc were also present in the food that was given to the mallards, and these metals may also influence toxicity and/or induce antagonistic/synergistic effects.

The selected avian TRVs for Cd are based on mallard reproductive effects (egg production) observed in a study by White and Finley (1978). In this study, adult mallards were fed breeder mash with Cd chloride for 90 days. Egg production was suppressed in the mallards fed 210 ppm

Cd (LOAEL), whereas mallards fed 1.6 to 15.2 ppm Cd were not affected (NOAEL). The resulting NOAEL and LOAEL for Cd based on this study are 1.45 mg/kg/d and 20 mg/kg/d, respectively.

Mammals: The EPA EcoSSL TRVs for Cd in mammals are a NOAEL of 0.77 mg/kg/d, and a LOAEL of 1.0 mg/kg/d. EPA states that the NOAEL is the highest bounded NOAEL that is lower than the lowest bounded LOAEL for reproduction, growth, or survival. The EPA NOAEL is from a study by Yuhas et al. (1979) on rat growth. However, rats were dosed with Cd in drinking water. Therefore, this study was eliminated from further consideration for TRV derivation, because food or gavage studies are more relevant oral exposure routes than drinking water. The EPA LOAEL, 1.0 mg/kg/d, is very close to the EPA NOAEL of 0.77 mg/kg/d. This LOAEL, for which EPA states that the TRV is the lowest bounded LOAEL from the EcoSSL studies, is based on a rat study (Rastogi et al. 1977), in which rats were dosed by gavage and the endpoint was growth (body weight). Other available Cd mammalian studies that reported both NOAELs and LOAELs for relevant endpoints were eliminated, because important parameters were not specified in the studies (e.g., weight of the test animals, how much they were fed), or because study duration or samples sizes were inadequate.

The study by Sutou et al. (1980) was selected for TRV development for mammals and Cd, because the endpoint in this study was reproduction, which is a more ecologically relevant and preferred endpoint than change in body weight. In this study, in female rats dosed by gavage at 10 mg/kg/d Cd for 6 weeks, the numbers of copulating and pregnant females decreased, the average numbers of total implantations and live fetuses decreased, the average number of resorbed fetuses increased, and fetus growth also decreased significantly from the control. There were no significant effects in the 1.0 mg/kg/d exposure group. Therefore, the Cd NOAEL TRV is 1.0 mg/kg/d and the LOAEL TRV is 10 mg/kg/d.

Chromium

Birds: EPA did not calculate an EcoSSL TRV for Cr6+, because there were not enough study results to meet the minimum data requirements. The EPA EcoSSL TRV for Cr3+ for birds is a NOAEL of 2.66 mg/kg/d. EPA states that the NOAEL is based on the geometric mean of NOAELs for reproduction and growth. The EPA EcoSSL TRV for Cr3+ for birds is also based on a study on the effects of chromium on black ducks by Haseltine et al. (unpublished data). Sample et al. (1996) used this same study to develop chronic TRVs for birds. The only other study used by EPA to develop the EcoSSL for birds that reported both a NOAEL and a LOAEL for relevant endpoints for birds was of shorter duration than Haseltine et al. (unpublished data) and used chickens, which are not as ecologically relevant as black ducks. Therefore, the Haseltine et al. data is used to develop the chromium TRVs for birds. In this study, Haseltine et al. exposed black ducks to 0, 10, or 50 ppm Cr+3 in the diet for 10 months and observed reduced duckling survival at the 50-ppm dose level. No significant differences in duckling survival were observed at the 10-ppm dose level. This study did not provide information needed to develop a daily dose, and body weight and ingestion rate were assumed (Table D-3). The resulting chromium NOAEL is 1.5 mg/kg/d, and the LOAEL is 7.5 mg/kg/d.

Mammals: The EPA EcoSSL TRV for Cr3+ for mammals is a NOAEL of 2.40 mg/kg/d. EPA states that the NOAEL is based on the geometric mean of NOAELs for reproduction and growth. EPA also developed an EcoSSL TRV for Cr6+, and this value is 5.66 mg/kg/d—the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, and survival. A key study used to develop the EcoSSL TRV for Cr3+ is a study by Zahid et al. (1990). This study was the source of the lowest LOAEL used by EPA in developing the EcoSSL TRV for Cr3+. In this study, mice were fed 0, 100, 200, or 400 mg/kg chromium sulfate (38.02% Cr3+ by molecular weight) in food for 35 days. Decreased sperm count was observed in mice fed a 100-ppm dose, the lowest dose tested. This study provided information needed to calculate the daily dose, and the resulting LOAEL is 5.96 mg/kg/d. To estimate a NOAEL, the LOAEL is divided by 10, resulting in a NOAEL of 0.596 mg/kg/d. The Zahid et al. (1990) study was selected to develop the chromium TRV for mammals, because other studies with both NOAELs and LOAELs used shorter exposure duration, less preferred exposure routes, or higher final NOAELs and LOAELs.

Copper

Birds: The EPA EcoSSL TRV for copper (Cu) for birds is a NOAEL of 4.05 mg/kg/d. EPA states that the NOAEL is the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, and mortality. The EPA NOAEL is based on a chicken study (Ankari et al. 1998). Chickens are not good surrogate species for mallard or other wildlife species (in some cases, chickens have been shown to be among the most sensitive of bird species). Therefore, chicken studies were eliminated from consideration in this TRV derivation process when data for a more relevant species were available. The only other study from the EPA EcoSSL list that was relevant (i.e., for a relevant species, reported a NOAEL and LOAEL, and for a relevant endpoint) was Foster (1999). In this study, juvenile ducks were fed 0, 218.5, 420, or 1024 ppm Cu in food for 34 days, and reduced growth was observed in the 420-ppm group, but growth was in the 218.5-ppm group. This study reported information needed to calculate daily doses, and the resulting NOAEL is 56.8 mg/kg/d and LOAEL is 109 mg/kg/d. Because the exposure duration of this study was only 35 days, a subchronic-to-chronic uncertainty factor of 0.1 was applied. The final Cu NOAEL for birds is 5.68 mg/kg/d, and Cu LOAEL for birds is 10.9 mg/kg/d.

Mammals: The EPA EcoSSL TRV for Cu for mammals is a NOAEL of 5.06 mg/kg/d. EPA states that the NOAEL is the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, and mortality. The EPA NOAEL is based on a mink study (Aulerich et al. 1982). Other available Cu mammalian studies that reported both NOAELs and LOAELs for relevant endpoints were not considered in this TRV selection process, because the study durations were shorter than the study by Aulerich et al. (1982). Aulerich et al. (1982) fed 0, 25, 50, 100, or 200 ppm Cu in food to juvenile mink for 357 days. The feed without addition of Cu contained 60.5 ppm; this base level of Cu should be added to the Cu doses. Kit mortality was observed in the 50-ppm group, but not the 25-ppm group. This study did not provide necessary information to estimate the daily doses, and body weight and ingestion rate values were assumed (Table D-1). The NOAEL is 11.7 mg/kg/d (25 mg/kg diet + 60.5 mg/kg in food * 0.137 kg food/kg body weight/d) and the LOAEL is 15.1 mg/kg/d (50 mg/kg diet + 60.5 mg/kg in food * 0.137 kg food/kg body weight/d).

Lead

Birds: The EPA EcoSSL TRV for lead (Pb) for birds is a NOAEL of 1.63 mg/kg/d. EPA states that the NOAEL is the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, and mortality. The EPA NOAEL is based on a chicken study (Edens and Garlich 1983). Chickens are not good surrogate species for mallard or other wildlife species (in some cases, chickens have been shown to be among the most sensitive of bird species). Therefore, chicken studies were eliminated from consideration in this TRV derivation process, when data for a more relevant species were available. Studies using preferred exposure routes, duration, and endpoints, as well as reporting both a NOAEL and LOAEL, were limited to studies using Japanese quail. However, studies on American kestrels were available (Hoffman et al. 1985; Pattee 1984). These studies were selected over the studies with Japanese quail, because kestrels are important wildlife species and represent birds that are generally more sensitive to bioaccumulating chemicals, such as lead, because they are top-level predators. The study by Hoffman et al. (1985) used a non-preferred exposure route (gavage) to treat kestrels with lead. Therefore, the study by Pattee (1984), in which American kestrels were fed lead in food for seven months, was selected for lead TRV development. Pattee (1984) fed sixteen breeding pairs of kestrels 0, 10, or 50 ppm Pb in food for seven months. No adverse effects on egg laying, fertility, or eggshell thickness were observed in 10- or 50-ppm Pb groups. The mean Pb level in the 50-ppm diet fed to kestrels was 54 ppm. This study did not provide daily doses of lead, but did provide body-weight data. Using the body weight and a food ingestion rate of 10 g/day (Sample et al. 1996), the resulting Pb NOAEL for birds is 3.75 mg/kg/d.

For a LOAEL, the geometric mean of LOAELs for reproduction and growth for bird species was taken and used in this ERC. That value is 25.5 mg/kg/day (Table D-4). Only studies that showed no more than 20% reduction in growth or reproduction were used to calculate the LOAEL.

Mammals: The EPA EcoSSL TRV for Pb for mammals is a NOAEL of 4.70 mg/kg/d. EPA states that the NOAEL is the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, and mortality. This is based on a study that dosed rats with lead in drinking water, which is not the preferred exposure route. Therefore, a study by Azar et al. (1973), in which rats were fed lead in food (0, 10, 50, 100, 500, 1000, or 2000 ppm Pb) for three generations, was selected for lead TRV development. While other available studies used relevant test animals, those studies used shorter exposure durations than the study by Azar et al. (1973) or did not use the preferred exposure route (oral in food). The average weight of weanling rats decreased in the 1000-ppm and 2000-ppm Pb groups, but did not decrease in the 0-, 10-, 50-, and 100-ppm Pb groups. The measured Pb concentrations in the 100-ppm and 1000-ppm diets were 141 and 1130 ppm, respectively. This study did not provide information needed to develop daily doses, and a body weight and ingestion rate was assumed (Table D-1). The resulting Pb NOAEL for mammals is 11 mg/kg/d, and the LOAEL is 90 mg/kg/d.

Mercury

Birds: EPA does not provide mercury (Hg) EcoSSL TRVs for birds. Once mercury moves into the foodchain the predominant form is meHg and is a greater risk because meHg biomagnifies.

Fuchsman et al. (2017) conducted an extensive review of the effects of methylmercury (meHg) on bird reproduction. Fuchsman et al. found typical ranges of meHg thresholds for adverse effects on avian reproductive success are approximately 0.05 mg/kg/d to 0.5 mg/kg/d. Therefore, the lower threshold was selected as the NOAEL (0.05 mg/kg/d) and the upper threshold was selected as the LOAEL (0.5 mg/kg/day).

Mammals: EPA does not provide Hg EcoSSL TRVs for mammals. Sample et al. (1996) provides mgHg TRVs for mammals based on a study by Verschuuren (1976, as cited in Sample et al. [1996]). In that study, rats were exposed to meHg in the diet at three dose levels (0.1, 0.5, and 2.5 mg meHg/kg) for three generations. The highest dose (2.5 mg meHg/kg) resulted in reduced pup viability, but no adverse reproductive effects were observed in rats at other two doses (0.1 or 0.5 mg mgHg/kg). The NOAEL was considered to be 0.5 mg meHg/kg and the LOAEL was considered to be 2.5 mg meHg/kg. Using an ingestion rate of 0.028 kg/d and a body weight of 0.35 kg, the resulting NOAEL was 0.032 mg/kg/d and the LOAEL was 0.16 mg/kg/d.

Nickel

Birds: The EPA EcoSSL TRV for nickel (Ni) for birds is a NOAEL of 6.71 mg/kg/d. EPA states that the NOAEL is based on the geometric mean of NOAELs for reproduction and growth, which are mostly based on studies with chickens. EPA lists two studies on mallards (Eastin and O'Shea, 1981; Cain and Pafford, 1981) that use relevant route of exposure and endpoints. However, the study by Eastin and O'Shea does not provide both a NOAEL and LOAEL is not considered further in this TRV development process. Cain and Paddford (1981) fed juvenile mallards 0, 200, 800 or 1200 ppm Ni (as nickel sulfate) in food for 90 days. Growth and survival were significantly lower in the 800 ppm (774 ppm Ni) group, but were unaffected in the 200 ppm (176 ppm Ni) group. The body weight and ingestion rate was provided in this study (shown in Table D-3) and daily doses for the 200 (NOAEL) and 800 (LOAEL) ppm groups were calculated. The resulting Ni NOAEL is 31 mg/kg/d and the LOAEL is 135 mg/kg/d.

Mammals: The EPA EcoSSL TRV for Ni for mammals is a NOAEL of 7.70 mg/kg/d. EPA states that the NOAEL is the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, and mortality. This is based a study that dosed rats with Ni in drinking water, which is not the preferred exposure route. Therefore, a study by Ambrose et al. (1976), in which rats were fed Ni in food (0, 250, 500, or 1000 ppm nickel sulfate, 22% Ni) for three generations, was selected for Ni TRV development. While other available studies used relevant test animals, those studies used shorter exposure durations than the study by Ambrose et al. (1976), did not provide both NOAELs and LOAELs, or did not use the preferred exposure route (oral in food). The average weight of weanling rats decreased in the 1000-ppm group, but did not decrease in the 0-, 250-, and 500-ppm groups. This study did not provide the information needed to develop daily doses, and body weight and ingestion rate were assumed (Table D-1). The resulting Ni NOAEL for mammals is 9 mg/kg/d, and the LOAEL is 18 mg/kg/d, assuming the doses contained 22% nickel.

Vanadium

Birds: The EPA EcoSSL TRV for V for birds is a NOAEL of 0.344 mg/kg/d. EPA states that the NOAEL is the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, and mortality. The EPA NOAEL is based on a chicken study (Hill 1979). Chickens are not good surrogate species for mallard or other wildlife species, as discussed above. Therefore, chicken studies were eliminated from consideration in this TRV derivation process, when data for a more relevant species were available. The other available studies from the EPA EcoSSL list that were relevant (i.e., for a relevant species, used oral-in-food exposure route, and for a relevant endpoint), lacked LOAELs. Of these studies (White and Dieter 1978; Van Vleet et al. 1981; Hafez and Kratzer 1976), the study by White and Dieter (1978) used the longest exposure duration and provided the lowest NOAEL dose. Therefore, this study was used for this TRV derivation process. In this study, mallard ducks were fed 0, 1.87, 2.84, 10.36, or 110 ppm V in food for 12 weeks, and no significant effects on growth or survival were observed, even at the highest concentration tested (110-ppm group). This study reported information needed to calculate daily doses, and the resulting NOAEL is 11 mg/kg/d.

Mammals: The EPA EcoSSL TRV for V for birds is a NOAEL of 4.16 mg/kg/d. EPA states that the NOAEL is the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, and mortality. The EPA NOAEL is based on a reproduction study with mice (Sanchez et al. 1991). The study by Sanchez et al (1991) used a non-preferred exposure route (gavage). Another study by Daniel and Lillie (1938) was selected for this TRV derivation process, because it used the preferred exposure route (oral in food), provided a NOAEL and LOAEL for an ecologically relevant endpoint (growth), and used a relevant test species (rat). The other available studies from the EPA EcoSSL list were eliminated, because those studies did not use relevant test species, did not use the oral-in-food exposure route, or did not provide both NOAELs and LOAELs for a relevant endpoint. Therefore, the Daniel and Lillie (1938) study was used for this TRV derivation process. In this study, juvenile rats were fed 0, 0.444, 1.03, 5.11, 9.78, or 19 mg V/kg/d in diet for 10 weeks. Reduced body weight (growth) was observed in rats fed 5.11 mg/kg/d, but not in rats fed 1.03, 0.444, or 0 mg/kg/d. This study is considered subchronic, because the exposure duration was less than one-half of the test species' lifespan. Therefore, the NOAEL is 1.03 mg/kg/d, and the LOAEL is 5.11 mg/kg/d after applying a subchronic-to-chronic uncertainty factor of 0.1 to the daily doses.

Zinc

Birds: The EPA EcoSSL TRV for zinc (Zn) for birds is a NOAEL of 66.1 mg/kg/d. EPA states that the NOAEL is based on the geometric mean of NOAELs for reproduction and growth data, and is the lowest bounded NOAEL for reproduction, growth, and survival. Most of the studies underlying the EPA EcoSSL TRV for Zn in birds use chickens, which are not preferred test organisms for developing TRVs for avian wildlife. One study by Gasaway and Buss (1972) fed juvenile mallards 0, 3000, 6000, 9000, or 12000 ppm Zn in food for 60 days. In this study, male ducks fed 3000 to 12000 ppm Zn for 60 days had significantly reduced gonad size, such that reproductive function was probably lost. While Gasaway and Buss (1972) did not determine a NOAEL, this study was selected for this TRV derivation process, because the other available studies that reported both NOAEL and LOAEL for relevant endpoints used Japanese quail as

the test species and a shorter exposure duration. Using the ingestion rate for mallards provided in the study and an assumed body weight for mallards (Table D-3), the LOAEL is 102 mg/kg/d. To estimate a NOAEL from the LOAEL in this study, a LOAEL-to-NOAEL uncertainty factor of 0.1 is applied, resulting in a NOAEL of 10.2 mg/kg/d.

Mammals: The EPA EcoSSL TRV for Zn for mammals is a NOAEL of 75.4 mg/kg/d. EPA states that the NOAEL is based on the geometric mean of NOAELs for reproduction and growth, and is the lowest bounded NOAEL for reproduction, growth, and survival. One of the key studies that were used to develop the EPA EcoSSL TRV for Zn was by Schlicker and Cox (1968). In this study, female rats were fed control diet, diet containing 0.2% Zn, or 0.4% Zn during gestation for sixteen days. Fetal development was normal in the fetus of mothers fed 0.2% Zn (2,000 ppm), but the weights of fetuses in mothers fed 0.4% Zn (4,000 ppm) were significantly reduced. This study did not provide the information needed to develop a daily dose, and a body weight and ingestion rate was assumed (Table D-1). The resulting NOAEL for reproduction is 160 mg/kg/d, and the LOAEL is 320 mg/kg/d. This study was used to develop the mammalian TRVs for Zn, because a NOAEL and LOAEL were determined, an ecologically relevant endpoint was reported, and the exposure duration was considered chronic. However, daily dose information was not provided. This study was selected to develop the NOAEL and LOAEL TRVs over other available studies, because other available Zn mammalian studies lacked both NOAELs and LOAELs for relevant endpoints, did not use ecologically relevant animals, or had higher effective doses than those in the Schlicker and Cox (1968) study.

Total PAHs

Birds: EPA does not provide EcoSSL TRVs for birds, and all of the studies except two (Trust et al. 1994; Landis Assoc. Inc. 1985) were rejected for use in deriving an avian TRV. The study by Landis Assoc. (1985) did not report a LOAEL and was eliminated from this TRV derivation process. The study by Trust et al. (1994) was used to develop the PAH TRVs for birds in this evaluation. Trust et al. (1994) fed nine-day-old European starlings 0, 2, or 20 mg/kg/d 7,12-dimethylbenz(a)anthracene in feed for five days. Starlings fed the 20-mg/kg/d dose exhibited significantly lower growth rates than those in the control group. Starlings fed 2 mg/kg/d exhibited statistically similar growth rates to those fed the control diet. This study was five days duration and was considered to be a subchronic exposure; a subchronic-to-chronic uncertainty factor of 0.1 was applied to the NOAEL and LOAEL. The resulting NOAEL TRV is 0.2 mg/kg/d, and the LOAEL TRV is 2 mg/kg/d.

Mammals: The EPA EcoSSL TRV for low-molecular-weight PAHs for mammals is a NOAEL of 65.6 mg/kg/d, and the TRV for high-molecular-weight PAHs for mammals is a NOAEL of 0.615 mg/kg/d. Both of these values are the highest bounded NOAEL below the lowest bounded LOAEL for reproduction, growth, and mortality. Because the high-molecular-weight PAH NOAEL is lower than the low-molecular-weight PAH NOAEL, the studies used to develop the EPA high-molecular-weight PAH NOAEL will be considered for TRV derivation. The EPA high-molecular-weight NOAEL is based on a 2-year feeding study with mice (Culp et al. 1998). This study was selected over other available studies to develop the NOAEL and LOAEL TRVs, because other available high-molecular-weight PAH studies for mammals lacked both NOAELs and LOAELs for relevant endpoints, used shorter exposure durations, or had higher effective

doses than those in the Culp et al. (1998) study. In the Culp et al. (1998) study, mice were fed 0, 5, 25, or 100 ppm benzo(a)pyrene in the diet for 2 years. Survival of mice fed 25 ppm (LOAEL) or 100 ppm benzo(a)pyrene was significantly lower than those in the control group. Survival of mice fed 5 ppm (NOAEL) benzo(a)pyrene was similar to the control group. This study did not provide daily dose information, except for body weights for mice in the feeding study. A NOAEL of 0.8 mg/kg/d and a LOAEL of 3.8 mg/kg/d were estimated using the body-weight data from the study and an assumed ingestion rate (Table D-1).

References

Ambrose, A.M., P.S. Larson, J.F. Brozelleca, and G.R. Hennigar, Jr. 1976. Long-term toxicologic assessment of nickel in rats and dogs. J. Food Sci. Technol. 13:181-187.

Ankari, A., H. Najib, and A. al Hozab. 1998. Yolk and serum cholesterol and production traits, as affected by incorporating a supraoptimal amount of copper in the diet of the leghorn hen. Br. Poult. Sci. 39(3):393-397.

Aulerich, R.J., R.K. Ringer, M.R. Bleavins, and A. Napolitano. 1982. Effects of supplemental dietary copper on growth, reproductive performance and kit survival of standard dark mink and the acute toxicity of copper to mink. J. Anim. Sci. 55(2):337-343.

Azar, A., H.J. Trochimowicz, and M.E. Maxwell. 1973. Review of lead studies in animals carried out at Haskell Laboratory: Two-year feeding study and response to hemorrhage study. In: Environmental Health Aspects of Lead: Proceedings, International Symposium, D. Barth et al., Eds. Commission of European Communities. Pp. 199-210.

Bleavins, M.R., and R.J. Aulerich. 1981. Feed consumption and food passage time in mink (*Mustela vison*) and European ferrets (*Mustela putorius furo*). Lab. Anim. Sci. 31:268-269.

Borzelleca, J.F., L.W. Condie, Jr., and J.L. Egle, Jr. 1988. Short-term toxicity (one- and ten-day gavage) of barium chloride in male and female rats. J. Am. Coll. Toxicol. 7:675-685.

Cain, B.W., and E.A. Pafford. 1981. Effects of dietary nickel on survival and growth of mallard ducklings. Arch. Environ. Contam. Toxicol. 10(6): 737-745.

Calder, W.A., and E.J. Braun. 1983. Scaling of osmotic regulation in mammals and birds. Am. J. Physiol. 224:R601-R606.

Camardese, M.B., D.J. Hoffman, X. LeCaptain, J. Leonard, and G.W. Pendleton. 1990. Effects of arsenate on growth and physiology in mallard ducklings. Environ. Toxicol. Chem. 9(6):785-795.

Culp, S.J., D.W. Gaylor, W.G. Sheldon, L.S. Goldstein, and F.A. Beland. 1998. A comparison of the tumors induced by coal tar and benzo(a)pyrene in a 2-year bioassay. Carcinogenesis 19(1):117-124.

Daniel, E.P., and Lillie, R.D. 1938. Experimental vanadium poisoning in the white rat. Public Health Rep. 53:765.

Di Giulio, R.T., and P.F. Scanlon. 1984. Sublethal effects of cadmium ingestion on mallard ducks. Arch. Environ. Contam. Toxicol. 13(6):765-776.

Dieter, M.P., M.I. Luster, G.A. Boorman, C.W. Jameson, J.H. Dean, and J.W. Cox. 1983. Immunological and biochemical responses in mice treated with mercuric chloride. Toxicol. Appl. Pharmacol. 68:218–228.

Dietz, D.D., M.R. Elwell, W.E. Davis, Jr., and E.F. Meirhenry. 1992. Subchronic toxicity of barium chloride dehydrate administered to rats and mice in the drinking water. Fundam. Appl. Toxicol. 19:527-537.

Eastin, W.C. Jr., and T.J. O'Shea. 1981. Effects of dietary nickel on mallards. J. Toxicol. Environ. Health 7(6):883-892.

Edens, F.W., and J.D. Garlich. 1983. Lead-induced egg production decrease in leghorn and Japanese quail hens. Poult. Sci. 62(9):1757-1763.

Foster, S.D. 1999. The biological and physiological effects of excess copper in juvenile mallards (*Anas platyrhynchos*): An investigation of the toxicity of acid mine drainage in waterfowl. Masters Thesis. Colorado State University, Fort Collins, CO. 131 pp.

Gasaway, W.C., and I.O. Buss. 1972. Zinc toxicity in the mallard. J. Wildl. Manage. 36:1107-1117.

Hafez, Y.S.M., and F.H. Kratzer. 1976. The effect of pharmacological levels of dietary vanadium on the egg production, shell thickness and egg yolk cholesterol in laying hens and coturnix. Poult. Sci. 55(3):923-926.

Hill, C.H. 1979. The effect of dietary protein levels on mineral toxicity in chicks. J. Nutr. 109(3):501-507.

Hoffman, D.J., J.C. Franson, O.H. Pattee, C.M. Bunck, and A. Anderson. 1985. Survival growth and accumulation of ingested lead in nestling American kestrels *Falco sparverius*. Arch. Environ. Contam. Toxicol. 14(1):89-94.

Hoffman, D.J., C.J. Sanderson, L.J. LeCaptain, E. Cromartie, and G.W. Pendleton. 1992. Interactive effects of arsenate, selenium, and dietary protein on survival, growth, and physiology in mallard ducklings. Arch. Environ. Contam. Toxicol. 22(1): 55-62.

Holcman, A., and V. Stibilj. 1997. Arsenic residues in eggs from laying hens fed with a diet containing arsenic (iii) oxide. Arch. Environ. Contam. Toxicol. 32(4):407-410.

Hudson, R.H., R.K. Tucker, and M.A. Haegele. 1984. Handbook of toxicity of pesticides to wildlife. U.S. Fish and Wildlife Service, Resour. Publ. 153. 90 p.

Johnson, D. Jr., A.L. Mehring, Jr., and H.W. Titus. 1960. Tolerance of chickens for barium. Proc. Soc. Exp. Biol. Med. 104:436-438.

Kezhou, W., H.D. Stowe, A.M. House, K. Chou, and T. Thiel. 1987. Comparison of cupric and sulfate ion effects on chronic selenosis in rats. J. Anim. Sci. 64(5):1467-1475.

Leach, R.M. Jr., K.W. Wang, and D.E. Baker. 1979. Cadmium and the food chain: The effect of dietary cadmium on tissue composition in chicks and laying hens. J. Nutr. 109(3):437-443.

Landis Assoc. Inc. 1985. A dietary LC50 study in the bobwhite with naphthalene (final report). EPA/OTS; Doc#86-870000551.

Nagy, K.A. 1987. Field metabolic rate and food requirement scaling in mammals and birds. Ecol. Monogr. 57:111-128.

Nagy, K.A. 2001. Food requirements of wild animals: Predictive equations for free-living mammals, reptiles, and birds. Nutr. Abstr. Rev. Series B 71:21R-31R.

Neiger, R.D., and G.D. Osweiler. 1989. Effect of subacute low level dietary sodium arsenite on dogs. Fund. Appl. Toxicol. 13:439-451.

Nemec, M.D., J.F. Holson, C.H. Farr, and R.D. Hood. 1998. Developmental toxicity assessment of arsenic acid in mice and rabbits. Reprod. Toxicol. 12(6):647-658.

Pattee, O.H. 1984. Eggshell thickness and reproduction in American kestrels exposed to chronic dietary lead. Arch. Environ. Contam. Toxicol. 13:29-34.

Rastogi, R.B., Z. Merali, and R.L. Singhal. 1977. Cadmium alters behavior and the biosynthetic capacity for catecholamines and serotonin in neo natal rat brain. J. Neurochem. 28(4):789-794.

Sample, B.E., D.M. Opresko, and G.W. Suter. 1996. Toxicological benchmarks for wildlife: 1996 Revision. Prepared by the Risk Assessment Program, Health Sciences Research Division, Oak Ridge, TN. ES/ER/TM-86/R3.

Sanchez, D., A. Ortega, J.L. Domingo, and J. Corbella. 1991. Development toxicity evaluation of orthovanadate in the mouse. Biol. Trace Elem. Res. 30(3):219-226.

Schlicker, S.A., and D.H. Cox. 1968. Maternal dietary zinc, and development and zinc, iron and copper content of the rat fetus. J. Nutr. 95:245-294.

Schroeder, H.A., and M. Mitchener. 1975. Life-term studies in rats. Effects of aluminum, barium, beryllium, and tungsten. J. Nutr. 105(4): 421-7

Schroeder, H.A., M. Mitchener, J.J. Balassa, M. Kanisawa, and A.P. Nason. 1968. Zirconium, niobium, antimony, and fluorine in mice: Effects on growth, survival and tissue levels. J. Nutr. 95:95-101.

Stanley, T.R. Jr., J.W. Spann, G.J. Smith, and R. Rosscoe. 1994. Main and interactive effects of arsenic and selenium on mallard reproduction and duckling growth and survival. Arch. Environ. Contam. Toxicol. 26(4):444-451.

Sutou, S., K. Yamamoto, H. Sendota, and M. Sugiyama. 1980. Toxicity, fertility, teratogenicity, and dominant lethal tests in rats administered cadmium subchronically. I. Fertility, teratogenicity, and dominant lethal tests. Ecotoxicol. Environ. Saf. 4(1):51-56.

Trust, K.A., A. Fairbrother, and M.J. Hooper. 1994. Effects of 7,12-dimethylbenz(a)anthracene on immune function and mixed-function oxygenase activity in the European starling. Environ. Toxicol. Chem. 13(5):821-830.

U.S. EPA. 1988. Recommendations for and documentation of biological values for use in risk assessment. EPA/600/6-87/008. U.S. Environmental Protection Agency, Office of Research and Development, Cincinnati, OH.

U.S. EPA. 1993. Wildlife exposure factors handbook. Volume I of II. EPA/600/R-93/187a. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

U.S. EPA. 1995. Great Lakes Water Quality Initiative technical support document for wildlife criteria. EPA-820-B-95-009. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

U.S. EPA. 1997. Ecological risk assessment guidance for Superfund: Process for designing and conducting ecological risk assessments. Interim Final. EPA/630/R-92/001 U.S. Environmental Protection Agency, Environmental Response Team, Edison, NJ. February.

U.S. EPA. 1998. Guidelines for ecological risk assessment. EPA/630/R-95/002F. U.S. Environmental Protection Agency Washington, DC. April.

White, D.H., and M.P. Dieter. 1978. Effects of dietary vanadium in mallard ducks. J. Toxicol. Environ. Health. 4:43-50.

White, D.H., and M.T. Finley. 1978. Uptake and retention of dietary cadmium in mallard ducks. Environ. Res. 17(1):53-59.

Yuhas, E.M., R.C. Schnell, and T.S. Miya. 1979. Dose-related alterations in growth and mineral disposition by chronic oral cadmium administration in the male rat. Toxicol. 12(1):19-29.

Zahid, Z.R., Z.S. Al Hakkak, A.H.H. Kadhim, E.A. Elias, and I.S. Al Jumaily. 1990. Comparative effects of trivalent and hexavalent chromium on spermatogenesis of the mouse. Toxicol. Environ. Chem. 25(2-3):131-136.

Table D-1. Studies used in the toxicity reference values for mammalian wildlife

	Test Organism Information											
CoPEC	Test Species	Body Weight (kg)	Exposure Route	No-Effects Dose Concentration	Lowest Observed Effects Dose Concentration	Ingestion Rate	Endpoint	Duration of Study	Uncertainty Factor	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	References
Arsenic as Arsenate	Rabbit	4.4	oral in food	--	--	--	reproduction	18 days during gestation	--	0.75	3.0	Nemec et al. (1998)
Barium	Mouse	0.307	oral inwater	61 mg/kg/day	121 mg/kg/day	--	growth	92 days	0.1 [c]	6.1	12	Dietz et al. (1992)
Cadmium	Rat	0.303	oral gavage	1 mg/kg bw/day	10 mg/kg bw/day	--	reproduction	6 weeks through gestation	--	1.0	10	Sutou et al. (1980)
Chromium 3+	Mouse	0.0249	oral in food	--	100 ppm; 38.02% Cr3+ by MW	0.16 kg/kg/day	reproduction	35 days	0.1 [b]	0.60	5.96	Zahid et al. (1990)
Copper	Mink	1.0 [d]	oral in food	25 ppm and 60.5 ppm in food	50 ppm and 60.5 ppm in food	0.137 kg/kg bw-day[e]	kit mortality	357 days	--	12	15	Aulerich et al. (1982)
Lead	Rat	0.35 [f]	oral in food	141 ppm	1130 ppm	0.08 kg/kg/day	weight of weanlings and kidney histology	3 generations	--	11	90	Azar et al. (1973)
Mercury, methyl	Rat	0.35 [f]	oral in food	0.5 ppm	2.5 ppm	0.028 kg/day[g]	reproduction	3 generations	--	0.032	0.16	Verschuuren et al. (1976)
Nickel	Rat	0.35 [a]	oral in food	500 ppm; 22% Ni by MW	1,000 ppm; 22% Ni by MW	0.028 kg/day[g]	offspring body weight	3 generations	--	9	18	Ambrose et al. (1976)
Vanadium	Rat	0.35 [f]	oral in food	1.03 mg/kg/day	5.11 mg/kg/day	--	growth	10 weeks	0.1 [c]	0.103	0.511	Daniel and Lillie (1938)
Zinc	Sprague-Dawley rat	0.35 [a]	oral in diet	2,000 ppm	4,000 ppm	0.028 kg/day[g]	reproduction	16 days during gestation	--	160	320	Schlicker and Cox (1968)
Total PAHs	Mouse	0.038	oral in food	5 ppm	25 ppm	0.15 kg/kg/day	growth, mortality	2 years	--	0.8	3.8	Culp et al. (1998)

Note: Dose concentrations and ingestion rates are expressed in wet weight unless otherwise noted.

bw - body weight
dw - dry weight
LOAEL - lowest-observed-adverse-effect level
NOAEL - no-observed-adverse-effect level
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
TRV - toxicity reference value
UF - uncertainty factor
ww - wet weight

[a] U.S. EPA (1988).
[b] LOAEL to NOAEL UF of 0.1.
[c] Subchronic to Chronic UF of 0.1.
[d] U.S. EPA (1993)
[e] Based on the observations of Bleavins and Aulerich (1981).
[f] U.S. EPA (1995).
[g] Calculated used allometric equation from U.S. EPA (1988).
[h] TRVs for the raccoon are adjusted for differences in body weight between the test orga and the raccoon (see report text for details).

Table D-2. Mammalian toxicity reference values (TRVs) for ecological risk calculations

	Test Species				Raccoon[a]		
Chemical	Test Species	Body Weight (kg)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Body Weight (kg)	Final NOAEL (mg/kg/d)	Final LOAEL (mg/kg/d)
Metals							
Arsenic as Arsenate	Rabbit	4.4	0.75	3.0	6	0.69	2.80
Barium	Mouse	0.307	6.1	12	6	2.9	5.8
Cadmium	Rat	0.303	1.0	10	6	0.47	4.7
Chromium 3+	Mouse	0.0249	0.60	5.96	6	0.15	1.5
Copper	Mink	1.0	12	15	6	7.5	9.7
Lead	Rat	0.35	11	90	6	5.6	44
Mercury, methyl	Rat	0.35	0.032	0.16	6	0.016	0.08
Nickel	Rat	0.35	9	18	6	4.4	8.8
Vanadium	Rat	0.35	0.103	0.511	6	0.05	0.25
Zinc	Sprague-Dawley rat	0.35	160	320	6	79	160
Polycyclic aromatic hydrocarbons							
Total PAHs	Mouse	0.038	0.8	3.8	6	0.23	1.10

Notes:

[a] TRVs for the raccoon are adjusted for differences in body weight between the test organisms and the raccoon (see report text for details).

Table D-3. Avian toxicity reference values (TRVs) for ecological risk calculations

CoPEC	Test Species	Body Weight (kg)	Exposure Route	No-Effects Dose Concentration	Lowest Observed Effects Dose Concentration	Ingestion Rate	Endpoint	Duration of Study	Uncertainty Factor	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	References
Arsenic as Arsenate	Mallard duck	1.043 [a]	oral in food	100 ppm	400 ppm	0.1 kg/day	reproduction	4 weeks	--	10	38	Stanley et al. (1994)
Barium	Chicks	0.121 [b]	oral in food	2,000 ppm	4,000 ppm	0.0126 kg/day[a]	mortality	4 weeks	0.1 [c]	21	42	Johnson et al. (1960)
Cadmium	Mallard duck	1.153	oral in food	15.2 ppm	210 ppm	0.110 kg/day	reproduction	90 days	--	1.45	20	White and Finley (1978)
Chromium 3+	Black duck	1.25	oral in food	10 ppm	50 ppm	0.15 kg/kg/day[d]	reproduction	10 months	--	1.5	7.5	Haseltine et al. (1985) as cited in Sample et al. (1996)
Copper	Mallard duck	0.8	oral in food	218.5 ppm	420 ppm	0.26 kg/kg/day	growth	35 days	--	5.68	10.9	Foster (1999)
Lead	American kestrels	0.144	oral in food	50 ppm	--	0.01 kg/day[e]	reproduction	7 months	--	3.75	25.5	Pattee (1984); Eco-SSL (2005)
Mercury, methyl	Various	--	dietary	--	--	--	reproduction	Chronic	--	0.05	0.5	Fuchsman et al. (2017)
Nickel	Mallard ducklings	0.782	oral in food	176 ppm	774 ppm	0.17 kg/kg/day	mortality	90 days	--	31	135	Cain and Pafford (1981)
Vanadium	Mallard duck	1.17	oral in food	110 ppm	--	0.10 kg/kg/day	mortality, growth	12 weeks	--	11	n/a	White and Dieter (1978)
Zinc	Mallard duck	1.043 [a]	oral in food	--	3000 ppm	0.03 kg/kg/day	reproduction	60 days	0.1 [f]	10.2	102	Gasaway and Buss (1974)
Total PAHs	European starling	0.055	gavage	2 mg/kg/day	20 mg/kg/day	--	growth	5 days	0.1 [c]	0.2	2	Trust et al. (1994)

Note: Dose concentrations and ingestion rates are expressed in wet weight unless otherwise noted.

bw - body weight
dw - dry weight
LOAEL - lowest-observed-adverse-effect level
NOAEL - no-observed-adverse-effect level
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
TRV - toxicity reference value
UF - uncertainty factor
ww - wet weight

[a] U.S. EPA (1993).

[b] U.S. EPA (1988), mean at 5 weeks.

[c] Subchronic to Chronic UF (0.1); Acute to Chronic UF (0.01).

[d] Nagy (2001)

[e] Sample et al. (1996).

[f] LOAEL to NOAEL UF of 0.1.

Table D-4. Lead LOAEL TRV - Avian Data

Results #	Reference	Species	Route of Exposure	Exposure Duration	Duration units	Conversion	Duration days	Effect Type	Effect Measure	mg/kg/day NOAEL	mg/kg/day LOAEL	LOAEL Response Level	Specific Measure	Form	Notes
50	Edens and Garlich, 1983	Japanese quail	FD	5	w	7	35	REP	PROG	0.194	1.94	28%	Egg production	Lead acetate	Table 2 - 10 mg/kg dose represent LOAEL
51	Edens and Garlich, 1983	Chicken	FD	4	w	7	28	REP	PROG	1.63	3.26	12%	Egg production	Lead acetate	Table 1 - 4 week exposure 50 mg/kg dose represent LOAEL
52	Meluzzi et al., 1996	Chicken	FD	30	d	1	30	REP	ALWT	2.69	4.04	6%	Albumin weight	Lead Oxide	Table 5 - Albumen weight at 30 days. Weak study - no effect on albumin at 75 day, the LOAEL appears to be based on a sporative effect found at 30 days, but not at 75 day. This is a multiple metal exposure study (Cr and Ni too).
55	Morgan et al., 1975	Japanese quail	FD	5	w	7	35	REP	TEWT	12.6	126	50%	Testes weight	Lead acetate	Table 2- Testes weight at 100 ppm lead in diet represents LOAEL. Note at the next higher dose of 500 ppm the effect level was 15%. Also note 5 wk old bird response was more sensitive than 6 week old birds did not show a response.
56	Morgan et al., 1975	Japanese quail	FD	5	w	7	35	REP	TEWT	67.4	135	28%	Testes weight	Lead acetate	Table 1 - Testes weight at 1000 ppm lead in diet represents LOAEL. Note this is based on 6 wk old bird data.
64	Edens and Garlich, 1983	Japanese quail	FD	5	w	7	35	GRO	BDWT	1.56	15.6	2%	Body weight	Lead acetate	Table 4 - Japanese quail bw data. 100 mg/kg lead in diet represented LOAEL.
67	Edens and Melvin, 1989	Japanese quail	FD	4	w	7	28	GRO	BDWT	5.93	59.3	22%	Body weight	Lead acetate	Text to Figure 1 - Experiment 1 showed that Fatty had reduced growth at 6 weeks of 10 % while the random breed had a reduction of 22% based on body weight. LOAEL was represented by 500 ppm diet. Response for the random breed was reported as it appeared to be more applicable.
68	Damron et al., 1969	Chicken	FD	4	w	7	28	GRO	BDWT	6.14	61.4	39%	Body weight	Lead acetate	Table 1 - Experiment 1 body weight data; 1000 ppm dose
69	Damron et al., 1969	Chicken	FD	4	w	7	28	GRO	BDWT	7.1	71	6%	Body weight	Lead acetate	Table 1 - Experiment 2 body weight data; 1000 ppm dose

Table D-4. Lead LOAEL TRV - Avian Data

Results #	Reference	Species	Route of Exposure	Exposure Duration	Duration units	Conversion	Duration days	Effect Type	Effect Measure	mg/kg/day NOAEL	mg/kg/day LOAEL	LOAEL Response Level	Specific Measure	Form	Notes
70	Edens et. al., 1976	Japanese quail	FD	12	w	7	84	GRO	BDWT	11.1	111	21%	Body weight	Lead acetate	Table 5 - Body weight data - females only, males showed no effect at 12 weeks. LOAEL was 1000 ppm lead.
71	Edens, 1985	Japanese quail	FD	12	w	7	84	GRO	BDWT	11.2	112	18%	Body weight	Lead acetate	Table 1 - Only effect was for females at highest dose of 1000 ppm
									Data evaluation with restricted data set (5-30% response level)			18%			
									Overall Geometric Mean of restricted data set	**5**	**25.5**				

Study used by EPA to develop TRV for Eco SSL
Represents study with longest duration for Effect Type (i.e., reproduction or growth)
Represents the studies selected to develop the LOAEL, based on studies that reported a 20% or less reduction in growth or reproduction.

Criteria used to select data from that available in Eco SSL Document
1. NOAEL and LOAEL provided in study
2. Duration of exposure greater than or equal to 28 days or 4 weeks
3. Reproductive or growth effects used only

Acronyms
ALWT = albumin weight; BDWT = body weight changes; d = days; FD = food; GRO = growth; PROG = progeny counts or numbers; REP = reproduction; TEWT = testes weight; w = weeks

Appendix E

Food-chain Models for Wildlife

Table E-1. Wildlife Exposure Dose Calculations - Food-chain Model - Mallard Consuming Plants - NOAEL, Hockanum River

Model Run Information	
Species:	Mallard
Food Item:	Plants
TRV Type:	NOAEL

Parameter:	Value
Normalized Food Ingestion Rate (NFIR) (kg ww/kg-day)	0.16
Normalized Sediment Ingestion Rate (NSIR) (kg dw/kg-day)	0.0017
Normalized Water Ingestion Rate (NWIR) (L/kg-day)	0.058
Fraction of Diet as Invertebrate (FDin) (-)	1
Site Utilization Factor (SUF) (-)	1

CoPEC	Sediment Concentration (mg/kg dw)	Plants Concentration (mg/kg ww)	Surface Water Concentration (mg/L)	Chemical Intake Due to Food Ingestion (mg/kg/day)	Chemical Intake Due to Sediment Ingestion (mg/kg/day)	Chemical Intake Due to Water Ingestion (mg/kg/day)	Total Chemical Intake (mg/kg/day)	Toxicity Reference Value (mg/kg/day)	Toxicity Reference Value Endpoint	Hazard Quotient Due to Food Ingestion (-)	Hazard Quotient Due to Sediment Ingestion (-)	Hazard Quotient Due to Water Ingestion (-)	Total Hazard Quotient (-)
Arsenic	7.30E+00	5.48E-02	4.00E-03	8.59E-03	1.21E-02	2.33E-04	2.09E-02	9.59E+00	reproduction	9.0E-04	1.3E-03	2.4E-05	2E-03
Barium	3.24E+02	1.01E+01	5.60E-02	1.58E+00	5.36E-01	3.26E-03	2.12E+00	2.08E+01	mortality	7.6E-02	2.6E-02	1.6E-04	1E-01
Cadmium	2.90E+00	2.22E-01	1.00E-03	3.49E-02	4.80E-03	5.82E-05	3.97E-02	1.45E+00	reproduction	2.4E-02	3.3E-03	4.0E-05	3E-02
Chromium	6.64E+01	5.44E-01	1.00E-03	8.53E-02	1.10E-01	5.82E-05	1.95E-01	1.50E+00	reproduction	5.7E-02	7.3E-02	3.9E-05	1E-01
Copper	2.19E+03	8.08E+00	5.00E-03	1.27E+00	3.62E+00	2.91E-04	4.89E+00	5.68E+00	growth	2.2E-01	6.4E-01	5.1E-05	9E-01
Lead	2.67E+02	1.22E+00	2.00E-03	1.91E-01	4.42E-01	1.16E-04	6.33E-01	3.75E+00	reproduction	5.1E-02	1.2E-01	3.1E-05	2E-01
Mercury	2.10E-01	3.16E-02	2.00E-04	4.95E-03	3.48E-04	1.16E-05	5.31E-03	5.00E-02	reproduction	9.9E-02	7.0E-03	2.3E-04	1E-01
Nickel	4.16E+01	3.52E-01	1.00E-03	5.52E-02	6.88E-02	5.82E-05	1.24E-01	3.10E+01	mortality	1.8E-03	2.2E-03	1.9E-06	4E-03
Vanadium	1.09E+02	1.06E-01	2.00E-03	1.66E-02	1.80E-01	1.16E-04	1.97E-01	1.10E+01	mortality, growth	1.5E-03	1.6E-02	1.1E-05	2E-02
Zinc	6.06E+02	3.36E+01	6.00E-03	5.27E+00	1.00E+00	3.49E-04	6.27E+00	1.02E+01	reproduction	5.2E-01	9.8E-02	3.4E-05	6E-01
Total PAHs	1.00E+02	1.04E+01	2.00E-03	1.63E+00	1.66E-01	1.16E-04	1.80E+00	2.00E-01	growth	8.2E+00	8.3E-01	5.8E-04	9E+00

Notes:
dw - dry weight
ww - wet weight
PAHs - polycyclic aromatic hydrocarbons

Table E-2. Wildlife Exposure Dose Calculations - Food-chain Model - Great Blue Heron Consuming Fish and Benthic Invertebrates - NOAEL, Hockanum River

Model Run Information	
Species:	Great Blue Heron Fish and Benthic
Food Item:	Invertebrates
TRV Type:	NOAEL

Parameter:	Value
Normalized Food Ingestion Rate (NFIR) (kg ww/kg-day)	0.12
Normalized Sediment Ingestion Rate (NSIR) (kg dw/kg-day)	0.00053
Normalized Water Ingestion Rate (NWIR) (L/kg-day)	0.045
Fraction of Diet as Invertebrate (FDin) (-)	1
Site Utilization Factor (SUF) (-)	1

CoPEC	Benthic Sediment Concentration (mg/kg dw)	Fish Concentration (mg/kg ww)	Invertebrates Concentration (mg/kg ww)	Surface Water Concentration (mg/L)	Chemical Intake Due to Food Ingestion (mg/kg/day)	Chemical Intake Due to Sediment Ingestion (mg/kg/day)	Chemical Intake Due to Water Ingestion (mg/kg/day)	Total Chemical Intake (mg/kg/day)	Toxicity Reference Value (mg/kg/day)	Toxicity Reference Value Endpoint	Hazard Quotient Due to Food Ingestion (-)	Hazard Quotient Due to Sediment Ingestion (-)	Hazard Quotient Due to Water Ingestion (-)	Total Hazard Quotient (-)
Arsenic	7.30E+00	1.51E+00	6.86E-01	4.00E-03	1.30E-01	3.88E-03	1.82E-04	1.34E-01	9.59E+00	reproduction	1.4E-02	4.0E-04	1.9E-05	1E-02
Barium	3.24E+02	8.85E+00	8.85E+00	5.60E-02	1.05E+00	1.72E-01	2.55E-03	1.22E+00	2.08E+01	mortality	5.0E-02	8.3E-03	1.2E-04	6E-02
Cadmium	2.90E+00	3.43E+00	6.86E-01	1.00E-03	2.44E-01	1.54E-03	4.55E-05	2.46E-01	1.45E+00	reproduction	1.7E-01	1.1E-03	3.1E-05	2E-01
Chromium	6.64E+01	2.25E-01	2.25E+00	1.00E-03	1.47E-01	3.53E-02	4.55E-05	1.82E-01	1.50E+00	reproduction	9.8E-02	2.4E-02	3.0E-05	1E-01
Copper	2.19E+03	1.56E+01	3.12E+01	5.00E-03	2.78E+00	1.16E+00	2.27E-04	3.94E+00	5.68E+00	growth	4.9E-01	2.0E-01	4.0E-05	7E-01
Lead	2.67E+02	1.32E+00	4.41E+00	2.00E-03	3.40E-01	1.42E-01	9.10E-05	4.82E-01	3.75E+00	reproduction	9.1E-02	3.8E-02	2.4E-05	1E-01
Mercury	2.10E-01	3.08E-01	3.85E-02	2.00E-04	2.06E-02	1.12E-04	9.10E-06	2.07E-02	5.00E-02	reproduction	4.1E-01	2.2E-03	1.8E-04	4E-01
Nickel	4.16E+01	2.79E+00	1.86E+00	1.00E-03	2.76E-01	2.21E-02	4.55E-05	2.98E-01	3.10E+01	mortality	8.9E-03	7.1E-04	1.5E-06	1E-02
Vanadium	1.09E+02	5.49E-01	1.37E+00	2.00E-03	1.14E-01	5.79E-02	9.10E-05	1.72E-01	1.10E+01	mortality, growth	1.0E-02	5.3E-03	8.3E-06	2E-02
Zinc	6.06E+02	7.18E+01	7.18E+01	6.00E-03	8.51E+00	3.22E-01	2.73E-04	8.84E+00	1.02E+01	reproduction	8.3E-01	3.2E-02	2.7E-05	9E-01
Total PAHs	1.00E+02	1.51E+01	3.01E+01	2.00E-03	2.68E+00	5.34E-02	9.10E-05	2.73E+00	2.00E-01	growth	1.3E+01	2.7E-01	4.5E-04	1E+01

Notes:
dw - dry weight
ww - wet weight
PAHs - polycyclic aromatic hydrocarbons

Table E-3. Wildlife Exposure Dose Calculations - Food-chain Model - Raccoon Consuming Fish and Benthic Invertebrates - NOAEL, Hockanum River

Model Run Information	
Species:	Raccoon
	Fish and Benthic
Food Item:	Invertebrates
TRV Type:	NOAEL

Parameter:	Value
Normalized Food Ingestion Rate (NFIR) (kg ww/kg-day)	0.082
Normalized Sediment Ingestion Rate (NSIR) (kg dw/kg-day)	0.0025
Normalized Water Ingestion Rate (NWIR) (L/kg-day)	0.083
Site Utilization Factor (SUF) (-)	1

CoPEC	Sediment Concentration (mg/kg dw)	Fish Concentration (mg/kg ww)	Benthic Invertebrates Concentration (mg/kg ww)	Surface Water Concentration (mg/L)	Chemical Intake Due to Food Ingestion (mg/kg/day)	Chemical Intake Due to Sediment Ingestion (mg/kg/day)	Chemical Intake Due to Water Ingestion (mg/kg/day)	Total Chemical Intake (mg/kg/day)	Toxicity Reference Value (mg/kg/day)	Toxicity Reference Value Endpoint	Hazard Quotient Due to Food Ingestion (-)	Hazard Quotient Due to Sediment Ingestion (-)	Hazard Quotient Due to Water Ingestion (-)	Total Hazard Quotient (-)
Arsenic	7.30E+00	1.51E+00	6.86E-01	4.00E-03	8.97E-02	1.80E-02	3.31E-04	1.08E-01	6.90E-01	reproduction	1.3E-01	2.6E-02	4.8E-04	2E-01
Barium	3.24E+02	8.85E+00	8.85E+00	5.60E-02	7.23E-01	7.99E-01	4.63E-03	1.53E+00	2.90E+00	growth	2.5E-01	2.8E-01	1.6E-03	5E-01
Cadmium	2.90E+00	3.43E+00	6.86E-01	1.00E-03	1.68E-01	7.15E-03	8.28E-05	1.76E-01	4.70E-01	reproduction	3.6E-01	1.5E-02	1.8E-04	4E-01
Chromium	6.64E+01	2.25E-01	2.25E+00	1.00E-03	1.01E-01	1.64E-01	8.28E-05	2.65E-01	1.50E-01	reproduction	6.7E-01	1.1E+00	5.5E-04	2E+00
Copper	2.19E+03	1.56E+01	3.12E+01	5.00E-03	1.92E+00	5.40E+00	4.14E-04	7.32E+00	7.50E+00	kit mortality	2.6E-01	7.2E-01	5.5E-05	9.8E-01
Lead	2.67E+02	1.32E+00	4.41E+00	2.00E-03	2.35E-01	6.59E-01	1.66E-04	8.93E-01	5.60E+00	weight of weanlings and kidney histology	4.2E-02	1.2E-01	3.0E-05	2E-01
Mercury	2.10E-01	3.08E-01	3.85E-02	2.00E-04	1.42E-02	5.18E-04	1.66E-05	1.47E-02	1.60E-02	reproduction	8.9E-01	3.2E-02	1.0E-03	9E-01
Nickel	4.16E+01	2.79E+00	1.86E+00	1.00E-03	1.90E-01	1.03E-01	8.28E-05	2.93E-01	4.40E+00	offspring body weight	4.3E-02	2.3E-02	1.9E-05	7E-02
Vanadium	1.09E+02	5.49E-01	1.37E+00	2.00E-03	7.86E-02	2.69E-01	1.66E-04	3.48E-01	5.10E-02	growth	1.5E+00	5.3E+00	3.2E-03	7E+00
Zinc	6.06E+02	7.18E+01	7.18E+01	6.00E-03	5.87E+00	1.49E+00	4.97E-04	7.36E+00	7.90E+01	reproduction	7.4E-02	1.9E-02	6.3E-06	9E-02
Total PAHs	1.00E+02	1.51E+01	3.01E+01	2.00E-03	1.85E+00	2.48E-01	1.66E-04	2.09E+00	2.30E-01	growth, mortality	8.0E+00	1.1E+00	7.2E-04	9E+00

Notes:
dw - dry weight
ww - wet weight
PAHs - polycyclic aromatic hydrocarbons

Appendix F

Supporting Tables for Evaluation of Sediment and Surface Water Data Upstream of the Rockville Former MGP Site, Rockville, Vernon, Connecticut

Table F-1. Benthic invertebrate assessment endpoint results - hazard quotients using sediment toxicity reference values - upstream data

CoPEC	Units	MDC/MRL	Sediment Screening Level	HQ	Comment
Arsenic	mg/kg	1.4	9.79	0.1	Results do not indicate a potential risk
Barium	mg/kg	26	0.7	37	Results indicate a potential risk
Cadmium	mg/kg	1.2	0.99	1	Results indicate a potential risk
Chromium (Total)	mg/kg	18	43.4	0.4	Results do not indicate a potential risk
Copper	mg/kg	24	31.6	0.8	Results do not indicate a potential risk
Lead	mg/kg	57	35.8	2	Results indicate a potential risk
Mercury	mg/kg	0.02	0.18	0.11	Results do not indicate a potential risk
Nickel	mg/kg	7.6	22.7	0.3	Results do not indicate a potential risk
Vanadium	mg/kg	35	50	0.7	Results do not indicate a potential risk
Zinc	mg/kg	150	121	1	Results indicate a potential risk
Methylnaphthalene, 2-	mg/kg	0.091	0.0202	5	Results indicate a potential risk
Acenaphthene	mg/kg	0.15	0.0067	22	Results indicate a potential risk
Acenaphthylene	mg/kg	0.89	0.0059	151	Results indicate a potential risk
Anthracene	mg/kg	0.79	0.0572	14	Results indicate a potential risk
Benzo(a)anthracene	mg/kg	2.3	0.108	21	Results indicate a potential risk
Benzo(a)pyrene	mg/kg	2.1	0.15	14	Results indicate a potential risk
Benzo(b)fluoranthene	mg/kg	2.5	10.4	0.2	Results do not indicate a potential risk
Benzo(g,h,i)perylene	mg/kg	1.7	0.17	10	Results indicate a potential risk
Benzo(k)fluoranthene	mg/kg	0.81	0.0272	30	Results indicate a potential risk
Chrysene	mg/kg	2.3	0.166	14	Results indicate a potential risk
Dibenz(a,h)anthracene	mg/kg	0.51	0.033	15	Results indicate a potential risk
Fluoranthene	mg/kg	5.1	0.423	12	Results indicate a potential risk
Fluorene	mg/kg	0.34	0.0774	4	Results indicate a potential risk
Indeno(1,2,3-cd)pyrene	mg/kg	1.5	0.0173	87	Results indicate a potential risk
Naphthalene	mg/kg	0.43	0.176	2	Results indicate a potential risk
Phenanthrene	mg/kg	3.3	0.204	16	Results indicate a potential risk
Pyrene	mg/kg	4.7	0.195	24	Results indicate a potential risk
Total PAHs	mg/kg	28	1.61	18	Results indicate a potential risk

Notes:
MDC - maximum detected concentration
MRL - maximum reporting limit
HQ>1 are highlighted in yellow, indicating a potential risk.
PAHs - polycyclic aromatic hydrocarbons

Table F-2. Amphibian and fish assessment endpoints results - hazard quotients for aquatic life using surface water toxicity reference values - upstream data

CoPEC	Units	MDC/MRL	Fish Surface Water SL	Fish Surface Water SL HQ	Amphibian Value	Amphibian Value HQ	Comment
Arsenic	mg/L	0.002	0.15	0.01	0.04	0.05	Results do not indicate a potential risk
Barium	mg/L	0.058	0.0039	15	244	0.0002	Results indicate a potential risk
Cadmium	mg/L	0.002	0.000125	16	0.019	0.11	Results indicate a potential risk
Chromium (Total)	mg/L	0.004	0.011	0.36	0.03	0.13	Results do not indicate a potential risk
Copper	mg/L	0.004	0.0048	0.8	0.015	0.3	Results do not indicate a potential risk
Lead	mg/L	0.0012	0.0012	1.0	0.04	0.03	Results do not indicate a potential risk
Mercury	mg/L	0.0002	0.00077	0.3	0.001	0.2	Results do not indicate a potential risk
Nickel	mg/L	0.004	0.0289	0.14	0.05	0.08	Results do not indicate a potential risk
Vanadium	mg/L	0.004	0.019	0.2	0.25	0.016	Results do not indicate a potential risk
Zinc	mg/L	0.016	0.065	0.25	0.01	2	Results indicate a potential risk
Methylnaphthalene, 2-	mg/L	0.00005	0.0047	0.0	NR	NA	Results do not indicate a potential risk
Acenaphthene	mg/L	0.00005	0.023	0.002	NR	NA	Results do not indicate a potential risk
Acenaphthylene	mg/L	0.00005	4.84	0.00001	NR	NA	Results do not indicate a potential risk
Anthracene	mg/L	0.00005	0.00073	0.07	0.025	0.002	Results do not indicate a potential risk
Benzo(a)anthracene	mg/L	0.00005	0.000027	2	NR	NA	Results indicate a potential risk
Benzo(a)pyrene	mg/L	0.00005	0.000014	4	3.33	2E-05	Results indicate a potential risk
Benzo(b)fluoranthene	mg/L	0.00005	0.00907	0.006	NR	NA	Results do not indicate a potential risk
Benzo(g,h,i)perylene	mg/L	0.00005	0.00764	0.01	NR	NA	Results do not indicate a potential risk
Benzo(k)fluoranthene	mg/L	0.00005	NR	NA	NR	NA	No values to compute HQs
Chrysene	mg/L	0.00005	NR	NA	NR	NA	No values to compute HQs
Dibenz(a,h)anthracene	mg/L	0.00005	NR	NA	NR	NA	No values to compute HQs
Fluoranthene	mg/L	0.00005	0.0081	0.006	0.052	0.001	Results do not indicate a potential risk
Fluorene	mg/L	0.00005	0.0039	0.01	NR	NA	Results do not indicate a potential risk
Indeno(1,2,3-cd)pyrene	mg/L	0.00005	0.00431	0.01	NR	NA	Results do not indicate a potential risk
Naphthalene	mg/L	0.0002	0.024	0.008	2.1	1E-04	Results do not indicate a potential risk
Phenanthrene	mg/L	0.00005	0.0063	0.008	NR	NA	Results do not indicate a potential risk
Pyrene	mg/L	0.00005	0.000025	2	0.14	0.0004	Results indicate a potential risk
Total PAHs	mg/L	0.002	NR	NA	NR	NA	No values to compute HQs

Notes:
MDC - maximum detected concentration
MRL - maximum reporting limit
NR - not reported
NA - not applicable
HQ>1 are highlighted in yellow, indicating a potential risk.

Table F-3. Wildlife assessment endpoint results - hazard quotients for the mallard, great blue heron, and raccoon - upstream data

	Mallard (aquatic plant consumer)		Great Blue Heron (fish and invertebrate consumer)		Raccoon (fish and invertebrate consumer)	
CoPEC	Total Chemical Intake (mg/kg/day)	HQ (unitless)	Total Chemical Intake (mg/kg/day)	HQ (unitless)	Total Chemical Intake (mg/kg/day)	HQ (unitless)
Arsenic	4.08E-03	0.0004	3.83E-02	0.004	2.94E-02	0.04
Barium	1.74E-01	0.008	1.01E-01	0.005	1.27E-01	0.04
Cadmium	2.36E-02	0.02	1.33E-01	0.09	9.45E-02	0.2
Chromium (Total)	5.32E-02	0.04	1.01E-01	0.07	1.07E-01	0.7
Copper	2.54E-01	0.04	8.06E-01	0.1	6.06E-01	0.08
Lead	1.75E-01	0.05	1.29E-01	0.03	2.09E-01	0.04
Mercury	1.42E-03	0.03	9.55E-03	0.2	6.63E-03	0.4
Nickel	2.83E-02	0.0009	5.72E-01	0.02	4.10E-01	0.09
Vanadium	6.35E-02	0.006	5.54E-02	0.01	1.12E-01	2
Zinc	2.68E+00	0.3	6.45E+00	0.6	4.76E+00	0.06
Total PAHs	5.80E-01	3	7.70E-01	4	5.90E-01	3

Notes:

PAHs - polycyclic aromatic hydrocarbons

PAHs were evaluated as the sum of individual PAHs or total PAHs.

HQ>1 are highlighted in yellow, indicating a potential risk.

Table F-4. Wildlife Exposure Dose Calculations - Food-chain Model - Mallard Consuming Plants - NOAEL, Hockanum River - Upstream Data

Model Run Information	
Species:	Mallard
Food Item:	Plants
TRV Type:	NOAEL

Parameter:	Value
Normalized Food Ingestion Rate (NFIR) (kg ww/kg-day)	0.16
Normalized Sediment Ingestion Rate (NSIR) (kg dw/kg-day)	0.0017
Normalized Water Ingestion Rate (NWIR) (L/kg-day)	0.058
Fraction of Diet as Invertebrate (FDin) (-)	1
Site Utilization Factor (SUF) (-)	1

	CoPEC Concentration (mg/kg dw)	Sediment Concentration (mg/kg ww)	Plants Concentration (mg/kg ww)	Surface Water Concentration (mg/L)	Chemical Intake Due to Food Ingestion (mg/kg/day)	Chemical Intake Due to Sediment Ingestion (mg/kg/day)	Chemical Intake Due to Water Ingestion (mg/kg/day)	Total Chemical Intake (mg/kg/day)	Toxicity Reference Value (mg/kg/day)	Toxicity Reference Value Endpoint	Hazard Quotient Due to Food Ingestion (-)	Hazard Quotient Due to Sediment Ingestion (-)	Hazard Quotient Due to Water Ingestion (-)	Total Hazard Quotient (-)
Arsenic	1.40E+00	1.05E-02	2.00E-03	1.65E-03	2.32E-03	1.16E-04	4.08E-03	9.59E+00	reproduction	1.7E-04	2.4E-04	1.2E-05	4E-04
Barium	2.60E+01	8.11E-01	5.80E-02	1.27E-01	4.30E-02	3.37E-03	1.74E-01	2.08E+01	mortality	6.1E-03	2.1E-03	1.6E-04	8E-03
Cadmium	1.20E+00	1.37E-01	2.00E-03	2.15E-02	1.99E-03	1.16E-04	2.36E-02	1.45E+00	reproduction	1.5E-02	1.4E-03	8.0E-05	2E-02
Chromium	1.80E+01	1.48E-01	4.00E-03	2.31E-02	2.98E-02	2.33E-04	5.32E-02	1.50E+00	reproduction	1.5E-02	2.0E-02	1.6E-04	4E-02
Copper	2.40E+01	1.36E+00	4.00E-03	2.14E-01	3.97E-02	2.33E-04	2.54E-01	5.68E+00	growth	3.8E-02	7.0E-03	4.1E-05	4E-02
Lead	5.70E+01	5.12E-01	1.20E-03	8.03E-02	9.43E-02	6.98E-05	1.75E-01	3.75E+00	reproduction	2.1E-02	2.5E-02	1.9E-05	5E-02
Mercury	2.00E-02	8.79E-03	2.00E-04	1.38E-03	3.31E-05	1.16E-05	1.42E-03	5.00E-02	reproduction	2.8E-02	6.6E-04	2.3E-04	3E-02
Nickel	7.60E+00	9.87E-02	4.00E-03	1.55E-02	1.26E-02	2.33E-04	2.83E-02	3.10E+01	mortality	5.0E-04	4.1E-04	7.5E-06	9E-04
Vanadium	3.50E+01	3.40E-02	4.00E-03	5.32E-03	5.79E-02	2.33E-04	6.35E-02	1.10E+01	mortality, growth	4.8E-04	5.3E-03	2.1E-05	6E-03
Zinc	1.50E+02	1.55E+01	1.60E-02	2.43E+00	2.48E-01	9.31E-04	2.68E+00	1.02E+01	reproduction	2.4E-01	2.4E-02	9.1E-05	3E-01
Total PAHs	2.83E+01	3.40E+00	2.00E-03	5.33E-01	4.68E-02	1.16E-04	5.80E-01	2.00E-01	growth	2.7E+00	2.3E-01	5.8E-04	3E+00

Notes:
dw - dry weight
ww - wet weight
PAHs - polycyclic aromatic hydrocarbons

Table F-5. Wildlife Exposure Dose Calculations - Food-chain Model - Great Blue Heron Consuming Fish and Benthic Invertebrates - NOAEL, Hockanum River - Upstream Data

Model Run Information	
Species:	Great Blue Heron Fish and Benthic
Food Item:	Invertebrates
TRV Type:	NOAEL

Parameter:	Value
Normalized Food Ingestion Rate (NFIR) (kg ww/kg-day)	0.12
Normalized Sediment Ingestion Rate (NSIR) (kg dw/kg-day)	0.00053
Normalized Water Ingestion Rate (NWIR) (L/kg-day)	0.045
Fraction of Diet as Invertebrate (FDin) (-)	1
Site Utilization Factor (SUF) (-)	1

CoPEC	Benthic Sediment Concentration (mg/kg dw)	Fish Concentration (mg/kg ww)	Invertebrates Concentration (mg/kg ww)	Surface Water Concentration (mg/L)	Chemical Intake Due to Food Ingestion (mg/kg/day)	Chemical Intake Due to Sediment Ingestion (mg/kg/day)	Chemical Intake Due to Water Ingestion (mg/kg/day)	Total Chemical Intake (mg/kg/day)	Toxicity Reference Value (mg/kg/day)	Toxicity Reference Value Endpoint	Hazard Quotient Due to Food Ingestion (-)	Hazard Quotient Due to Sediment Ingestion (-)	Hazard Quotient Due to Water Ingestion (-)	Total Hazard Quotient (-)
Arsenic	1.40E+00	4.34E-01	1.97E-01	2.00E-03	3.75E-02	7.44E-04	9.10E-05	3.83E-02	9.59E+00	reproduction	3.9E-03	7.8E-05	9.5E-06	4E-03
Barium	2.60E+01	7.10E-01	7.10E-01	5.80E-02	8.42E-02	1.38E-02	2.64E-03	1.01E-01	2.08E+01	mortality	4.0E-03	6.6E-04	1.3E-04	5E-03
Cadmium	1.20E+00	1.86E+00	3.73E-01	2.00E-03	1.33E-01	6.38E-04	9.10E-05	1.33E-01	1.45E+00	reproduction	9.1E-02	4.4E-04	6.3E-05	9E-02
Chromium	1.80E+01	1.39E-01	1.39E+00	4.00E-03	9.10E-02	9.57E-03	1.82E-04	1.01E-01	1.50E+00	reproduction	6.1E-02	6.4E-03	1.2E-04	7E-02
Copper	2.40E+01	4.45E+00	8.91E+00	4.00E-03	7.93E-01	1.28E-02	1.82E-04	8.06E-01	5.68E+00	growth	1.4E-01	2.2E-03	3.2E-05	1E-01
Lead	5.70E+01	3.84E-01	1.28E+00	1.20E-03	9.88E-02	3.03E-02	5.46E-05	1.29E-01	3.75E+00	reproduction	2.6E-02	8.1E-03	1.5E-05	3E-02
Mercury	2.00E-02	1.43E-01	1.78E-02	2.00E-04	9.53E-03	1.06E-05	9.10E-06	9.55E-03	5.00E-02	reproduction	1.9E-01	2.1E-04	1.8E-04	2E-01
Nickel	7.60E+00	5.74E+00	3.83E+00	4.00E-03	5.67E-01	4.04E-03	1.82E-04	5.72E-01	3.10E+01	mortality	1.8E-02	1.3E-04	5.9E-06	2E-02
Vanadium	3.50E+01	1.76E-01	4.41E-01	4.00E-03	3.66E-02	1.86E-02	1.82E-04	5.54E-02	1.10E+01	mortality, growth	3.3E-03	1.7E-03	1.7E-05	5E-03
Zinc	1.50E+02	5.37E+01	5.37E+01	1.60E-02	6.37E+00	7.97E-02	7.28E-04	6.45E+00	1.02E+01	reproduction	6.2E-01	7.8E-03	7.1E-05	6E-01
Total PAHs	2.83E+01	4.24E+00	8.48E+00	2.00E-03	7.55E-01	1.50E-02	9.10E-05	7.70E-01	2.00E-01	growth	3.8E+00	7.5E-02	4.5E-04	4E+00

Notes:
dw - dry weight
ww - wet weight
PAHs - polycyclic aromatic hydrocarbons

Table F-6. Wildlife Exposure Dose Calculations - Food-chain Model - Raccoon Consuming Fish and Benthic Invertebrates - NOAEL, Hockanum River - Upstream Data

Model Run Information	
Species:	Raccoon
	Fish and Benthic
Food Item:	Invertebrates
TRV Type:	NOAEL

Parameter:	Value
Normalized Food Ingestion Rate (NFIR) (kg ww/kg-day)	0.082
Normalized Sediment Ingestion Rate (NSIR) (kg dw/kg-day)	0.0025
Normalized Water Ingestion Rate (NWIR) (L/kg-day)	0.083
Site Utilization Factor (SUF) (-)	1

CoPEC	Sediment Concentration (mg/kg dw)	Fish Concentration (mg/kg ww)	Benthic Invertebrates Concentration (mg/kg ww)	Surface Water Concentration (mg/L)	Chemical Intake Due to Food Ingestion (mg/kg/day)	Chemical Intake Due to Sediment Ingestion (mg/kg/day)	Chemical Intake Due to Water Ingestion (mg/kg/day)	Total Chemical Intake (mg/kg/day)	Toxicity Reference Value (mg/kg/day)	Toxicity Reference Value Endpoint	Hazard Quotient Due to Food Ingestion (-)	Hazard Quotient Due to Sediment Ingestion (-)	Hazard Quotient Due to Water Ingestion (-)	Total Hazard Quotient (-)
Arsenic	1.40E+00	4.34E-01	1.97E-01	2.00E-03	2.58E-02	3.45E-03	1.66E-04	2.94E-02	6.90E-01	reproduction	3.7E-02	5.0E-03	2.4E-04	4E-02
Barium	2.60E+01	7.10E-01	7.10E-01	5.80E-02	5.80E-02	6.41E-02	4.80E-03	1.27E-01	2.90E+00	growth	2.0E-02	2.2E-02	1.7E-03	4E-02
Cadmium	1.20E+00	1.86E+00	3.73E-01	2.00E-03	9.14E-02	2.96E-03	1.66E-04	9.45E-02	4.70E-01	reproduction	1.9E-01	6.3E-03	3.5E-04	2E-01
Chromium	1.80E+01	1.39E-01	1.39E+00	4.00E-03	6.27E-02	4.44E-02	3.31E-04	1.07E-01	1.50E-01	reproduction	4.2E-01	3.0E-01	2.2E-03	7E-01
Copper	2.40E+01	4.45E+00	8.91E+00	4.00E-03	5.46E-01	5.92E-02	3.31E-04	6.06E-01	7.50E+00	kit mortality	7.3E-02	7.9E-03	4.4E-05	8.1E-02
Lead	5.70E+01	3.84E-01	1.28E+00	1.20E-03	6.81E-02	1.41E-01	9.93E-05	2.09E-01	5.60E+00	weight of weanlings and kidney histology	1.2E-02	2.5E-02	1.8E-05	4E-02
Mercury	2.00E-02	1.43E-01	1.78E-02	2.00E-04	6.57E-03	4.93E-05	1.66E-05	6.63E-03	1.60E-02	reproduction	4.1E-01	3.1E-03	1.0E-03	4E-01
Nickel	7.60E+00	5.74E+00	3.83E+00	4.00E-03	3.91E-01	1.87E-02	3.31E-04	4.10E-01	4.40E+00	offspring body weight	8.9E-02	4.3E-03	7.5E-05	9E-02
Vanadium	3.50E+01	1.76E-01	4.41E-01	4.00E-03	2.52E-02	8.63E-02	3.31E-04	1.12E-01	5.10E-02	growth	4.9E-01	1.7E+00	6.5E-03	2E+00
Zinc	1.50E+02	5.37E+01	5.37E+01	1.60E-02	4.39E+00	3.70E-01	1.32E-03	4.76E+00	7.90E+01	reproduction	5.6E-02	4.7E-03	1.7E-05	6E-02
Total PAHs	2.83E+01	4.24E+00	8.48E+00	2.00E-03	5.20E-01	6.98E-02	1.66E-04	5.90E-01	2.30E-01	growth, mortality	2.3E+00	3.0E-01	7.2E-04	3E+00

Notes:
dw - dry weight
ww - wet weight
PAHs - polycyclic aromatic hydrocarbons

Appendix B

Laboratory Data Packages

PHOENIX
Environmental Laboratories, Inc.

Wednesday, January 11, 2023

Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Project ID: ROCKVILLE FMR MGP
SDG ID: GCM98578
Sample ID#s: CM98578 - CM98601

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B
NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
VT Lab Registration #VT11301

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Telephone (860) 645-1102 Fax (860) 645-0823

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

January 11, 2023

SDG I.D.: GCM98578

Project ID: ROCKVILLE FMR MGP

Client Id	Lab Id	Matrix
SW-01	CM98578	SURFACE WATER
SD-01	CM98579	SOIL
SW-B01	CM98580	SURFACE WATER
SD-B01	CM98581	SOIL
SW-B02	CM98582	SURFACE WATER
SD-B02	CM98583	SOIL
SW-B03	CM98584	SURFACE WATER
SD-B03	CM98585	SOIL
SW-B04	CM98586	SURFACE WATER
SD-B04	CM98587	SOIL
SW-B05	CM98588	SURFACE WATER
SD-B05	CM98589	SOIL
SW-07	CM98590	SURFACE WATER
SD-07	CM98591	SOIL
SW-06	CM98592	SURFACE WATER
SD-06	CM98593	SOIL
SW-05	CM98594	SURFACE WATER
SD-05	CM98595	SOIL
SW-04	CM98596	SURFACE WATER
SD-04	CM98597	SOIL
SW-03	CM98598	SURFACE WATER
SD-03	CM98599	SOIL
SW-02	CM98600	SURFACE WATER
SD-02	CM98601	SOIL

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/06/22	9:15
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98578

Project ID: ROCKVILLE FMR MGP
Client ID: SW-01

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/14/22	TH	SW6010D	
Barium	0.042	0.002	mg/L	1	12/14/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Chromium	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/14/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	TH	SW6010D	
Barium (Dissolved)	0.038	0.002	mg/L	1	12/08/22	TH	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	TH	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	TH	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	TH	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	TH	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	TH	SW6010D	
Zinc (Dissolved)	0.034	0.002	mg/L	1	12/08/22	TH	SW6010D	
Hardness (CaCO3)	36.1	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Lead	0.002	0.001	mg/L	1	12/14/22	TH	SW6010D	B*
Antimony	< 0.005	0.005	mg/L	1	12/14/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/14/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-01

Phoenix I.D.: CM98578

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/07/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.042	0.004	mg/L	1	12/14/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/06/22	AG	

B* = Present in blank, a bias is possible.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/06/22	9:15
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98579

Project ID: ROCKVILLE FMR MGP
Client ID: SD-01

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Tot.Org.Carbon	9940	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/06/22	10:10
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98580

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B01

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/14/22	TH	SW6010D	
Barium	0.206	0.002	mg/L	1	12/14/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Chromium	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/14/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	TH	SW6010D	
Barium (Dissolved)	0.195	0.002	mg/L	1	12/08/22	TH	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	TH	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	TH	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	TH	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	TH	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	TH	SW6010D	
Zinc (Dissolved)	0.029	0.002	mg/L	1	12/08/22	TH	SW6010D	
Hardness (CaCO3)	137	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	
Lead	< 0.001	0.001	mg/L	1	12/14/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/14/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/14/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B01

Phoenix I.D.: CM98580

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/07/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.029	0.004	mg/L	1	12/14/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/06/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/06/22	10:10
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98581

Project ID: ROCKVILLE FMR MGP
Client ID: SD-B01

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	84		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	27300	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/06/22	10:45
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98582

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B02

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/10/22	TH	SW6010D	
Barium	0.040	0.002	mg/L	1	12/10/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Chromium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	TH	SW6010D	
Barium (Dissolved)	0.039	0.002	mg/L	1	12/08/22	TH	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	TH	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	TH	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	TH	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	TH	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	0.002	0.002	mg/L	1	12/08/22	TH	SW6010D	
Zinc (Dissolved)	0.034	0.002	mg/L	1	12/08/22	TH	SW6010D	
Hardness (CaCO3)	36.2	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Lead	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/10/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B02

Phoenix I.D.: CM98582

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/07/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.027	0.004	mg/L	1	12/10/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/06/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/06/22	10:45
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98583

Project ID: ROCKVILLE FMR MGP
Client ID: SD-B02

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	80		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	7730	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/06/22	11:40
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98584

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B03

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/10/22	TH	SW6010D	
Barium	0.041	0.002	mg/L	1	12/10/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Chromium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	TH	SW6010D	
Barium (Dissolved)	0.039	0.002	mg/L	1	12/08/22	TH	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	TH	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	TH	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	TH	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	TH	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	TH	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	TH	SW6010D	
Zinc (Dissolved)	0.031	0.002	mg/L	1	12/08/22	TH	SW6010D	
Hardness (CaCO3)	35.4	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Lead	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/10/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B03

Phoenix I.D.: CM98584

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/07/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.032	0.004	mg/L	1	12/10/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/06/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/06/22	11:40
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98585

Project ID: ROCKVILLE FMR MGP
Client ID: SD-B03

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	70		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	16700	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/06/22	12:20
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98586

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B04

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/10/22	TH	SW6010D	
Barium	0.049	0.002	mg/L	1	12/10/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Chromium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	CPP	SW6010D	
Barium (Dissolved)	0.047	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	CPP	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Zinc (Dissolved)	0.024	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Hardness (CaCO3)	41.5	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Lead	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/10/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B04

Phoenix I.D.: CM98586

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/08/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.028	0.004	mg/L	1	12/10/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/07/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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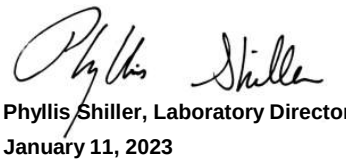

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/06/22	12:20
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98587

Project ID: ROCKVILLE FMR MGP
Client ID: SD-B04

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	72		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	16400	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/06/22	13:00
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98588

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B05

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/10/22	TH	SW6010D	
Barium	0.034	0.002	mg/L	1	12/10/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Chromium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	CPP	SW6010D	
Barium (Dissolved)	0.033	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	CPP	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Zinc (Dissolved)	0.017	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Hardness (CaCO3)	29.4	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Lead	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/10/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-B05

Phoenix I.D.: CM98588

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/08/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.019	0.004	mg/L	1	12/10/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/07/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/06/22	13:00
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98589

Project ID: ROCKVILLE FMR MGP
Client ID: SD-B05

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	81		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	19800	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

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Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/05/22	12:45
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98590

Project ID: ROCKVILLE FMR MGP
Client ID: SW-07

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/10/22	TH	SW6010D	
Barium	0.050	0.002	mg/L	1	12/10/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Chromium	0.003	0.001	mg/L	1	12/10/22	TH	SW6010D	
Copper	0.006	0.005	mg/L	1	12/10/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	CPP	SW6010D	
Barium (Dissolved)	0.037	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	CPP	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Zinc (Dissolved)	0.007	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Hardness (CaCO3)	35.4	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	0.003	0.001	mg/L	1	12/10/22	TH	SW6010D	
Lead	0.013	0.001	mg/L	1	12/10/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/10/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-07

Phoenix I.D.: CM98590

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/08/22	CPP	E200.8-5.4
Vanadium	0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.024	0.004	mg/L	1	12/10/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/07/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/05/22	12:45
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98591

Project ID: ROCKVILLE FMR MGP
Client ID: SD-07

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	81		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	5650	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

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Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/05/22	13:45
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98592

Project ID: ROCKVILLE FMR MGP
Client ID: SW-06

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/10/22	TH	SW6010D	
Barium	0.041	0.002	mg/L	1	12/10/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Chromium	0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	CPP	SW6010D	
Barium (Dissolved)	0.039	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	CPP	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Zinc (Dissolved)	0.006	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Hardness (CaCO3)	35.7	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Lead	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/10/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-06

Phoenix I.D.: CM98592

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/08/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.007	0.004	mg/L	1	12/10/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/07/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/05/22	13:45
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98593

Project ID: ROCKVILLE FMR MGP
Client ID: SD-06

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	76		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	6420	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

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587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
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Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/05/22	14:40
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98594

Project ID: ROCKVILLE FMR MGP
Client ID: SW-05

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/10/22	TH	SW6010D	
Barium	0.040	0.002	mg/L	1	12/10/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Chromium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	CPP	SW6010D	
Barium (Dissolved)	0.039	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	CPP	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	0.003	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Zinc (Dissolved)	0.006	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Hardness (CaCO3)	36.5	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Lead	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/10/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-05

Phoenix I.D.: CM98594

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/08/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.006	0.004	mg/L	1	12/10/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/07/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Ver 1

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/05/22	14:40
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98595

Project ID: ROCKVILLE FMR MGP
Client ID: SD-05

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	77		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	15400	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/05/22	15:35
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98596

Project ID: ROCKVILLE FMR MGP
Client ID: SW-04

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/10/22	TH	SW6010D	
Barium	0.041	0.002	mg/L	1	12/10/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Chromium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	CPP	SW6010D	
Barium (Dissolved)	0.040	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	CPP	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Zinc (Dissolved)	0.014	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Hardness (CaCO3)	36.2	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Lead	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/10/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-04

Phoenix I.D.: CM98596

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/08/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.009	0.004	mg/L	1	12/10/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/07/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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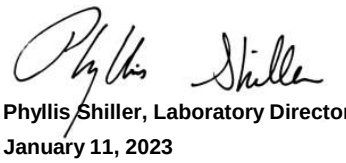

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/05/22	15:35
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98597

Project ID: ROCKVILLE FMR MGP
Client ID: SD-04

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	78		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	10100	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/05/22	16:10
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98598

Project ID: ROCKVILLE FMR MGP
Client ID: SW-03

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Silver	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Arsenic	< 0.004	0.004	mg/L	1	12/10/22	TH	SW6010D	
Barium	0.042	0.002	mg/L	1	12/10/22	TH	SW6010D	
Beryllium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Cadmium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Chromium	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Copper	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/08/22	CPP	SW6010D	
Barium (Dissolved)	0.040	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Chromium (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/08/22	CPP	SW6010D	
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/08/22	CPP	SW6010D	
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/08/22	CPP	E200.7-4.4	
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4	
Vanadium (Dissolved)	< 0.002	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Zinc (Dissolved)	0.031	0.002	mg/L	1	12/08/22	CPP	SW6010D	
Hardness (CaCO3)	36.0	0.1	mg/L	1	12/17/22		SM2340B-11	
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A	
Nickel	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	
Lead	< 0.001	0.001	mg/L	1	12/10/22	TH	SW6010D	B
Antimony	< 0.005	0.005	mg/L	1	12/10/22	TH	SW6010D	
Selenium	< 0.010	0.010	mg/L	1	12/10/22	TH	SW6010D	

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-03

Phoenix I.D.: CM98598

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/08/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/16/22	CPP	SW6010D
Zinc	0.036	0.004	mg/L	1	12/10/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/06/22	AG	
Total Metals Digestion MS	Completed				12/07/22	AG	

B = Present in blank, no bias suspected.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

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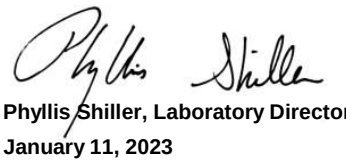

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/05/22	16:10
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98599

Project ID: ROCKVILLE FMR MGP
Client ID: SD-03

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	80		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	10100	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/09/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
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Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SURFACE WATER	Collected by:		12/06/22	8:40
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98600

Project ID: ROCKVILLE FMR MGP
Client ID: SW-02

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Silver	< 0.001	0.001	mg/L	1	12/13/22	TH	SW6010D
Arsenic	< 0.004	0.004	mg/L	1	12/13/22	TH	SW6010D
Barium	0.044	0.002	mg/L	1	12/13/22	TH	SW6010D
Beryllium	< 0.001	0.001	mg/L	1	12/13/22	TH	SW6010D
Cadmium	< 0.001	0.001	mg/L	1	12/13/22	TH	SW6010D
Chromium	0.007	0.001	mg/L	1	12/13/22	TH	SW6010D
Copper	< 0.005	0.005	mg/L	1	12/13/22	TH	SW6010D
Silver (Dissolved)	< 0.001	0.001	mg/L	1	12/13/22	TH	SW6010D
Arsenic (Dissolved)	< 0.004	0.004	mg/L	1	12/13/22	TH	SW6010D
Barium (Dissolved)	0.042	0.002	mg/L	1	12/13/22	TH	SW6010D
Beryllium (Dissolved)	< 0.001	0.001	mg/L	1	12/13/22	TH	SW6010D
Cadmium (Dissolved)	< 0.001	0.001	mg/L	1	12/13/22	TH	SW6010D
Chromium (Dissolved)	0.006	0.001	mg/L	1	12/13/22	TH	SW6010D
Copper (Dissolved)	< 0.005	0.005	mg/L	1	12/13/22	TH	SW6010D
Mercury (Dissolved)	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A
Nickel (Dissolved)	< 0.001	0.001	mg/L	1	12/13/22	TH	SW6010D
Lead (Dissolved)	< 0.002	0.002	mg/L	1	12/13/22	TH	SW6010D
Antimony (Dissolved)	< 0.005	0.005	mg/L	1	12/13/22	TH	SW6010D
Selenium (Dissolved)	< 0.011	0.011	mg/L	1	12/13/22	TH	E200.7-4.4
Thallium (Dissolved)	< 0.0006	0.0006	mg/L	2	12/08/22	CPP	E200.8-5.4
Vanadium (Dissolved)	< 0.002	0.002	mg/L	1	12/13/22	TH	SW6010D
Zinc (Dissolved)	0.024	0.002	mg/L	1	12/13/22	TH	SW6010D
Hardness (CaCO3)	44.1	0.1	mg/L	1	12/13/22		SM2340B-11
Mercury	< 0.0002	0.0002	mg/L	1	12/07/22	PM	SW7470A
Nickel	0.001	0.001	mg/L	1	12/13/22	TH	SW6010D
Lead	< 0.001	0.001	mg/L	1	12/13/22	TH	SW6010D
Antimony	< 0.005	0.005	mg/L	1	12/13/22	TH	SW6010D
Selenium	< 0.010	0.010	mg/L	1	12/13/22	TH	SW6010D

Ver 1

Project ID: ROCKVILLE FMR MGP
Client ID: SW-02

Phoenix I.D.: CM98600

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Thallium	< 0.0005	0.0005	mg/L	5	12/08/22	CPP	E200.8-5.4
Vanadium	< 0.002	0.002	mg/L	1	12/13/22	TH	SW6010D
Zinc	0.027	0.004	mg/L	1	12/13/22	TH	SW6010D
Filtration	Completed				12/07/22	AG	0.45um Filter
Mercury Dissolved Digestion	Completed				12/07/22	KL/AB	SW7470A
Mercury Digestion	Completed				12/07/22	KL/AB	SW7470A
Dissolved Metals Preparation	Completed				12/08/22	AG	SW3005A
Dissolved Metals Preparation	Completed				12/07/22	AG	SW3005A
Total Metals Digestion	Completed				12/07/22	AG	
Total Metals Digestion MS	Completed				12/07/22	AG	

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

January 11, 2023

FOR: Attn: Jeffery Holden
GEI Consultants
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033

Sample Information		Custody Information		Date	Time
Matrix:	SOIL	Collected by:		12/06/22	8:40
Location Code:	GEI-EVER	Received by:	B	12/06/22	15:42
Rush Request:	Standard	Analyzed by:	see "By" below		
P.O.#:	11173088/2200138				

Laboratory Data

SDG ID: GCM98578
Phoenix ID: CM98601

Project ID: ROCKVILLE FMR MGP
Client ID: SD-02

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference	
Percent Solid	78		%		12/06/22	Q	SW846-%Solid	
Tot.Org.Carbon	6160	100	mg/kg	1	12/08/22	MI	SW9060A mod	
Tot.Org.Carbon Preparation	Completed				12/06/22	MI		
Alkyl PAHs by SIM	Completed		mg/Kg		01/07/23	*	EPA 8270E-SIM(M)	C

C = This parameter is subcontracted.

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

Alkyl PAHs by SIM (EPA 8270E-SIM(M)) was analyzed by CT certified lab #PH-0141.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200.
The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director
January 11, 2023
Reviewed and Released by: Rashmi Makol, Project Manager

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

QA/QC Report

January 11, 2023

QA/QC Data

SDG I.D.: GCM98578

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 654902 (mg/L), QC Sample No: CM98440 (CM98578, CM98580, CM98582, CM98584, CM98586, CM98588, CM98590, CM98592, CM98594, CM98596, CM98598, CM98600)													
Mercury (Dissolved)	BRL	0.0002	<0.0002	<0.0002	NC	99.6			97.1			80 - 120	20
Comment:													
Additional Mercury criteria: LCS acceptance range for waters is 80-120% and for soils is 70-130%. MS acceptance range is 75-125%.													
QA/QC Batch 654904 (mg/L), QC Sample No: CM98578 (CM98578, CM98580, CM98582, CM98584, CM98586, CM98588, CM98590, CM98592, CM98594, CM98596, CM98598, CM98600)													
Mercury - Water	BRL	0.0002	<0.0002	<0.0002	NC	99.7			97.1			80 - 120	20
Comment:													
Additional Mercury criteria: LCS acceptance range for waters is 80-120% and for soils is 70-130%. MS acceptance range is 75-125%.													
QA/QC Batch 655015 (mg/L), QC Sample No: CM97697 (CM98600)													
ICP Metals - Aqueous													
Antimony	BRL	0.005	<0.005	<0.005	NC	102	100	2.0	101			80 - 120	20
Arsenic	BRL	0.004	<0.004	<0.004	NC	100	100	0.0	101			80 - 120	20
Barium	BRL	0.002	<0.002	0.001	NC	105	104	1.0	106			80 - 120	20
Beryllium	BRL	0.001	<0.001	<0.001	NC	104	104	0.0	105			80 - 120	20
Cadmium	BRL	0.001	<0.004	<0.001	NC	108	106	1.9	108			80 - 120	20
Chromium	BRL	0.001	<0.001	<0.001	NC	104	103	1.0	105			80 - 120	20
Copper	BRL	0.005	<0.005	<0.005	NC	104	103	1.0	105			80 - 120	20
Lead	BRL	0.001	<0.001	<0.001	NC	104	104	0.0	105			80 - 120	20
Nickel	BRL	0.001	<0.004	<0.001	NC	104	103	1.0	105			80 - 120	20
Selenium	BRL	0.010	<0.010	<0.010	NC	99.7	99.3	0.4	101			80 - 120	20
Silver	BRL	0.001	<0.001	<0.001	NC	103	102	1.0	104			80 - 120	20
Vanadium	BRL	0.002	<0.002	<0.002	NC	103	102	1.0	103			80 - 120	20
Zinc	BRL	0.004	<0.010	<0.004	NC	103	102	1.0	103			80 - 120	20
Comment:													
Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 654844 (mg/L), QC Sample No: CM98428 (CM98578, CM98580, CM98582, CM98584, CM98586, CM98588, CM98590, CM98592, CM98594, CM98596, CM98598)													
ICP Metals - Aqueous													
Antimony	BRL	0.005	<0.005	<0.005	NC	97.3	98.0	0.7	97.1			80 - 120	20
Arsenic	BRL	0.004	<0.004	<0.004	NC	95.9	96.1	0.2	95.6			80 - 120	20
Barium	BRL	0.002	0.004	0.004	NC	100	101	1.0	101			80 - 120	20
Beryllium	BRL	0.001	<0.001	<0.001	NC	103	103	0.0	102			80 - 120	20
Cadmium	BRL	0.001	<0.001	<0.001	NC	102	104	1.9	103			80 - 120	20
Chromium	BRL	0.001	<0.001	<0.001	NC	104	104	0.0	103			80 - 120	20
Copper	BRL	0.005	<0.005	<0.005	NC	97.5	97.7	0.2	98.4			80 - 120	20
Lead	0.001	0.001	<0.001	<0.001	NC	100	101	1.0	100			80 - 120	20
Nickel	BRL	0.001	0.002	0.002	NC	101	102	1.0	101			80 - 120	20
Selenium	BRL	0.010	<0.010	<0.010	NC	95.2	96.5	1.4	94.1			80 - 120	20
Silver	BRL	0.001	<0.001	<0.001	NC	96.9	97.3	0.4	96.8			80 - 120	20
Vanadium	BRL	0.002	<0.002	<0.002	NC	101	103	2.0	102			80 - 120	20

QA/QC Data

SDG I.D.: GCM98578

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
Zinc	BRL	0.004	0.007	0.007	NC	97.5	99.2	1.7	97.9			80 - 120	20
Comment:													
Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 655079 (mg/L), QC Sample No: CM98433 (CM98578, CM98580, CM98582, CM98584, CM98586, CM98588, CM98590, CM98592, CM98594, CM98596, CM98598)													
ICP Metals - Dissolved													
Antimony	BRL	0.005	<0.005	<0.005	NC	87.5	86.0	1.7	86.6			80 - 120	20
Arsenic	BRL	0.004	<0.004	<0.004	NC	85.6	84.3	1.5	84.7			80 - 120	20
Barium	BRL	0.002	0.004	0.004	NC	89.2	86.6	3.0	87.4			80 - 120	20
Beryllium	BRL	0.001	<0.001	<0.001	NC	92.5	90.8	1.9	91.7			80 - 120	20
Cadmium	BRL	0.001	<0.001	<0.001	NC	90.9	89.4	1.7	89.2			80 - 120	20
Chromium	BRL	0.001	<0.001	<0.001	NC	92.5	90.8	1.9	91.4			80 - 120	20
Copper	BRL	0.005	<0.005	<0.005	NC	88.3	86.2	2.4	87.1			80 - 120	20
Lead	BRL	0.002	<0.002	<0.002	NC	90.1	88.8	1.5	89.5			80 - 120	20
Nickel	BRL	0.001	0.002	0.002	NC	89.9	88.4	1.7	87.7			80 - 120	20
Selenium	BRL	0.011	<0.011	<0.011	NC	85.2	84.8	0.5	84.0			80 - 120	20
Silver	BRL	0.001	<0.001	<0.001	NC	88.4	86.2	2.5	87.0			80 - 120	20
Vanadium	BRL	0.002	<0.002	<0.002	NC	90.9	89.1	2.0	89.4			80 - 120	20
Zinc	BRL	0.002	0.005	0.004	NC	88.1	86.6	1.7	86.8			80 - 120	20
Comment:													
Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 655320 (mg/L), QC Sample No: CM99485 (CM98600)													
ICP Metals - Dissolved													
Antimony	BRL	0.005	<0.005	<0.005	NC	92.1	88.7	3.8	90.8			80 - 120	20
Arsenic	BRL	0.004	<0.004	<0.004	NC	90.5	86.8	4.2	88.8			80 - 120	20
Barium	BRL	0.002	0.013	0.013	0	93.7	90.5	3.5	92.8			80 - 120	20
Beryllium	BRL	0.001	<0.001	<0.001	NC	95.5	92.4	3.3	94.6			80 - 120	20
Cadmium	BRL	0.001	<0.001	<0.001	NC	95.3	92.2	3.3	94.3			80 - 120	20
Chromium	BRL	0.001	<0.001	<0.001	NC	93.6	90.6	3.3	92.8			80 - 120	20
Copper	BRL	0.005	0.013	0.013	NC	94.6	91.3	3.6	93.8			80 - 120	20
Lead	BRL	0.002	<0.002	<0.002	NC	94.5	90.9	3.9	92.5			80 - 120	20
Nickel	BRL	0.001	0.004	0.004	NC	94.0	90.9	3.4	92.8			80 - 120	20
Selenium	BRL	0.011	<0.011	<0.011	NC	90.1	87.1	3.4	88.6			80 - 120	20
Silver	BRL	0.001	<0.001	<0.001	NC	94.0	90.4	3.9	92.7			80 - 120	20
Vanadium	BRL	0.002	0.002	0.003	NC	93.0	90.1	3.2	92.1			80 - 120	20
Zinc	BRL	0.002	0.368	0.368	0	92.0	89.2	3.1	92.1			80 - 120	20
Comment:													
Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 654790 (mg/L), QC Sample No: CM96058 5X (CM98578, CM98580, CM98582, CM98584)													
ICP MS Metals - Aqueous													
Thallium	BRL	0.0005	<0.0005	<0.0005	NC	104	104	0.0	103			80 - 120	20
Comment:													
Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.													
QA/QC Batch 655082 (mg/L), QC Sample No: CM98440 2X (CM98578, CM98580, CM98582, CM98584, CM98586, CM98588, CM98590, CM98592, CM98594, CM98596, CM98598, CM98600)													
ICP Metals MS - Dissolved													
Thallium	BRL	0.0003	<0.0003	<0.0003	NC	93.5	91.8	1.8	91.2			80 - 120	20
Comment:													
Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.													

QA/QC Data

SDG I.D.: GCM98578

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 655009 (mg/L), QC Sample No: CM98590 5X (CM98586, CM98588, CM98590, CM98592, CM98594, CM98596, CM98598, CM98600)													
ICP MS Metals - Aqueous													
Thallium	BRL	0.0005	<0.0005	<0.0005	NC	100	99.6	0.4	98.8			80 - 120	20
Comment:													
Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.													

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

QA/QC Report

January 11, 2023

QA/QC Data

SDG I.D.: GCM98578

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
QA/QC Batch 655278 (mg/kg), QC Sample No: CM98579 (CM98579, CM98581, CM98583, CM98585, CM98587, CM98589, CM98591, CM98593, CM98595, CM98597, CM98599, CM98601)													
Tot.Org.Carbon	BRL	100	9940	9990	0.50	95.1						75 - 125	30

Comment:

Additional criteria matrix spike acceptance range is 75-125%.

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

RPD - Relative Percent Difference
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MS Dup - Matrix Spike Duplicate
NC - No Criteria
Intf - Interference

Phyllis Shiller, Laboratory Director
January 11, 2023

Wednesday, January 11, 2023

Criteria: CT: GAM, GBM, GWP, RC, SWP

State: CT

Sample Criteria Exceedances Report

GCM98578 - GEI-EVER

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units

*** No Data to Display ***

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.

PHOENIX

Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

ACCREDITED IN ACCORDANCE WITH nelac NY # 11301

Analysis Comments

January 11, 2023 SDG I.D.: GCM98578

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

CHAIN OF CUSTODY RECORD

PHOENIX Environmental Laboratories, Inc.

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Cooler: Yes [X] No [ ]
Coolant: IPK [ ] ICE [X] No [ ]
Temp 2.5 °C Pg 1 of

Data Delivery/Contact Options:
[ ] Fax:
[ ] Phone:
[X] Email: Jholden@geiconsultants.com

Customer: GEI Consultants Inc
Address: 455 Winding Brook Drive Suite 201
Glastonbury, CT 06033
860-368-5382

Project: Rockville FMR. MAP
Report to: Jeffery Holden*
Invoice to: Jeffery Holden*
QUOTE # 11173088

Project P.O: 11173088/2200138

This section MUST be completed with Bottle Quantities.

Sampler's Signature: Alert Date: 12-06-22

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = _____(Other)

PHOENIX USE ONLY SAMPLE #	Client Sample - Information - Identification: Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Analysis Request: Hardness; RSR CT-15 Metals	Dissolved; RSR CT-15 Metals (0.45 micron)	PAH 34 (ALPHA GL)	TOC	MS/MSD *	GL Amber 8 oz [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container (8) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [X] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is
98578	SW-01	SW	12/6/22	0915	X	X										1		1			2
98579	SD-01	S	"	"			X	X				2									2
98580	SW-B01	SW	"	1010	X	X										1		1			2
98581	SD-B01	S	"	"			X	X				2									2
98582	SW-B02	SW	"	1045	X	X										1		1			2
98583	SD-B02	S	"	"			X	X				2									2
98584	SW-B03	SW	"	1140	X	X										1		1			2
98585	SD-B03	S	"	"			X	X				2									2
98586	SW-B04	SW	"	1220	X	X										1		1			2
98587	SD-B04	S	"	"			X	X				2									2
98588	SW-B05	SW	"	1300	X	X										1		1			2
98589	SD-B05	S	"	1300			X	X				2									

Relinquished by:	Accepted by:	Date:	Time:
Bosede Akeredeyeni	Scott Sofield	12.6.22	1542

Comments, Special Requirements or Regulations:
* Jholden
**; cc: bakeredeyeni@geiconsultants.com
Pblessing

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

Turnaround Time:
[ ] 1 Day*
[ ] 2 Days*
[ ] 3 Days*
[X] Standard
[ ] Other
* SURCHARGE APPLIES

RI
[ ] (Residential) Direct Exposure
[ ] (Comm/Industrial) Direct Exposure
[ ] GA Leachability
[ ] GB Leachability
[ ] GA-GW Objectives
[ ] GB-GW Objectives

CT
[ ] RCP Cert
[X] GW Protection
[X] SW Protection
[X] GA Mobility
[X] GB Mobility
[X] Residential DEC
[ ] I/C DEC
[ ] Other

MA
[ ] MCP Certification
[ ] GW-1 [ ] MWRA eSMART
[ ] GW-2 [ ] S-1 10% CALC
[ ] GW-3
[ ] S-1 GW-1 [ ] S-1 GW-2 [ ] S-1 GW-3
[ ] S-2 GW-1 [ ] S-2 GW-2 [ ] S-2 GW-3
[ ] S-3 GW-1 [ ] S-3 GW-2 [ ] S-3 GW-3
[ ] SW Protection

State where samples were collected: CT

Data Format
[X] Excel
[X] PDF
[ ] GIS/Key
[ ] EQuIS
[ ] Other

Data Package
[ ] Tier II Checklist
[ ] Full Data Package*
[X] Phoenix Std Report
[ ] Other
* SURCHARGE APPLIES

PEL-126 REV. 03/22

Cooler: Yes [X] No [ ]
Coolant: IPK [ ] ICE [X] No [ ]

CHAIN OF CUSTODY RECORD

Temp 2.5 °C Pg of

PHOENIX
Environmental Laboratories, Inc.

587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
Client Services (860) 645-1102

Data Delivery/Contact Options:
[ ] Fax:
[ ] Phone:
[X] Email: jholden@geiconsultants.com

Customer: GEI Consultants Inc.
Address: 455 Winding Brook Drive Suite 201
Glastonbury, CT 06033
860-368-5382

Project: Rockville FMR. MGP
Report to: Jeffery Holden*
Invoice to: Jeffery Holden*
QUOTE # 111730 88

Project P.O: 111730 88 / 220018

This section MUST be completed with Bottle Quantities.

Sampler's Signature: [signature] Date: 12/6/22

Client Sample - Information - Identification

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe **OIL**=Oil
B=Bulk **L**=Liquid **X** = _____(Other)

Analysis Request

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Hardness; RSR CT-15 Metals Diss 6Wgd.; RSR CT-15 Metal (0.45 micron)	PAH 34 (ALPHA OL)	TOC	MS/MSD*	GL Amber 8 oz [ ] H3PO4 [ ] NAHSO4	Soil VOA Vials [ ] methanol [ ] H2O	GL Soil container (8) oz	GL Soil container ( ) oz	40 ml VOA Vial [ ] As is [ ] HCL	GL Amber 1000ml [ ] As is [ ] H2SO4	PL As is [✓] 250ml [ ] 500ml [ ] 1000ml	PL H2SO4 [ ] 250ml [ ] 500ml	PL HNO3 250ml	PL NaOH 250ml	Bacteria Bottle w/thio	Bacteria Bottle as is	
98590	SW-07	SW	12/5/22	1245	X	X										1		1			2
98591	SD-07	S	"	"			X	X								2					2
98592	SW-06	SW	"	1345	X	X										1		1			2
98593	SD-06	S	"	"			X	X								2					2
98594	SW-05	SW	"	1440	X	X										1		1			2
98595	SD-05	S	"	1440			X	X								2					2
98596	SW-04	SW	"	1535	X	X										1		1			2
98597	SD-04	S	"	"			X	X								2					2
98598	SW-03	SW	"	1610	X	X										1		1			2
98599	SD-03	S	"	1610			X	X								2					2
98600	SW-02	SW	12/6/22	0840	X	X										1		1			2
98601	SD-02	S	"	"			X	X								2					2

Relinquished by:	Accepted by:	Date:	Time:
Ba[redacted] Akeseyani	Scott Jaffuel	12.6.22	1542

Comments, Special Requirements or Regulations:
cc: Bakeseyani@geiconsultants.com
Pblessing

*MS/MSD are considered site samples and will be billed as such in accordance with the prices quoted.

Turnaround Time:
[ ] 1 Day*
[ ] 2 Days*
[ ] 3 Days*
[X] Standard
[ ] Other
* SURCHARGE APPLIES

RI
[ ] (Residential) Direct Exposure
[ ] (Comm/Industrial) Direct Exposure
[ ] GA Leachability
[ ] GB Leachability
[ ] GA-GW Objectives
[ ] GB-GW Objectives

CT
[ ] RCP Cert
[X] GW Protection
[X] SW Protection
[X] GA Mobility
[X] GB Mobility
[X] Residential DEC
[ ] I/C DEC
[ ] Other

MA
[ ] MCP Certification
[ ] GW-1 [ ] MWRA eSMART
[ ] GW-2 [ ] S-1 10% CALC
[ ] GW-3
[ ] S-1 GW-1 [ ] S-1 GW-2 [ ] S-1 GW-3
[ ] S-2 GW-1 [ ] S-2 GW-2 [ ] S-2 GW-3
[ ] S-3 GW-1 [ ] S-3 GW-2 [ ] S-3 GW-3
[ ] SW Protection

State where samples were collected: CT

Data Format
[X] Excel
[X] PDF
[ ] GIS/Key
[ ] EQuIS
[ ] Other

Data Package
[ ] Tier II Checklist
[ ] Full Data Package*
[X] Phoenix Std Report
[ ] Other
* SURCHARGE APPLIES

PEL-126 REV. 03/22

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ANALYTICAL REPORT

Lab Number:	L2268732
Client:	Phoenix Environmental Labs 587 East Middle Turnpike P.O. Box 370 Manchester, CT 06040
ATTN:	Helen Geoghegan
Phone:	(860) 645-8726
Project Name:	ROCKVILLE FORMER MGP
Project Number:	GCM98578
Report Date:	01/10/23

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA030), NH NELAP (2062), CT (PH-0141), DoD (L2474), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), NJ (MA015), NY (11627), NC (685), OH (CL106), PA (68-02089), RI (LAO00299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #P330-17-00150), USFWS (Permit #206964).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578

Lab Number: L2268732
Report Date: 01/10/23

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2268732-01	CM98579	SOIL	MD	12/06/22 09:15	12/07/22
L2268732-02	CM98581	SOIL	MD	12/06/22 10:10	12/07/22
L2268732-03	CM98583	SOIL	MD	12/06/22 10:45	12/07/22
L2268732-04	CM98585	SOIL	MD	12/06/22 11:40	12/07/22
L2268732-05	CM98587	SOIL	MD	12/06/22 12:20	12/07/22
L2268732-06	CM98589	SOIL	MD	12/06/22 13:00	12/07/22
L2268732-07	CM98591	SOIL	MD	12/05/22 12:45	12/07/22
L2268732-08	CM98593	SOIL	MD	12/05/22 13:45	12/07/22
L2268732-09	CM98595	SOIL	MD	12/05/22 14:40	12/07/22
L2268732-10	CM98597	SOIL	MD	12/05/22 15:35	12/07/22
L2268732-11	CM98599	SOIL	MD	12/05/22 16:10	12/07/22
L2268732-12	CM98601	SOIL	MD	12/06/22 08:40	12/07/22

Serial_No:01102313:25

Project Name:	ROCKVILLE FORMER MGP	**Lab Number:**	L2268732
Project Number:	GCM98578	**Report Date:**	01/10/23

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Serial_No:01102313:25

Project Name:	ROCKVILLE FORMER MGP	**Lab Number:**	L2268732
Project Number:	GCM98578	**Report Date:**	01/10/23

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Susan E O'Neil Susan O' Neil

Title: Technical Director/Representative Date: 01/10/23

ORGANICS

SEMIVOLATILES

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-01
Client ID: CM98579
Sample Location: MD

Date Collected: 12/06/22 09:15
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/07/23 00:52
Analyst: CNC
Percent Solids: 81%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	44.3		ug/kg	19.3	5.55	1
C1-Naphthalenes	41.8		ug/kg	19.3	5.55	1
C2-Naphthalenes	109		ug/kg	19.3	5.55	1
C3-Naphthalenes	160		ug/kg	19.3	5.55	1
C4-Naphthalenes	131		ug/kg	19.3	5.55	1
Acenaphthylene	323		ug/kg	19.3	3.68	1
Acenaphthene	51.4		ug/kg	19.3	3.40	1
Fluorene	111		ug/kg	19.3	5.15	1
C1-Fluorenes	116		ug/kg	19.3	5.15	1
C2-Fluorenes	180		ug/kg	19.3	5.15	1
C3-Fluorenes	273	G	ug/kg	19.3	5.15	1
Phenanthrene	1660		ug/kg	19.3	6.40	1
C1-Phenanthrenes/Anthracenes	1260		ug/kg	19.3	6.40	1
C2-Phenanthrenes/Anthr BS	1000		ug/kg	19.3	6.40	1
C3-Phenanthrenes/Anthracenes	494		ug/kg	19.3	6.40	1
C4-Phenanthrenes/Anthracenes	217		ug/kg	19.3	6.40	1
Anthracene	490		ug/kg	19.3	3.98	1
Fluoranthene	3640		ug/kg	19.3	6.13	1
Pyrene	3470		ug/kg	19.3	5.08	1
C1-Fluoranthenes/Pyrenes	1920		ug/kg	19.3	5.08	1
Benz(a)anthracene	1940		ug/kg	19.3	3.94	1
Chrysene	2020		ug/kg	19.3	3.90	1
C1-Chrysenes	1080		ug/kg	19.3	3.90	1
C2-Chrysenes BS	642		ug/kg	19.3	3.90	1
C3-Chrysenes	540		ug/kg	19.3	3.90	1
C4-Chrysenes	400		ug/kg	19.3	3.90	1
Benzo(b)fluoranthene	1930		ug/kg	19.3	5.02	1
Benzo(j)+(k)fluoranthene	1970		ug/kg	19.3	3.83	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-01 Date Collected: 12/06/22 09:15
Client ID: CM98579 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	1560		ug/kg	19.3	3.98	1
Benzo(a)pyrene	2370		ug/kg	19.3	5.51	1
Perylene	655		ug/kg	19.3	3.72	1
Indeno(1,2,3-cd)pyrene	1620		ug/kg	19.3	5.24	1
Dibenz(a,h)+(a,c)anthracene	382		ug/kg	19.3	5.21	1
Benzo(g,h,i)perylene	1720		ug/kg	19.3	5.13	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	56		50-130
Phenanthrene-d10	84		50-130
Benzo(a)pyrene-d12	74		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Lab Number: L2268732
Project Number: GCM98578
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-02
Client ID: CM98581
Sample Location: MD
Date Collected: 12/06/22 10:10
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/07/23 02:18
Analyst: CNC
Percent Solids: 81%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	93.3		ug/kg	63.2	18.2	1
C1-Naphthalenes	108		ug/kg	63.2	18.2	1
C2-Naphthalenes	253		ug/kg	63.2	18.2	1
C3-Naphthalenes	406		ug/kg	63.2	18.2	1
C4-Naphthalenes	406		ug/kg	63.2	18.2	1
Acenaphthylene	494		ug/kg	63.2	12.0	1
Acenaphthene	209		ug/kg	63.2	11.1	1
Fluorene	219		ug/kg	63.2	16.8	1
C1-Fluorenes	137		ug/kg	63.2	16.8	1
C2-Fluorenes	390		ug/kg	63.2	16.8	1
C3-Fluorenes	1120	G	ug/kg	63.2	16.8	1
Phenanthrene	4740		ug/kg	63.2	20.9	1
C1-Phenanthrenes/Anthracenes	2480		ug/kg	63.2	20.9	1
C2-Phenanthrenes/Anthr BS	2220		ug/kg	63.2	20.9	1
C3-Phenanthrenes/Anthracenes	1200		ug/kg	63.2	20.9	1
C4-Phenanthrenes/Anthracenes	640		ug/kg	63.2	20.9	1
Anthracene	788		ug/kg	63.2	13.0	1
Fluoranthene	8770		ug/kg	63.2	20.1	1
Pyrene	7780		ug/kg	63.2	16.6	1
C1-Fluoranthenes/Pyrenes	3190		ug/kg	63.2	16.6	1
Benz(a)anthracene	3500		ug/kg	63.2	12.9	1
Chrysene	3920		ug/kg	63.2	12.8	1
C1-Chrysenes	2080		ug/kg	63.2	12.8	1
C2-Chrysenes BS	1470		ug/kg	63.2	12.8	1
C3-Chrysenes	1500		ug/kg	63.2	12.8	1
C4-Chrysenes	1080		ug/kg	63.2	12.8	1
Benzo(b)fluoranthene	3340		ug/kg	63.2	16.4	1
Benzo(j)+(k)fluoranthene	3490		ug/kg	63.2	12.5	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-02 Date Collected: 12/06/22 10:10
Client ID: CM98581 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	2560		ug/kg	63.2	13.0	1
Benzo(a)pyrene	3760		ug/kg	63.2	18.0	1
Perylene	1010		ug/kg	63.2	12.2	1
Indeno(1,2,3-cd)pyrene	3840		ug/kg	63.2	17.1	1
Dibenz(a,h)+(a,c)anthracene	1010		ug/kg	63.2	17.1	1
Benzo(g,h,i)perylene	3470		ug/kg	63.2	16.8	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	53		50-130
Phenanthrene-d10	82		50-130
Benzo(a)pyrene-d12	77		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-03
Client ID: CM98583
Sample Location: MD

Date Collected: 12/06/22 10:45
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/07/23 03:45
Analyst: CNC
Percent Solids: 78%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	26.2		ug/kg	5.37	1.54	1
C1-Naphthalenes	20.9		ug/kg	5.37	1.54	1
C2-Naphthalenes	51.8		ug/kg	5.37	1.54	1
C3-Naphthalenes	123		ug/kg	5.37	1.54	1
C4-Naphthalenes	62.8		ug/kg	5.37	1.54	1
Acenaphthylene	264		ug/kg	5.37	1.02	1
Acenaphthene	39.9		ug/kg	5.37	0.947	1
Fluorene	95.5		ug/kg	5.37	1.43	1
C1-Fluorenes	55.7		ug/kg	5.37	1.43	1
C2-Fluorenes	113		ug/kg	5.37	1.43	1
C3-Fluorenes	230	G	ug/kg	5.37	1.43	1
Phenanthrene	1260		ug/kg	5.37	1.78	1
C1-Phenanthrenes/Anthracenes	691		ug/kg	5.37	1.78	1
C2-Phenanthrenes/Anthr BS	500		ug/kg	5.37	1.78	1
C3-Phenanthrenes/Anthracenes	212		ug/kg	5.37	1.78	1
C4-Phenanthrenes/Anthracenes	78.2		ug/kg	5.37	1.78	1
Anthracene	284		ug/kg	5.37	1.11	1
Fluoranthene	2600		ug/kg	5.37	1.71	1
Pyrene	2280		ug/kg	5.37	1.41	1
C1-Fluoranthenes/Pyrenes	1100		ug/kg	5.37	1.41	1
Benz(a)anthracene	1210		ug/kg	5.37	1.10	1
Chrysene	1420		ug/kg	5.37	1.08	1
C1-Chrysenes	625		ug/kg	5.37	1.08	1
C2-Chrysenes BS	329		ug/kg	5.37	1.08	1
C3-Chrysenes	231		ug/kg	5.37	1.08	1
C4-Chrysenes	141		ug/kg	5.37	1.08	1
Benzo(b)fluoranthene	1280		ug/kg	5.37	1.40	1
Benzo(j)+(k)fluoranthene	1250		ug/kg	5.37	1.07	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-03 Date Collected: 12/06/22 10:45
Client ID: CM98583 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	998		ug/kg	5.37	1.11	1
Benzo(a)pyrene	1440		ug/kg	5.37	1.53	1
Perylene	356		ug/kg	5.37	1.04	1
Indeno(1,2,3-cd)pyrene	974		ug/kg	5.37	1.46	1
Dibenz(a,h)+(a,c)anthracene	273		ug/kg	5.37	1.45	1
Benzo(g,h,i)perylene	997		ug/kg	5.37	1.43	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	50		50-130
Phenanthrene-d10	77		50-130
Benzo(a)pyrene-d12	67		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID:	L2268732-04	Date Collected:	12/06/22 11:40
Client ID:	CM98585	Date Received:	12/07/22
Sample Location:	MD	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	ALPHA OP-013
Analytical Method:	1,8270E-SIM(M)	Extraction Date:	12/17/22 09:14
Analytical Date:	01/07/23 05:11	Cleanup Method:	EPA 3611B
Analyst:	CNC	Cleanup Date:	01/06/23
Percent Solids:	75%		

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	56.8		ug/kg	17.7	5.08	1
C1-Naphthalenes	47.9		ug/kg	17.7	5.08	1
C2-Naphthalenes	120		ug/kg	17.7	5.08	1
C3-Naphthalenes	176		ug/kg	17.7	5.08	1
C4-Naphthalenes	130		ug/kg	17.7	5.08	1
Acenaphthylene	358		ug/kg	17.7	3.37	1
Acenaphthene	56.3		ug/kg	17.7	3.11	1
Fluorene	146		ug/kg	17.7	4.71	1
C1-Fluorenes	124		ug/kg	17.7	4.71	1
C2-Fluorenes	190		ug/kg	17.7	4.71	1
C3-Fluorenes	324	G	ug/kg	17.7	4.71	1
Phenanthrene	2160		ug/kg	17.7	5.85	1
C1-Phenanthrenes/Anthracenes	1350		ug/kg	17.7	5.85	1
C2-Phenanthrenes/Anthr BS	996		ug/kg	17.7	5.85	1
C3-Phenanthrenes/Anthracenes	482		ug/kg	17.7	5.85	1
C4-Phenanthrenes/Anthracenes	209		ug/kg	17.7	5.85	1
Anthracene	474		ug/kg	17.7	3.64	1
Fluoranthene	3710		ug/kg	17.7	5.61	1
Pyrene	3430		ug/kg	17.7	4.64	1
C1-Fluoranthenes/Pyrenes	1840		ug/kg	17.7	4.64	1
Benz(a)anthracene	1700		ug/kg	17.7	3.60	1
Chrysene	1860		ug/kg	17.7	3.57	1
C1-Chrysenes	1020		ug/kg	17.7	3.57	1
C2-Chrysenes BS	616		ug/kg	17.7	3.57	1
C3-Chrysenes	470		ug/kg	17.7	3.57	1
C4-Chrysenes	356		ug/kg	17.7	3.57	1
Benzo(b)fluoranthene	1560		ug/kg	17.7	4.59	1
Benzo(j)+(k)fluoranthene	1490		ug/kg	17.7	3.50	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-04 Date Collected: 12/06/22 11:40
Client ID: CM98585 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	1230		ug/kg	17.7	3.64	1
Benzo(a)pyrene	1800		ug/kg	17.7	5.04	1
Perylene	450		ug/kg	17.7	3.41	1
Indeno(1,2,3-cd)pyrene	1180		ug/kg	17.7	4.79	1
Dibenz(a,h)+(a,c)anthracene	330		ug/kg	17.7	4.77	1
Benzo(g,h,i)perylene	1220		ug/kg	17.7	4.69	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	52		50-130
Phenanthrene-d10	80		50-130
Benzo(a)pyrene-d12	74		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-05 Date Collected: 12/06/22 12:20
Client ID: CM98587 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:
Matrix: Soil Extraction Method: ALPHA OP-013
Analytical Method: 1,8270E-SIM(M) Extraction Date: 12/17/22 09:14
Analytical Date: 01/07/23 06:38 Cleanup Method: EPA 3611B
Analyst: CNC Cleanup Date: 01/06/23
Percent Solids: 75%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	36.1		ug/kg	25.8	7.41	1
C1-Naphthalenes	35.9		ug/kg	25.8	7.41	1
C2-Naphthalenes	78.7		ug/kg	25.8	7.41	1
C3-Naphthalenes	98.4		ug/kg	25.8	7.41	1
C4-Naphthalenes	84.9		ug/kg	25.8	7.41	1
Acenaphthylene	271		ug/kg	25.8	4.92	1
Acenaphthene	99.9		ug/kg	25.8	4.54	1
Fluorene	166		ug/kg	25.8	6.88	1
C1-Fluorenes	78.9		ug/kg	25.8	6.88	1
C2-Fluorenes	132		ug/kg	25.8	6.88	1
C3-Fluorenes	266	G	ug/kg	25.8	6.88	1
Phenanthrene	2200		ug/kg	25.8	8.54	1
C1-Phenanthrenes/Anthracenes	880		ug/kg	25.8	8.54	1
C2-Phenanthrenes/Anthr BS	687		ug/kg	25.8	8.54	1
C3-Phenanthrenes/Anthracenes	265		ug/kg	25.8	8.54	1
C4-Phenanthrenes/Anthracenes	144		ug/kg	25.8	8.54	1
Anthracene	534		ug/kg	25.8	5.32	1
Fluoranthene	5180		ug/kg	25.8	8.19	1
Pyrene	3230		ug/kg	25.8	6.78	1
C1-Fluoranthenes/Pyrenes	1490		ug/kg	25.8	6.78	1
Benz(a)anthracene	1610		ug/kg	25.8	5.26	1
Chrysene	1780		ug/kg	25.8	5.21	1
C1-Chrysenes	735		ug/kg	25.8	5.21	1
C2-Chrysenes BS	398		ug/kg	25.8	5.21	1
C3-Chrysenes	471		ug/kg	25.8	5.21	1
C4-Chrysenes	ND		ug/kg	25.8	5.21	1
Benzo(b)fluoranthene	1580		ug/kg	25.8	6.71	1
Benzo(j)+(k)fluoranthene	1530		ug/kg	25.8	5.12	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-05 Date Collected: 12/06/22 12:20
Client ID: CM98587 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	1220		ug/kg	25.8	5.32	1
Benzo(a)pyrene	1790		ug/kg	25.8	7.36	1
Perylene	467		ug/kg	25.8	4.98	1
Indeno(1,2,3-cd)pyrene	1220		ug/kg	25.8	7.00	1
Dibenz(a,h)+(a,c)anthracene	366		ug/kg	25.8	6.97	1
Benzo(g,h,i)perylene	1280		ug/kg	25.8	6.85	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	54		50-130
Phenanthrene-d10	88		50-130
Benzo(a)pyrene-d12	82		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-06
Client ID: CM98589
Sample Location: MD

Date Collected: 12/06/22 13:00
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/07/23 08:05
Analyst: CNC
Percent Solids: 80%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	21.1	J	ug/kg	63.6	18.3	1
C1-Naphthalenes	21.4	J	ug/kg	63.6	18.3	1
C2-Naphthalenes	61.2	J	ug/kg	63.6	18.3	1
C3-Naphthalenes	95.2		ug/kg	63.6	18.3	1
C4-Naphthalenes	109		ug/kg	63.6	18.3	1
Acenaphthylene	137		ug/kg	63.6	12.1	1
Acenaphthene	22.7	J	ug/kg	63.6	11.2	1
Fluorene	37.2	J	ug/kg	63.6	17.0	1
C1-Fluorenes	30.5	J	ug/kg	63.6	17.0	1
C2-Fluorenes	104		ug/kg	63.6	17.0	1
C3-Fluorenes	269	G	ug/kg	63.6	17.0	1
Phenanthrene	772		ug/kg	63.6	21.1	1
C1-Phenanthrenes/Anthracenes	390		ug/kg	63.6	21.1	1
C2-Phenanthrenes/Anthr BS	354		ug/kg	63.6	21.1	1
C3-Phenanthrenes/Anthracenes	338		ug/kg	63.6	21.1	1
C4-Phenanthrenes/Anthracenes	252		ug/kg	63.6	21.1	1
Anthracene	159		ug/kg	63.6	13.1	1
Fluoranthene	1440		ug/kg	63.6	20.2	1
Pyrene	1250		ug/kg	63.6	16.7	1
C1-Fluoranthenes/Pyrenes	821		ug/kg	63.6	16.7	1
Benz(a)anthracene	566		ug/kg	63.6	13.0	1
Chrysene	641		ug/kg	63.6	12.9	1
C1-Chrysenes	372		ug/kg	63.6	12.9	1
C2-Chrysenes BS	405		ug/kg	63.6	12.9	1
C3-Chrysenes	652		ug/kg	63.6	12.9	1
C4-Chrysenes	ND		ug/kg	63.6	12.9	1
Benzo(b)fluoranthene	606		ug/kg	63.6	16.6	1
Benzo(j)+(k)fluoranthene	588		ug/kg	63.6	12.6	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-06 Date Collected: 12/06/22 13:00
Client ID: CM98589 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	501		ug/kg	63.6	13.1	1
Benzo(a)pyrene	693		ug/kg	63.6	18.2	1
Perylene	196		ug/kg	63.6	12.3	1
Indeno(1,2,3-cd)pyrene	499		ug/kg	63.6	17.3	1
Dibenz(a,h)+(a,c)anthracene	114		ug/kg	63.6	17.2	1
Benzo(g,h,i)perylene	540		ug/kg	63.6	16.9	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	52		50-130
Phenanthrene-d10	80		50-130
Benzo(a)pyrene-d12	77		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Lab Number: L2268732
Project Number: GCM98578
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-07
Client ID: CM98591
Sample Location: MD

Date Collected: 12/05/22 12:45
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/07/23 10:59
Analyst: CNC
Percent Solids: 79%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	34.1		ug/kg	8.10	2.33	1
C1-Naphthalenes	24.1		ug/kg	8.10	2.33	1
C2-Naphthalenes	66.7		ug/kg	8.10	2.33	1
C3-Naphthalenes	155		ug/kg	8.10	2.33	1
C4-Naphthalenes	125		ug/kg	8.10	2.33	1
Acenaphthylene	374		ug/kg	8.10	1.55	1
Acenaphthene	32.0		ug/kg	8.10	1.43	1
Fluorene	79.1		ug/kg	8.10	2.16	1
C1-Fluorenes	115		ug/kg	8.10	2.16	1
C2-Fluorenes	197		ug/kg	8.10	2.16	1
C3-Fluorenes	299	G	ug/kg	8.10	2.16	1
Phenanthrene	1590		ug/kg	8.10	2.68	1
C1-Phenanthrenes/Anthracenes	1330		ug/kg	8.10	2.68	1
C2-Phenanthrenes/Anthr BS	962		ug/kg	8.10	2.68	1
C3-Phenanthrenes/Anthracenes	390		ug/kg	8.10	2.68	1
C4-Phenanthrenes/Anthracenes	121		ug/kg	8.10	2.68	1
Anthracene	486		ug/kg	8.10	1.67	1
Fluoranthene	3710		ug/kg	8.10	2.58	1
Pyrene	3330		ug/kg	8.10	2.13	1
C1-Fluoranthenes/Pyrenes	1860		ug/kg	8.10	2.13	1
Benz(a)anthracene	1940		ug/kg	8.10	1.65	1
Chrysene	2050		ug/kg	8.10	1.64	1
C1-Chrysenes	1140		ug/kg	8.10	1.64	1
C2-Chrysenes BS	584		ug/kg	8.10	1.64	1
C3-Chrysenes	386		ug/kg	8.10	1.64	1
C4-Chrysenes	252		ug/kg	8.10	1.64	1
Benzo(b)fluoranthene	1780		ug/kg	8.10	2.11	1
Benzo(j)+(k)fluoranthene	1550		ug/kg	8.10	1.61	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-07 Date Collected: 12/05/22 12:45
Client ID: CM98591 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	1260		ug/kg	8.10	1.67	1
Benzo(a)pyrene	1950		ug/kg	8.10	2.31	1
Perylene	465		ug/kg	8.10	1.56	1
Indeno(1,2,3-cd)pyrene	1600		ug/kg	8.10	2.20	1
Dibenz(a,h)+(a,c)anthracene	528		ug/kg	8.10	2.19	1
Benzo(g,h,i)perylene	1190		ug/kg	8.10	2.15	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	53		50-130
Phenanthrene-d10	93		50-130
Benzo(a)pyrene-d12	84		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-08
Client ID: CM98593
Sample Location: MD

Date Collected: 12/05/22 13:45
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/07/23 12:25
Analyst: CNC
Percent Solids: 79%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	51.7	J	ug/kg	64.5	18.5	1
C1-Naphthalenes	38.3	J	ug/kg	64.5	18.5	1
C2-Naphthalenes	125		ug/kg	64.5	18.5	1
C3-Naphthalenes	284		ug/kg	64.5	18.5	1
C4-Naphthalenes	298		ug/kg	64.5	18.5	1
Acenaphthylene	517		ug/kg	64.5	12.3	1
Acenaphthene	49.8	J	ug/kg	64.5	11.4	1
Fluorene	113		ug/kg	64.5	17.2	1
C1-Fluorenes	146		ug/kg	64.5	17.2	1
C2-Fluorenes	294		ug/kg	64.5	17.2	1
C3-Fluorenes	457		ug/kg	64.5	17.2	1
Phenanthrene	1950		ug/kg	64.5	21.4	1
C1-Phenanthrenes/Anthracenes	1660		ug/kg	64.5	21.4	1
C2-Phenanthrenes/Anthr BS	1720		ug/kg	64.5	21.4	1
C3-Phenanthrenes/Anthracenes	974		ug/kg	64.5	21.4	1
C4-Phenanthrenes/Anthracenes	398		ug/kg	64.5	21.4	1
Anthracene	653		ug/kg	64.5	13.3	1
Fluoranthene	6760		ug/kg	64.5	20.5	1
Pyrene	8220		ug/kg	64.5	17.0	1
C1-Fluoranthenes/Pyrenes	3320		ug/kg	64.5	17.0	1
Benz(a)anthracene	2480		ug/kg	64.5	13.2	1
Chrysene	2400		ug/kg	64.5	13.0	1
C1-Chrysenes	1250		ug/kg	64.5	13.0	1
C2-Chrysenes BS	823		ug/kg	64.5	13.0	1
C3-Chrysenes	795		ug/kg	64.5	13.0	1
C4-Chrysenes	ND		ug/kg	64.5	13.0	1
Benzo(b)fluoranthene	2100		ug/kg	64.5	16.8	1
Benzo(j)+(k)fluoranthene	2210		ug/kg	64.5	12.8	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-08 Date Collected: 12/05/22 13:45
Client ID: CM98593 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	1540		ug/kg	64.5	13.3	1
Benzo(a)pyrene	2520		ug/kg	64.5	18.4	1
Perylene	632		ug/kg	64.5	12.4	1
Indeno(1,2,3-cd)pyrene	1600		ug/kg	64.5	17.5	1
Dibenz(a,h)+(a,c)anthracene	407		ug/kg	64.5	17.4	1
Benzo(g,h,i)perylene	1580		ug/kg	64.5	17.1	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	57		50-130
Phenanthrene-d10	85		50-130
Benzo(a)pyrene-d12	80		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-09
Client ID: CM98595
Sample Location: MD

Date Collected: 12/05/22 14:40
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/07/23 13:52
Analyst: CNC
Percent Solids: 75%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	62.1		ug/kg	26.7	7.67	1
C1-Naphthalenes	69.7		ug/kg	26.7	7.67	1
C2-Naphthalenes	143		ug/kg	26.7	7.67	1
C3-Naphthalenes	243		ug/kg	26.7	7.67	1
C4-Naphthalenes	292		ug/kg	26.7	7.67	1
Acenaphthylene	465		ug/kg	26.7	5.09	1
Acenaphthene	314		ug/kg	26.7	4.70	1
Fluorene	521		ug/kg	26.7	7.12	1
C1-Fluorenes	209		ug/kg	26.7	7.12	1
C2-Fluorenes	303		ug/kg	26.7	7.12	1
C3-Fluorenes	813	G	ug/kg	26.7	7.12	1
Phenanthrene	5680		ug/kg	26.7	8.84	1
C1-Phenanthrenes/Anthracenes	2240		ug/kg	26.7	8.84	1
C2-Phenanthrenes/Anthr BS	1680		ug/kg	26.7	8.84	1
C3-Phenanthrenes/Anthracenes	852		ug/kg	26.7	8.84	1
C4-Phenanthrenes/Anthracenes	358		ug/kg	26.7	8.84	1
Anthracene	1070		ug/kg	26.7	5.50	1
Fluoranthene	10000		ug/kg	26.7	8.48	1
Pyrene	8330		ug/kg	26.7	7.02	1
C1-Fluoranthenes/Pyrenes	3500		ug/kg	26.7	7.02	1
Benz(a)anthracene	3900		ug/kg	26.7	5.44	1
Chrysene	4300		ug/kg	26.7	5.39	1
C1-Chrysenes	1990		ug/kg	26.7	5.39	1
C2-Chrysenes BS	1140		ug/kg	26.7	5.39	1
C3-Chrysenes	870		ug/kg	26.7	5.39	1
C4-Chrysenes	560		ug/kg	26.7	5.39	1
Benzo(b)fluoranthene	4040		ug/kg	26.7	6.94	1
Benzo(j)+(k)fluoranthene	3410		ug/kg	26.7	5.30	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-09 Date Collected: 12/05/22 14:40
Client ID: CM98595 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	2810		ug/kg	26.7	5.51	1
Benzo(a)pyrene	4030		ug/kg	26.7	7.62	1
Perylene	1050		ug/kg	26.7	5.15	1
Indeno(1,2,3-cd)pyrene	2820		ug/kg	26.7	7.24	1
Dibenz(a,h)+(a,c)anthracene	910		ug/kg	26.7	7.21	1
Benzo(g,h,i)perylene	2840		ug/kg	26.7	7.09	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	51		50-130
Phenanthrene-d10	82		50-130
Benzo(a)pyrene-d12	74		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Lab Number: L2268732
Project Number: GCM98578
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-10
Client ID: CM98597
Sample Location: MD

Date Collected: 12/05/22 15:35
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/07/23 15:19
Analyst: CNC
Percent Solids: 79%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	39.9		ug/kg	27.8	7.98	1
C1-Naphthalenes	24.3	J	ug/kg	27.8	7.98	1
C2-Naphthalenes	58.1		ug/kg	27.8	7.98	1
C3-Naphthalenes	97.8		ug/kg	27.8	7.98	1
C4-Naphthalenes	93.3		ug/kg	27.8	7.98	1
Acenaphthylene	211		ug/kg	27.8	5.29	1
Acenaphthene	24.0	J	ug/kg	27.8	4.89	1
Fluorene	41.8		ug/kg	27.8	7.40	1
C1-Fluorenes	55.0		ug/kg	27.8	7.40	1
C2-Fluorenes	118		ug/kg	27.8	7.40	1
C3-Fluorenes	211	G	ug/kg	27.8	7.40	1
Phenanthrene	836		ug/kg	27.8	9.19	1
C1-Phenanthrenes/Anthracenes	733		ug/kg	27.8	9.19	1
C2-Phenanthrenes/Anthr BS	581		ug/kg	27.8	9.19	1
C3-Phenanthrenes/Anthracenes	308		ug/kg	27.8	9.19	1
C4-Phenanthrenes/Anthracenes	138		ug/kg	27.8	9.19	1
Anthracene	221		ug/kg	27.8	5.72	1
Fluoranthene	1830		ug/kg	27.8	8.82	1
Pyrene	1810		ug/kg	27.8	7.30	1
C1-Fluoranthenes/Pyrenes	1080		ug/kg	27.8	7.30	1
Benz(a)anthracene	938		ug/kg	27.8	5.66	1
Chrysene	1120		ug/kg	27.8	5.61	1
C1-Chrysenes	712		ug/kg	27.8	5.61	1
C2-Chrysenes BS	419		ug/kg	27.8	5.61	1
C3-Chrysenes	387		ug/kg	27.8	5.61	1
C4-Chrysenes	265		ug/kg	27.8	5.61	1
Benzo(b)fluoranthene	1010		ug/kg	27.8	7.22	1
Benzo(j)+(k)fluoranthene	855		ug/kg	27.8	5.51	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-10 Date Collected: 12/05/22 15:35
Client ID: CM98597 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	770		ug/kg	27.8	5.72	1
Benzo(a)pyrene	1040		ug/kg	27.8	7.92	1
Perylene	259		ug/kg	27.8	5.36	1
Indeno(1,2,3-cd)pyrene	711		ug/kg	27.8	7.53	1
Dibenz(a,h)+(a,c)anthracene	208		ug/kg	27.8	7.50	1
Benzo(g,h,i)perylene	771		ug/kg	27.8	7.37	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	55		50-130
Phenanthrene-d10	85		50-130
Benzo(a)pyrene-d12	79		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Lab Number: L2268732
Project Number: GCM98578
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-11
Client ID: CM98599
Sample Location: MD

Date Collected: 12/05/22 16:10
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/09/23 15:22
Analyst: CNC
Percent Solids: 83%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	100		ug/kg	37.5	10.8	1
C1-Naphthalenes	65.4		ug/kg	37.5	10.8	1
C2-Naphthalenes	136		ug/kg	37.5	10.8	1
C3-Naphthalenes	191		ug/kg	37.5	10.8	1
C4-Naphthalenes	202		ug/kg	37.5	10.8	1
Acenaphthylene	480		ug/kg	37.5	7.16	1
Acenaphthene	58.3		ug/kg	37.5	6.61	1
Fluorene	92.2		ug/kg	37.5	10.0	1
C1-Fluorenes	113		ug/kg	37.5	10.0	1
C2-Fluorenes	244		ug/kg	37.5	10.0	1
C3-Fluorenes	479	G	ug/kg	37.5	10.0	1
Phenanthrene	1950		ug/kg	37.5	12.4	1
C1-Phenanthrenes/Anthracenes	1550		ug/kg	37.5	12.4	1
C2-Phenanthrenes/Anthr BS	1190		ug/kg	37.5	12.4	1
C3-Phenanthrenes/Anthracenes	651		ug/kg	37.5	12.4	1
C4-Phenanthrenes/Anthracenes	337		ug/kg	37.5	12.4	1
Anthracene	591		ug/kg	37.5	7.73	1
Fluoranthene	4400		ug/kg	37.5	11.9	1
Pyrene	4440		ug/kg	37.5	9.87	1
C1-Fluoranthenes/Pyrenes	2450		ug/kg	37.5	9.87	1
Benz(a)anthracene	2000		ug/kg	37.5	7.65	1
Chrysene	2230		ug/kg	37.5	7.58	1
C1-Chrysenes	1320		ug/kg	37.5	7.58	1
C2-Chrysenes BS	852		ug/kg	37.5	7.58	1
C3-Chrysenes	757		ug/kg	37.5	7.58	1
C4-Chrysenes	560		ug/kg	37.5	7.58	1
Benzo(b)fluoranthene	1770		ug/kg	37.5	9.76	1
Benzo(j)+(k)fluoranthene	2160		ug/kg	37.5	7.45	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-11 Date Collected: 12/05/22 16:10
Client ID: CM98599 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	1600		ug/kg	37.5	7.74	1
Benzo(a)pyrene	2380		ug/kg	37.5	10.7	1
Perylene	602		ug/kg	37.5	7.24	1
Indeno(1,2,3-cd)pyrene	1560		ug/kg	37.5	10.2	1
Dibenz(a,h)+(a,c)anthracene	460		ug/kg	37.5	10.1	1
Benzo(g,h,i)perylene	1630		ug/kg	37.5	9.97	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	90		50-130
Phenanthrene-d10	97		50-130
Benzo(a)pyrene-d12	91		50-130

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-12
Client ID: CM98601
Sample Location: MD

Date Collected: 12/06/22 08:40
Date Received: 12/07/22
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/07/23 18:13
Analyst: CNC
Percent Solids: 78%

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Naphthalene	41.2	J	ug/kg	50.6	14.5	1
C1-Naphthalenes	40.5	J	ug/kg	50.6	14.5	1
C2-Naphthalenes	152		ug/kg	50.6	14.5	1
C3-Naphthalenes	201		ug/kg	50.6	14.5	1
C4-Naphthalenes	172		ug/kg	50.6	14.5	1
Acenaphthylene	503		ug/kg	50.6	9.66	1
Acenaphthene	81.8		ug/kg	50.6	8.92	1
Fluorene	154		ug/kg	50.6	13.5	1
C1-Fluorenes	100		ug/kg	50.6	13.5	1
C2-Fluorenes	189		ug/kg	50.6	13.5	1
C3-Fluorenes	386	G	ug/kg	50.6	13.5	1
Phenanthrene	2390		ug/kg	50.6	16.8	1
C1-Phenanthrenes/Anthracenes	1300		ug/kg	50.6	16.8	1
C2-Phenanthrenes/Anthr BS	856		ug/kg	50.6	16.8	1
C3-Phenanthrenes/Anthracenes	465		ug/kg	50.6	16.8	1
C4-Phenanthrenes/Anthracenes	218		ug/kg	50.6	16.8	1
Anthracene	679		ug/kg	50.6	10.4	1
Fluoranthene	4620		ug/kg	50.6	16.1	1
Pyrene	4010		ug/kg	50.6	13.3	1
C1-Fluoranthenes/Pyrenes	1890		ug/kg	50.6	13.3	1
Benz(a)anthracene	2190		ug/kg	50.6	10.3	1
Chrysene	2270		ug/kg	50.6	10.2	1
C1-Chrysenes	1140		ug/kg	50.6	10.2	1
C2-Chrysenes BS	648		ug/kg	50.6	10.2	1
C3-Chrysenes	601		ug/kg	50.6	10.2	1
C4-Chrysenes	ND		ug/kg	50.6	10.2	1
Benzo(b)fluoranthene	2280		ug/kg	50.6	13.2	1
Benzo(j)+(k)fluoranthene	1940		ug/kg	50.6	10.0	1

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732

Project Number: GCM98578 **Report Date:** 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-12 Date Collected: 12/06/22 08:40
Client ID: CM98601 Date Received: 12/07/22
Sample Location: MD Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
PAHs - Mansfield Lab						
Benzo(e)pyrene	1620		ug/kg	50.6	10.4	1
Benzo(a)pyrene	2400		ug/kg	50.6	14.4	1
Perylene	638		ug/kg	50.6	9.77	1
Indeno(1,2,3-cd)pyrene	1630		ug/kg	50.6	13.7	1
Dibenz(a,h)+(a,c)anthracene	482		ug/kg	50.6	13.7	1
Benzo(g,h,i)perylene	1680		ug/kg	50.6	13.4	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	54		50-130
Phenanthrene-d10	86		50-130
Benzo(a)pyrene-d12	80		50-130

Project Name: ROCKVILLE FORMER MGP **Lab Number:** L2268732
Project Number: GCM98578 **Report Date:** 01/10/23

Method Blank Analysis
Batch Quality Control

Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/06/23 20:31
Analyst: CNC

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL
PAHs - Mansfield Lab for sample(s): 01-12 Batch: WG1724522-1					
Naphthalene	ND		ug/kg	1.00	0.287
C1-Naphthalenes	ND		ug/kg	1.00	0.287
C2-Naphthalenes	ND		ug/kg	1.00	0.287
C3-Naphthalenes	ND		ug/kg	1.00	0.287
C4-Naphthalenes	ND		ug/kg	1.00	0.287
Acenaphthylene	ND		ug/kg	1.00	0.191
Acenaphthene	ND		ug/kg	1.00	0.176
Fluorene	ND		ug/kg	1.00	0.267
C1-Fluorenes	ND		ug/kg	1.00	0.267
C2-Fluorenes	ND		ug/kg	1.00	0.267
C3-Fluorenes	ND		ug/kg	1.00	0.267
Phenanthrene	ND		ug/kg	1.00	0.331
C1-Phenanthrenes/Anthracenes	ND		ug/kg	1.00	0.331
C2-Phenanthrenes/Anthr BS	ND		ug/kg	1.00	0.331
C3-Phenanthrenes/Anthracenes	ND		ug/kg	1.00	0.331
C4-Phenanthrenes/Anthracenes	ND		ug/kg	1.00	0.331
Anthracene	ND		ug/kg	1.00	0.206
Fluoranthene	ND		ug/kg	1.00	0.318
Pyrene	ND		ug/kg	1.00	0.263
C1-Fluoranthenes/Pyrenes	ND		ug/kg	1.00	0.263
Benz(a)anthracene	ND		ug/kg	1.00	0.204
Chrysene	ND		ug/kg	1.00	0.202
C1-Chrysenes	ND		ug/kg	1.00	0.202
C2-Chrysenes BS	ND		ug/kg	1.00	0.202
C3-Chrysenes	ND		ug/kg	1.00	0.202
C4-Chrysenes	ND		ug/kg	1.00	0.202
Benzo(b)fluoranthene	ND		ug/kg	1.00	0.260
Benzo(j)+(k)fluoranthene	ND		ug/kg	1.00	0.198
Benzo(e)pyrene	ND		ug/kg	1.00	0.206

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

Method Blank Analysis
Batch Quality Control

Analytical Method: 1,8270E-SIM(M)
Analytical Date: 01/06/23 20:31
Analyst: CNC

Extraction Method: ALPHA OP-013
Extraction Date: 12/17/22 09:14
Cleanup Method: EPA 3611B
Cleanup Date: 01/06/23

Parameter	Result	Qualifier	Units	RL	MDL
PAHs - Mansfield Lab for sample(s): 01-12 Batch: WG1724522-1					
Benzo(a)pyrene	ND		ug/kg	1.00	0.285
Perylene	ND		ug/kg	1.00	0.193
Indeno(1,2,3-cd)pyrene	ND		ug/kg	1.00	0.271
Dibenz(a,h)+(a,c)anthracene	ND		ug/kg	1.00	0.270
Benzo(g,h,i)perylene	ND		ug/kg	1.00	0.266

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Naphthalene-d8	62		50-130
Phenanthrene-d10	85		50-130
Benzo(a)pyrene-d12	76		50-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578

Lab Number: L2268732
Report Date: 01/10/23

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
PAHs - Mansfield Lab Associated sample(s): 01-12 Batch: WG1724522-2 WG1724522-3								
Naphthalene	62		61		50-130	2		30
Acenaphthylene	63		63		50-130	0		30
Acenaphthene	71		69		50-130	3		30
Fluorene	72		73		50-130	1		30
Phenanthrene	74		74		50-130	0		30
Anthracene	77		75		50-130	3		30
Fluoranthene	77		77		50-130	0		30
Pyrene	78		78		50-130	0		30
Benz(a)anthracene	75		72		50-130	4		30
Chrysene	74		72		50-130	3		30
Benzo(b)fluoranthene	81		79		50-130	3		30
Benzo(j)+(k)fluoranthene	82		78		50-130	5		30
Benzo(a)pyrene	74		72		50-130	3		30
Indeno(1,2,3-cd)pyrene	87		85		50-130	2		30
Dibenz(a,h)+(a,c)anthracene	88		84		50-130	5		30
Benzo(g,h,i)perylene	82		80		50-130	2		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Naphthalene-d8	65		66		50-130
Phenanthrene-d10	84		84		50-130
Benzo(a)pyrene-d12	77		74		50-130

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INORGANICS
&
MISCELLANEOUS

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-01
Client ID: CM98579
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/06/22 09:15
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	81.1		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-02
Client ID: CM98581
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/06/22 10:10
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	80.7		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-03
Client ID: CM98583
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/06/22 10:45
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	78.2		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-04
Client ID: CM98585
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/06/22 11:40
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	74.9		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-05
Client ID: CM98587
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/06/22 12:20
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	75.2		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-06
Client ID: CM98589
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/06/22 13:00
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	80.3		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-07
Client ID: CM98591
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/05/22 12:45
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	79.3		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-08
Client ID: CM98593
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/05/22 13:45
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	78.6		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-09
Client ID: CM98595
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/05/22 14:40
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	74.5		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-10
Client ID: CM98597
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/05/22 15:35
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	79.3		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-11
Client ID: CM98599
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/05/22 16:10
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	82.8		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Serial_No:01102313:25

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578
Lab Number: L2268732
Report Date: 01/10/23

SAMPLE RESULTS

Lab ID: L2268732-12
Client ID: CM98601
Sample Location: MD
Sample Depth:
Matrix: Soil

Date Collected: 12/06/22 08:40
Date Received: 12/07/22
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Mansfield Lab										
Solids, Total	78.3		%	0.100	0.100	1	-	12/28/22 18:56	121,2540G	AM

Lab Duplicate Analysis
Batch Quality Control

Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578

Lab Number: L2268732
Report Date: 01/10/23

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Mansfield Lab Associated sample(s): 01-12 QC Batch ID: WG1728231-1 QC Sample: L2268689-08 Client ID: DUP Sample						
Solids, Total	52.1	56.4	%	8		10

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Project Name: ROCKVILLE FORMER MGP
Project Number: GCM98578

Lab Number: L2268732
Report Date: 01/10/23

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2268732-01A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-02A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-03A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-04A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-05A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-06A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-07A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-08A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-09A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-10A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-11A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)
L2268732-12A	Glass 250ml/8oz unpreserved	A	NA		3.9	Y	Absent		A2-ALKPAH(14),A2-TS(7)

*Values in parentheses indicate holding time in days

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d/b/a Eversource Energy
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Date Issued September 29, 2026
RSR-032 Attachment 6
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Project Name:	ROCKVILLE FORMER MGP	**Lab Number:**	L2268732
Project Number:	GCM98578	**Report Date:**	01/10/23

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: DU Report with 'J' Qualifiers

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Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively

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Data Qualifiers

Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Report Format: DU Report with 'J' Qualifiers

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Project Number:	GCM98578	**Report Date:**	01/10/23

REFERENCES

1 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - VI, 2018.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Serial_No:01102313:25

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

12/7/22 L2268732

CHAIN OF CUSTODY RECORD

Cooler: Yes ☐ No ☐
Coolant: IPK ☐ ICE ☐ No ☐
Temp °C Pg of

PHOENIX Environmental Laboratories, Inc.

Page 1 of 2
587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
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☐ Email: HelenG@PhoenixLabs.com

Customer: Alpha Analytical
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Westborough, MA
(508) 898-9220

Project #: GCM98578
Report to: HelenG@PhoenixLabs.com / Helen Geoghegan
Invoice to: AccountsPayable@PhoenixLabs.com
Quote# :

Project P.O: GCM98578

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature _____ Date: _____

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe
OIL=Oil **B**=Bulk **L**=Liquid

Analysis Request

Phoenix Sample ID	Sample Comment	Sample Matrix	Date Sampled	Time Sampled	Alkyl PAHs by SIM EPA 8270E-SIM(M)	8oz Amber-As-Is Glass Jar
CM98579		SOIL	12/6/2022	9:15 AM	x	1
CM98581		SOIL	12/6/2022	10:10 AM	x	1
CM98583		SOIL	12/6/2022	10:45 AM	x	1
CM98585		SOIL	12/6/2022	11:40 AM	x	1
CM98587		SOIL	12/6/2022	12:20 PM	x	1
CM98589		SOIL	12/6/2022	1:00 PM	x	1
CM98591		SOIL	12/5/2022	12:45 PM	x	1
CM98593		SOIL	12/5/2022	1:45 PM	x	1
CM98595		SOIL	12/5/2022	2:40 PM	x	1
CM98597		SOIL	12/5/2022	3:35 PM	x	1
CM98599		SOIL	12/5/2022	4:10 PM	x	1

Relinquished by:	Accepted by:	Date:	Time:
	AAL	12-7-22	14:09
		12/7/22	1750
		12/7/22	19:30

Comments, Special Requirements or Regulations:

Please send notice as soon as possible not exceeding 24 hours of obtaining valid data, of the results of all drinking water samples that exceed any EPA or Department-established maximum contaminant level, maximum residual disinfectant level or reportable concentration.
Please notify Phoenix Environmental Laboratories, Inc. immediately and prior to conducting analysis if certification is not held for the analyses requested.

Turnaround:
☐ 1 Day
☐ 2 Days
☐ 3 Days
☐ 5 Days
☐ 10 Days
☒ Standard
☐ Other_____

Report Type:
☒ Standard PDF
☐ Full Data Package
☐ NJ Reduced Deliverable
☐ NJ Full Deliverable
☐ NY ASP B

EDD Format:
☐ Excel
☐ GIS/Key
☐ EQuIS
☐ NJ Hazsite EDD
☐ NY EZ EDD (ASP)
☐ Other:_____

State Criteria:
CT: GA GW Protection
CT: GA Mobility
CT: GB Mobility
CT: Res. Criteria
CT: SW Protection

What State were samples collected?
CT

AAL 12/7/22 2030

12/7/22 L2268732

Cooler: Yes ☐ No ☐
Coolant: IPK ☐ ICE ☐ No ☐

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Client Services (860) 645-8726

Temp °C Pg of

Contact Options:
☐ Fax: 860-645-0823
☐ Phone: 800-827-5426
☐ Email: HelenG@PhoenixLabs.com

Customer: Alpha Analytical
Address: 8 Walkup Dr
Westborough, MA
(508) 898-9220

Project #: GCM98578
Report to: HelenG@PhoenixLabs.com / Helen Geoghegan
Invoice to: AccountsPayable@PhoenixLabs.com
Quote# :

Project P.O: GCM98578

This section MUST be completed with Bottle Quantities.

Client Sample - Information - Identification

Sampler's Signature _____ Date: _____

Matrix Code:
DW=Drinking Water **GW**=Ground Water **SW**=Surface Water **WW**=Waste Water
RW=Raw Water **SE**=Sediment **SL**=Sludge **S**=Soil **SD**=Solid **W**=Wipe
OIL=Oil **B**=Bulk **L**=Liquid

Phoenix Sample ID	Sample Comment	Sample Matrix	Date Sampled	Time Sampled	Analysis Request: Alkyl PAHs by SIM EPA 8270E-SIM(M)	8oz Amber Jar-G Glass Jar
12 CM98601		SOIL	12/6/2022	8:40 AM	x	1
						1
						1
						1
						1
						1
						1
						1
						1
						1
						1

Relinquished by:	Accepted by:	Date:	Time:
Tom Bailey	Dan Rea AAC	12-7-22	14:07
Dan Rea AAC	Jennifer R. MacDay	12/7/22	1750
Jennifer R. MacDay		12/7/22	19.30

Comments, Special Requirements or Regulations:

Please send notice as soon as possible not exceeding 24 hours of obtaining valid data, of the results of all drinking water samples that exceed any EPA or Department-established maximum contaminant level, maximum residual disinfectant level or reportable concentration.

Please notify Phoenix Environmental Laboratories, Inc. immediately and prior to conducting analysis if certification is not held for the analyses requested.

Turnaround:
☐ 1 Day
☐ 2 Days
☐ 3 Days
☐ 5 Days
☐ 10 Days
☒ Standard
☐ Other_____

Report Type:
☒ Standard PDF
☐ Full Data Package
☐ NJ Reduced Deliverable
☐ NJ Full Deliverable
☐ NY ASP B

EDD Format:
☐ Excel
☐ GIS/Key
☐ EQuIS
☐ NJ Hazsite EDD
☐ NY EZ EDD (ASP)
☐ Other:_____

State Criteria:
CT: GA GW Protection
CT: GA Mobility
CT: GB Mobility
CT: Res. Criteria
CT: SW Protection

What State were samples collected?
CT

Jennifer R. MacDay 12/7/22 2031

AAC 12/7/22 2030

The Connecticut Light and Power Company
d/b/a Eversource Energy
Docket No. 26-05-10
Date Issued September 29, 2026
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Appendix C

ProUCL Site EPC Output

1	UCL Statistics for Data Sets with Non-Detects										
2											
3	User Selected Options										
4	Date/Time of Computation	ProUCL 5.2 2/9/2023 10:32:11 PM									
5	From File	WorkSheet.xls									
6	Full Precision	OFF									
7	Confidence Coefficient	95%									
8	Number of Bootstrap Operations	2000									
9											
10	Acenaphthene										
11											
12	General Statistics										
13	Total Number of Observations	14			Number of Distinct Observations	13					
14					Number of Missing Observations	14					
15	Number of Detects	9			Number of Non-Detects	5					
16	Number of Distinct Detects	9			Number of Distinct Non-Detects	4					
17	Minimum Detect	0.024			Minimum Non-Detect	0.26					
18	Maximum Detect	1.2			Maximum Non-Detect	3					
19	Variance Detects	0.146			Percent Non-Detects	35.71%					
20	Mean Detects	0.209			SD Detects	0.382					
21	Median Detects	0.0583			CV Detects	1.824					
22	Skewness Detects	2.729			Kurtosis Detects	7.626					
23	Mean of Logged Detects	-2.453			SD of Logged Detects	1.223					
24											
25	Normal GOF Test on Detects Only										
26	Shapiro Wilk Test Statistic	0.538			Shapiro Wilk GOF Test						
27	1% Shapiro Wilk Critical Value	0.764			Detected Data Not Normal at 1% Significance Level						
28	Lilliefors Test Statistic	0.409			Lilliefors GOF Test						
29	1% Lilliefors Critical Value	0.316			Detected Data Not Normal at 1% Significance Level						
30	Detected Data Not Normal at 1% Significance Level										
31											
32	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
33	KM Mean	0.161			KM Standard Error of Mean	0.0908					
34	90KM SD	0.308			95% KM (BCA) UCL	0.319					
35	95% KM (t) UCL	0.322			95% KM (Percentile Bootstrap) UCL	0.321					
36	95% KM (z) UCL	0.311			95% KM Bootstrap t UCL	1.727					
37	90% KM Chebyshev UCL	0.434			95% KM Chebyshev UCL	0.557					
38	97.5% KM Chebyshev UCL	0.728			99% KM Chebyshev UCL	1.064					
39											
40	Gamma GOF Tests on Detected Observations Only										
41	A-D Test Statistic	1.181			Anderson-Darling GOF Test						
42	5% A-D Critical Value	0.757			Detected Data Not Gamma Distributed at 5% Significance Level						
43	K-S Test Statistic	0.374			Kolmogorov-Smirnov GOF						
44	5% K-S Critical Value	0.291			Detected Data Not Gamma Distributed at 5% Significance Level						
45	Detected Data Not Gamma Distributed at 5% Significance Level										
46											
47	Gamma Statistics on Detected Data Only										
48	k hat (MLE)	0.682			k star (bias corrected MLE)	0.529					
49	Theta hat (MLE)	0.307			Theta star (bias corrected MLE)	0.396					
50	nu hat (MLE)	12.27			nu star (bias corrected)	9.516					
51	Mean (detects)	0.209									
52											
53	Gamma ROS Statistics using Imputed Non-Detects										

	A	B	C	D	E	F	G	H	I	J	K	L
54	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
55	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
56	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
57	This is especially true when the sample size is small.											
58	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
59					Minimum	0.01				Mean		0.151
60					Maximum	1.2				Median		0.0549
61					SD	0.311				CV		2.063
62					k hat (MLE)	0.667				k star (bias corrected MLE)		0.571
63					Theta hat (MLE)	0.226				Theta star (bias corrected MLE)		0.264
64					nu hat (MLE)	18.66				nu star (bias corrected)		16
65					Adjusted Level of Significance (β)	0.0312						
66					Approximate Chi Square Value (16.00, α)	7.961				Adjusted Chi Square Value (16.00, β)		7.22
67					95% Gamma Approximate UCL	0.303				95% Gamma Adjusted UCL		0.334
68												
69	Estimates of Gamma Parameters using KM Estimates											
70					Mean (KM)	0.161				SD (KM)		0.308
71					Variance (KM)	0.095				SE of Mean (KM)		0.0908
72					k hat (KM)	0.274				k star (KM)		0.263
73					nu hat (KM)	7.658				nu star (KM)		7.35
74					theta hat (KM)	0.589				theta star (KM)		0.614
75					80% gamma percentile (KM)	0.238				90% gamma percentile (KM)		0.482
76					95% gamma percentile (KM)	0.769				99% gamma percentile (KM)		1.528
77												
78	Gamma Kaplan-Meier (KM) Statistics											
79					Approximate Chi Square Value (7.35, α)	2.365				Adjusted Chi Square Value (7.35, β)		2.007
80					95% KM Approximate Gamma UCL	0.501				95% KM Adjusted Gamma UCL		0.59
81												
82	Lognormal GOF Test on Detected Observations Only											
83					Shapiro Wilk Test Statistic	0.842				Shapiro Wilk GOF Test		
84					10% Shapiro Wilk Critical Value	0.859				Detected Data Not Lognormal at 10% Significance Level		
85					Lilliefors Test Statistic	0.294				Lilliefors GOF Test		
86					10% Lilliefors Critical Value	0.252				Detected Data Not Lognormal at 10% Significance Level		
87	Detected Data Not Lognormal at 10% Significance Level											
88												
89	Lognormal ROS Statistics Using Imputed Non-Detects											
90					Mean in Original Scale	0.157				Mean in Log Scale		-2.582
91					SD in Original Scale	0.308				SD in Log Scale		0.994
92					95% t UCL (assumes normality of ROS data)	0.303				95% Percentile Bootstrap UCL		0.31
93					95% BCA Bootstrap UCL	0.405				95% Bootstrap t UCL		1.83
94					95% H-UCL (Log ROS)	0.267						
95												
96	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
97					KM Mean (logged)	-2.626				KM Geo Mean		0.0724
98					KM SD (logged)	1.019				95% Critical H Value (KM-Log)		2.824
99					KM Standard Error of Mean (logged)	0.311				95% H-UCL (KM -Log)		0.27
100					KM SD (logged)	1.019				95% Critical H Value (KM-Log)		2.824
101					KM Standard Error of Mean (logged)	0.311						
102	Note: KM UCLs may be biased low with this dataset. Other substitution method recommended											
103												
104	DL/2 Statistics											
105					DL/2 Normal					DL/2 Log-Transformed		
106					Mean in Original Scale	0.283				Mean in Log Scale		-2.103

	A	B	C	D	E	F	G	H	I	J	K	L
107					SD in Original Scale	0.462					SD in Log Scale	1.225
108					95% t UCL (Assumes normality)	0.501					95% H-Stat UCL	0.761
109	DL/2 is not a recommended method, provided for comparisons and historical reasons											
110												
111	Nonparametric Distribution Free UCL Statistics											
112	Data do not follow a Discernible Distribution											
113												
114	Suggested UCL to Use											
115					95% KM (t) UCL	0.322						
116												
117	The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.											
118	Please verify the data were collected from random locations.											
119	If the data were collected using judgmental or other non-random methods,											
120	then contact a statistician to correctly calculate UCLs.											
121												
122	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
123	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
124	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
125												
126	Acenaphthylene											
127												
128	General Statistics											
129					Total Number of Observations	14					Number of Distinct Observations	14
130											Number of Missing Observations	14
131					Number of Detects	13					Number of Non-Detects	1
132					Number of Distinct Detects	13					Number of Distinct Non-Detects	1
133					Minimum Detect	0.211					Minimum Non-Detect	3
134					Maximum Detect	1.4					Maximum Non-Detect	3
135					Variance Detects	0.086					Percent Non-Detects	7.143%
136					Mean Detects	0.51					SD Detects	0.293
137					Median Detects	0.465					CV Detects	0.575
138					Skewness Detects	2.577					Kurtosis Detects	7.995
139					Mean of Logged Detects	-0.78					SD of Logged Detects	0.452
140												
141	Normal GOF Test on Detects Only											
142					Shapiro Wilk Test Statistic	0.717			Shapiro Wilk GOF Test			
143					1% Shapiro Wilk Critical Value	0.814			Detected Data Not Normal at 1% Significance Level			
144					Lilliefors Test Statistic	0.26			Lilliefors GOF Test			
145					1% Lilliefors Critical Value	0.271			Detected Data appear Normal at 1% Significance Level			
146	Detected Data appear Approximate Normal at 1% Significance Level											
147												
148	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
149					KM Mean	0.51					KM Standard Error of Mean	0.0813
150					90KM SD	0.282					95% KM (BCA) UCL	0.651
151					95% KM (t) UCL	0.654					95% KM (Percentile Bootstrap) UCL	0.652
152					95% KM (z) UCL	0.644					95% KM Bootstrap t UCL	0.798
153					90% KM Chebyshev UCL	0.754					95% KM Chebyshev UCL	0.865
154					97.5% KM Chebyshev UCL	1.018					99% KM Chebyshev UCL	1.319
155												
156	Gamma GOF Tests on Detected Observations Only											
157					A-D Test Statistic	0.607			Anderson-Darling GOF Test			
158					5% A-D Critical Value	0.736			Detected data appear Gamma Distributed at 5% Significance Level			
159					K-S Test Statistic	0.197			Kolmogorov-Smirnov GOF			

	A	B	C	D	E	F	G	H	I	J	K	L
160					5% K-S Critical Value	0.237	Detected data appear Gamma Distributed at 5% Significance Level					
161	Detected data appear Gamma Distributed at 5% Significance Level											
162												
163	Gamma Statistics on Detected Data Only											
164					k hat (MLE)	4.839				k star (bias corrected MLE)		3.774
165					Theta hat (MLE)	0.105				Theta star (bias corrected MLE)		0.135
166					nu hat (MLE)	125.8				nu star (bias corrected)		98.12
167					Mean (detects)	0.51						
168												
169	Gamma ROS Statistics using Imputed Non-Detects											
170	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
171	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
172	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
173	This is especially true when the sample size is small.											
174	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
175					Minimum	0.211				Mean		0.508
176					Maximum	1.4				Median		0.472
177					SD	0.282				CV		0.555
178					k hat (MLE)	5.193				k star (bias corrected MLE)		4.128
179					Theta hat (MLE)	0.0978				Theta star (bias corrected MLE)		0.123
180					nu hat (MLE)	145.4				nu star (bias corrected)		115.6
181					Adjusted Level of Significance (β)	0.0312						
182					Approximate Chi Square Value (115.59, α)	91.77				Adjusted Chi Square Value (115.59, β)		88.95
183					95% Gamma Approximate UCL	0.64				95% Gamma Adjusted UCL		0.66
184												
185	Estimates of Gamma Parameters using KM Estimates											
186					Mean (KM)	0.51				SD (KM)		0.282
187					Variance (KM)	0.0794				SE of Mean (KM)		0.0813
188					k hat (KM)	3.28				k star (KM)		2.625
189					nu hat (KM)	91.83				nu star (KM)		73.49
190					theta hat (KM)	0.156				theta star (KM)		0.194
191					80% gamma percentile (KM)	0.74				90% gamma percentile (KM)		0.932
192					95% gamma percentile (KM)	1.113				99% gamma percentile (KM)		1.509
193												
194	Gamma Kaplan-Meier (KM) Statistics											
195					Approximate Chi Square Value (73.49, α)	54.75				Adjusted Chi Square Value (73.49, β)		52.61
196					95% KM Approximate Gamma UCL	0.685				95% KM Adjusted Gamma UCL		0.713
197												
198	Lognormal GOF Test on Detected Observations Only											
199					Shapiro Wilk Test Statistic	0.933			Shapiro Wilk GOF Test			
200					10% Shapiro Wilk Critical Value	0.889			Detected Data appear Lognormal at 10% Significance Level			
201					Lilliefors Test Statistic	0.165			Lilliefors GOF Test			
202					10% Lilliefors Critical Value	0.215			Detected Data appear Lognormal at 10% Significance Level			
203	Detected Data appear Lognormal at 10% Significance Level											
204												
205	Lognormal ROS Statistics Using Imputed Non-Detects											
206					Mean in Original Scale	0.507				Mean in Log Scale		-0.78
207					SD in Original Scale	0.282				SD in Log Scale		0.435
208					95% t UCL (assumes normality of ROS data)	0.64				95% Percentile Bootstrap UCL		0.638
209					95% BCA Bootstrap UCL	0.688				95% Bootstrap t UCL		0.77
210					95% H-UCL (Log ROS)	0.641						
211												
212	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											

	A	B	C	D	E	F	G	H	I	J	K	L
213					KM Mean (logged)	-0.78					KM Geo Mean	0.459
214					KM SD (logged)	0.435					95% Critical H Value (KM-Log)	2
215				KM Standard Error of Mean (logged)		0.125					95% H-UCL (KM -Log)	0.641
216					KM SD (logged)	0.435					95% Critical H Value (KM-Log)	2
217				KM Standard Error of Mean (logged)		0.125						
218												
219						DL/2 Statistics						
220					DL/2 Normal					DL/2 Log-Transformed		
221					Mean in Original Scale	0.581					Mean in Log Scale	-0.695
222					SD in Original Scale	0.386					SD in Log Scale	0.538
223					95% t UCL (Assumes normality)	0.764					95% H-Stat UCL	0.784
224					DL/2 is not a recommended method, provided for comparisons and historical reasons							
225												
226						Nonparametric Distribution Free UCL Statistics						
227						Detected Data appear Approximate Normal Distributed at 1% Significance Level						
228												
229						Suggested UCL to Use						
230						95% KM (t) UCL	0.654					
231												
232						When a data set follows an approximate distribution passing only one of the GOF tests,						
233						it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL						
234												
235						Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
236						Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.						
237						However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
238												
239	Anthracene											
240												
241						General Statistics						
242					Total Number of Observations	14				Number of Distinct Observations		14
243										Number of Missing Observations		14
244					Number of Detects	12				Number of Non-Detects		2
245					Number of Distinct Detects	12				Number of Distinct Non-Detects		2
246					Minimum Detect	0.221				Minimum Non-Detect		0.26
247					Maximum Detect	2.9				Maximum Non-Detect		3
248					Variance Detects	0.474				Percent Non-Detects		14.29%
249					Mean Detects	0.833				SD Detects		0.688
250					Median Detects	0.622				CV Detects		0.827
251					Skewness Detects	2.834				Kurtosis Detects		8.916
252					Mean of Logged Detects	-0.379				SD of Logged Detects		0.606
253												
254						Normal GOF Test on Detects Only						
255					Shapiro Wilk Test Statistic	0.637			Shapiro Wilk GOF Test			
256					1% Shapiro Wilk Critical Value	0.805			Detected Data Not Normal at 1% Significance Level			
257					Lilliefors Test Statistic	0.294			Lilliefors GOF Test			
258					1% Lilliefors Critical Value	0.281			Detected Data Not Normal at 1% Significance Level			
259						Detected Data Not Normal at 1% Significance Level						
260												
261						Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs						
262					KM Mean	0.785				KM Standard Error of Mean		0.189
263					90KM SD	0.654				95% KM (BCA) UCL		1.124
264					95% KM (t) UCL	1.121				95% KM (Percentile Bootstrap) UCL		1.118
265					95% KM (z) UCL	1.097				95% KM Bootstrap t UCL		1.572

	A	B	C	D	E	F	G	H	I	J	K	L
266					90% KM Chebyshev UCL	1.354				95% KM Chebyshev UCL		1.611
267					97.5% KM Chebyshev UCL	1.968				99% KM Chebyshev UCL		2.67
268												
269					Gamma GOF Tests on Detected Observations Only							
270					A-D Test Statistic	0.853	Anderson-Darling GOF Test					
271					5% A-D Critical Value	0.74	Detected Data Not Gamma Distributed at 5% Significance Level					
272					K-S Test Statistic	0.213	Kolmogorov-Smirnov GOF					
273					5% K-S Critical Value	0.248	Detected data appear Gamma Distributed at 5% Significance Level					
274					Detected data follow Appr. Gamma Distribution at 5% Significance Level							
275												
276					Gamma Statistics on Detected Data Only							
277					k hat (MLE)	2.711				k star (bias corrected MLE)		2.089
278					Theta hat (MLE)	0.307				Theta star (bias corrected MLE)		0.399
279					nu hat (MLE)	65.07				nu star (bias corrected)		50.14
280					Mean (detects)	0.833						
281												
282					Gamma ROS Statistics using Imputed Non-Detects							
283					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
284					GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
285					For such situations, GROS method may yield incorrect values of UCLs and BTVs							
286					This is especially true when the sample size is small.							
287					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
288					Minimum	0.01				Mean		0.762
289					Maximum	2.9				Median		0.622
290					SD	0.671				CV		0.88
291					k hat (MLE)	1.36				k star (bias corrected MLE)		1.116
292					Theta hat (MLE)	0.56				Theta star (bias corrected MLE)		0.683
293					nu hat (MLE)	38.08				nu star (bias corrected)		31.25
294					Adjusted Level of Significance (β)	0.0312						
295					Approximate Chi Square Value (31.25, α)	19.48				Adjusted Chi Square Value (31.25, β)		18.25
296					95% Gamma Approximate UCL	1.223				95% Gamma Adjusted UCL		1.305
297												
298					Estimates of Gamma Parameters using KM Estimates							
299					Mean (KM)	0.785				SD (KM)		0.654
300					Variance (KM)	0.428				SE of Mean (KM)		0.189
301					k hat (KM)	1.443				k star (KM)		1.181
302					nu hat (KM)	40.4				nu star (KM)		33.08
303					theta hat (KM)	0.544				theta star (KM)		0.665
304					80% gamma percentile (KM)	1.246				90% gamma percentile (KM)		1.736
305					95% gamma percentile (KM)	2.22				99% gamma percentile (KM)		3.33
306												
307					Gamma Kaplan-Meier (KM) Statistics							
308					Approximate Chi Square Value (33.08, α)	20.93				Adjusted Chi Square Value (33.08, β)		19.65
309					95% KM Approximate Gamma UCL	1.241				95% KM Adjusted Gamma UCL		1.322
310												
311					Lognormal GOF Test on Detected Observations Only							
312					Shapiro Wilk Test Statistic	0.904	Shapiro Wilk GOF Test					
313					10% Shapiro Wilk Critical Value	0.883	Detected Data appear Lognormal at 10% Significance Level					
314					Lilliefors Test Statistic	0.203	Lilliefors GOF Test					
315					10% Lilliefors Critical Value	0.223	Detected Data appear Lognormal at 10% Significance Level					
316					Detected Data appear Lognormal at 10% Significance Level							
317												
318					Lognormal ROS Statistics Using Imputed Non-Detects							

319				Mean in Original Scale		0.776				Mean in Log Scale		-0.46
320				SD in Original Scale		0.654				SD in Log Scale		0.625
321			95% t UCL (assumes normality of ROS data)			1.085				95% Percentile Bootstrap UCL		1.091
322				95% BCA Bootstrap UCL		1.2				95% Bootstrap t UCL		1.499
323				95% H-UCL (Log ROS)		1.133						
324												
325						Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution						
326				KM Mean (logged)		-0.466				KM Geo Mean		0.628
327				KM SD (logged)		0.634				95% Critical H Value (KM-Log)		2.257
328				KM Standard Error of Mean (logged)		0.184				95% H-UCL (KM -Log)		1.141
329				KM SD (logged)		0.634				95% Critical H Value (KM-Log)		2.257
330				KM Standard Error of Mean (logged)		0.184						
331												
332						DL/2 Statistics						
333				DL/2 Normal						DL/2 Log-Transformed		
334				Mean in Original Scale		0.83				Mean in Log Scale		-0.442
335				SD in Original Scale		0.688				SD in Log Scale		0.752
336				95% t UCL (Assumes normality)		1.156				95% H-Stat UCL		1.411
337						DL/2 is not a recommended method, provided for comparisons and historical reasons						
338												
339						Nonparametric Distribution Free UCL Statistics						
340						Detected Data appear Approximate Gamma Distributed at 5% Significance Level						
341												
342						Suggested UCL to Use						
343				95% KM Adjusted Gamma UCL		1.322				95% GROS Adjusted Gamma UCL		1.305
344												
345						When a data set follows an approximate distribution passing only one of the GOF tests,						
346						it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL						
347												
348						Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
349						Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.						
350						However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
351												
352												
353	Benz(a)anthracene											
354												
355						General Statistics						
356				Total Number of Observations		14				Number of Distinct Observations		12
357										Number of Missing Observations		14
358				Minimum		0.938				Mean		2.471
359				Maximum		4				Median		2.095
360				SD		1.072				Std. Error of Mean		0.286
361				Coefficient of Variation		0.434				Skewness		0.282
362												
363						Normal GOF Test						
364				Shapiro Wilk Test Statistic		0.894				Shapiro Wilk GOF Test		
365				1% Shapiro Wilk Critical Value		0.825				Data appear Normal at 1% Significance Level		
366				Lilliefors Test Statistic		0.178				Lilliefors GOF Test		
367				1% Lilliefors Critical Value		0.263				Data appear Normal at 1% Significance Level		
368						Data appear Normal at 1% Significance Level						
369												
370						Assuming Normal Distribution						
371						95% Normal UCL						95% UCLs (Adjusted for Skewness)

	A	B	C	D	E	F	G	H	I	J	K	L
372					95% Student's-t UCL	2.978			95% Adjusted-CLT UCL (Chen-1995)			2.965
373									95% Modified-t UCL (Johnson-1978)			2.981
374												
375					Gamma GOF Test							
376					A-D Test Statistic	0.496			Anderson-Darling Gamma GOF Test			
377					5% A-D Critical Value	0.738			Detected data appear Gamma Distributed at 5% Significance Level			
378					K-S Test Statistic	0.172			Kolmogorov-Smirnov Gamma GOF Test			
379					5% K-S Critical Value	0.229			Detected data appear Gamma Distributed at 5% Significance Level			
380					Detected data appear Gamma Distributed at 5% Significance Level							
381												
382					Gamma Statistics							
383					k hat (MLE)	5.301			k star (bias corrected MLE)			4.213
384					Theta hat (MLE)	0.466			Theta star (bias corrected MLE)			0.586
385					nu hat (MLE)	148.4			nu star (bias corrected)			118
386					MLE Mean (bias corrected)	2.471			MLE Sd (bias corrected)			1.204
387									Approximate Chi Square Value (0.05)			93.88
388					Adjusted Level of Significance	0.0312			Adjusted Chi Square Value			91.03
389												
390					Assuming Gamma Distribution							
391					95% Approximate Gamma UCL	3.104			95% Adjusted Gamma UCL			3.201
392												
393					Lognormal GOF Test							
394					Shapiro Wilk Test Statistic	0.908			Shapiro Wilk Lognormal GOF Test			
395					10% Shapiro Wilk Critical Value	0.895			Data appear Lognormal at 10% Significance Level			
396					Lilliefors Test Statistic	0.153			Lilliefors Lognormal GOF Test			
397					10% Lilliefors Critical Value	0.208			Data appear Lognormal at 10% Significance Level			
398					Data appear Lognormal at 10% Significance Level							
399												
400					Lognormal Statistics							
401					Minimum of Logged Data	-0.064			Mean of logged Data			0.807
402					Maximum of Logged Data	1.386			SD of logged Data			0.475
403												
404					Assuming Lognormal Distribution							
405					95% H-UCL	3.268			90% Chebyshev (MVUE) UCL			3.458
406					95% Chebyshev (MVUE) UCL	3.897			97.5% Chebyshev (MVUE) UCL			4.508
407					99% Chebyshev (MVUE) UCL	5.707						
408												
409					Nonparametric Distribution Free UCL Statistics							
410					Data appear to follow a Discernible Distribution							
411												
412					Nonparametric Distribution Free UCLs							
413					95% CLT UCL	2.942			95% BCA Bootstrap UCL			2.953
414					95% Standard Bootstrap UCL	2.928			95% Bootstrap-t UCL			3.012
415					95% Hall's Bootstrap UCL	2.946			95% Percentile Bootstrap UCL			2.922
416					90% Chebyshev(Mean, Sd) UCL	3.33			95% Chebyshev(Mean, Sd) UCL			3.719
417					97.5% Chebyshev(Mean, Sd) UCL	4.259			99% Chebyshev(Mean, Sd) UCL			5.32
418												
419					Suggested UCL to Use							
420					95% Student's-t UCL	2.978						
421												
422	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
423	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
424	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

	A	B	C	D	E	F	G	H	I	J	K	L
425												
426												
427	Benzo[a]pyrene											
428												
429	General Statistics											
430				Total Number of Observations		14				Number of Distinct Observations		13
431										Number of Missing Observations		14
432				Minimum		1.04				Mean		2.485
433				Maximum		4.03				Median		2.39
434				SD		0.893				Std. Error of Mean		0.239
435				Coefficient of Variation		0.359				Skewness		0.0789
436												
437	Normal GOF Test											
438				Shapiro Wilk Test Statistic		0.959			Shapiro Wilk GOF Test			
439				1% Shapiro Wilk Critical Value		0.825			Data appear Normal at 1% Significance Level			
440				Lilliefors Test Statistic		0.127			Lilliefors GOF Test			
441				1% Lilliefors Critical Value		0.263			Data appear Normal at 1% Significance Level			
442	Data appear Normal at 1% Significance Level											
443												
444	Assuming Normal Distribution											
445			95% Normal UCL						95% UCLs (Adjusted for Skewness)			
446				95% Student's-t UCL		2.908				95% Adjusted-CLT UCL (Chen-1995)		2.883
447										95% Modified-t UCL (Johnson-1978)		2.909
448												
449	Gamma GOF Test											
450				A-D Test Statistic		0.344			Anderson-Darling Gamma GOF Test			
451				5% A-D Critical Value		0.736			Detected data appear Gamma Distributed at 5% Significance Level			
452				K-S Test Statistic		0.141			Kolmogorov-Smirnov Gamma GOF Test			
453				5% K-S Critical Value		0.229			Detected data appear Gamma Distributed at 5% Significance Level			
454	Detected data appear Gamma Distributed at 5% Significance Level											
455												
456	Gamma Statistics											
457				k hat (MLE)		7.379				k star (bias corrected MLE)		5.846
458				Theta hat (MLE)		0.337				Theta star (bias corrected MLE)		0.425
459				nu hat (MLE)		206.6				nu star (bias corrected)		163.7
460				MLE Mean (bias corrected)		2.485				MLE Sd (bias corrected)		1.028
461										Approximate Chi Square Value (0.05)		135.1
462				Adjusted Level of Significance		0.0312				Adjusted Chi Square Value		131.7
463												
464	Assuming Gamma Distribution											
465				95% Approximate Gamma UCL		3.011				95% Adjusted Gamma UCL		3.089
466												
467	Lognormal GOF Test											
468				Shapiro Wilk Test Statistic		0.92			Shapiro Wilk Lognormal GOF Test			
469				10% Shapiro Wilk Critical Value		0.895			Data appear Lognormal at 10% Significance Level			
470				Lilliefors Test Statistic		0.164			Lilliefors Lognormal GOF Test			
471				10% Lilliefors Critical Value		0.208			Data appear Lognormal at 10% Significance Level			
472	Data appear Lognormal at 10% Significance Level											
473												
474	Lognormal Statistics											
475				Minimum of Logged Data		0.0392				Mean of logged Data		0.841
476				Maximum of Logged Data		1.394				SD of logged Data		0.405
477												

	A	B	C	D	E	F	G	H	I	J	K	L
478	Assuming Lognormal Distribution											
479					95% H-UCL	3.146				90% Chebyshev (MVUE) UCL		3.329
480					95% Chebyshev (MVUE) UCL	3.703				97.5% Chebyshev (MVUE) UCL		4.224
481					99% Chebyshev (MVUE) UCL	5.246						
482												
483	Nonparametric Distribution Free UCL Statistics											
484	Data appear to follow a Discernible Distribution											
485												
486	Nonparametric Distribution Free UCLs											
487					95% CLT UCL	2.878				95% BCA Bootstrap UCL		2.864
488					95% Standard Bootstrap UCL	2.863				95% Bootstrap-t UCL		2.918
489					95% Hall's Bootstrap UCL	2.91				95% Percentile Bootstrap UCL		2.855
490					90% Chebyshev(Mean, Sd) UCL	3.201				95% Chebyshev(Mean, Sd) UCL		3.526
491					97.5% Chebyshev(Mean, Sd) UCL	3.976				99% Chebyshev(Mean, Sd) UCL		4.86
492												
493	Suggested UCL to Use											
494					95% Student's-t UCL	2.908						
495												
496	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
497	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
498	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
499												
500	Benzo(b)fluoranthene											
501												
502	General Statistics											
503					Total Number of Observations	14				Number of Distinct Observations		14
504										Number of Missing Observations		14
505					Number of Detects	13				Number of Non-Detects		1
506					Number of Distinct Detects	13				Number of Distinct Non-Detects		1
507					Minimum Detect	0.89				Minimum Non-Detect		3
508					Maximum Detect	4.04				Maximum Non-Detect		3
509					Variance Detects	0.835				Percent Non-Detects		7.143%
510					Mean Detects	2.269				SD Detects		0.914
511					Median Detects	2.1				CV Detects		0.403
512					Skewness Detects	0.35				Kurtosis Detects		-0.28
513					Mean of Logged Detects	0.736				SD of Logged Detects		0.442
514												
515	Normal GOF Test on Detects Only											
516					Shapiro Wilk Test Statistic	0.97			Shapiro Wilk GOF Test			
517					1% Shapiro Wilk Critical Value	0.814			Detected Data appear Normal at 1% Significance Level			
518					Lilliefors Test Statistic	0.113			Lilliefors GOF Test			
519					1% Lilliefors Critical Value	0.271			Detected Data appear Normal at 1% Significance Level			
520	Detected Data appear Normal at 1% Significance Level											
521												
522	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
523					KM Mean	2.243				KM Standard Error of Mean		0.245
524					90KM SD	0.866				95% KM (BCA) UCL		2.603
525					95% KM (t) UCL	2.677				95% KM (Percentile Bootstrap) UCL		2.622
526					95% KM (z) UCL	2.646				95% KM Bootstrap t UCL		2.724
527					90% KM Chebyshev UCL	2.978				95% KM Chebyshev UCL		3.312
528					97.5% KM Chebyshev UCL	3.774				99% KM Chebyshev UCL		4.683
529												
530	Gamma GOF Tests on Detected Observations Only											

	A	B	C	D	E	F	G	H	I	J	K	L
531					A-D Test Statistic	0.225	Anderson-Darling GOF Test					
532					5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level					
533					K-S Test Statistic	0.139	Kolmogorov-Smirnov GOF					
534					5% K-S Critical Value	0.237	Detected data appear Gamma Distributed at 5% Significance Level					
535	Detected data appear Gamma Distributed at 5% Significance Level											
536												
537	Gamma Statistics on Detected Data Only											
538					k hat (MLE)	6.163				k star (bias corrected MLE)		4.792
539					Theta hat (MLE)	0.368				Theta star (bias corrected MLE)		0.474
540					nu hat (MLE)	160.2				nu star (bias corrected)		124.6
541					Mean (detects)	2.269						
542												
543	Gamma ROS Statistics using Imputed Non-Detects											
544	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
545	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
546	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
547	This is especially true when the sample size is small.											
548	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
549					Minimum	0.89				Mean		2.241
550					Maximum	4.04				Median		2.015
551					SD	0.884				CV		0.394
552					k hat (MLE)	6.533				k star (bias corrected MLE)		5.181
553					Theta hat (MLE)	0.343				Theta star (bias corrected MLE)		0.433
554					nu hat (MLE)	182.9				nu star (bias corrected)		145.1
555					Adjusted Level of Significance (β)	0.0312						
556					Approximate Chi Square Value (145.07, α)	118.2				Adjusted Chi Square Value (145.07, β)		115
557					95% Gamma Approximate UCL	2.75				95% Gamma Adjusted UCL		2.827
558												
559	Estimates of Gamma Parameters using KM Estimates											
560					Mean (KM)	2.243				SD (KM)		0.866
561					Variance (KM)	0.75				SE of Mean (KM)		0.245
562					k hat (KM)	6.707				k star (KM)		5.318
563					nu hat (KM)	187.8				nu star (KM)		148.9
564					theta hat (KM)	0.334				theta star (KM)		0.422
565					80% gamma percentile (KM)	2.994				90% gamma percentile (KM)		3.544
566					95% gamma percentile (KM)	4.044				99% gamma percentile (KM)		5.098
567												
568	Gamma Kaplan-Meier (KM) Statistics											
569					Approximate Chi Square Value (148.89, α)	121.7				Adjusted Chi Square Value (148.89, β)		118.4
570					95% KM Approximate Gamma UCL	2.744				95% KM Adjusted Gamma UCL		2.819
571												
572	Lognormal GOF Test on Detected Observations Only											
573					Shapiro Wilk Test Statistic	0.949	Shapiro Wilk GOF Test					
574					10% Shapiro Wilk Critical Value	0.889	Detected Data appear Lognormal at 10% Significance Level					
575					Lilliefors Test Statistic	0.167	Lilliefors GOF Test					
576					10% Lilliefors Critical Value	0.215	Detected Data appear Lognormal at 10% Significance Level					
577	Detected Data appear Lognormal at 10% Significance Level											
578												
579	Lognormal ROS Statistics Using Imputed Non-Detects											
580					Mean in Original Scale	2.236				Mean in Log Scale		0.726
581					SD in Original Scale	0.887				SD in Log Scale		0.427
582					95% t UCL (assumes normality of ROS data)	2.656				95% Percentile Bootstrap UCL		2.616
583					95% BCA Bootstrap UCL	2.624				95% Bootstrap t UCL		2.748

584				95% H-UCL (Log ROS)	2.866						
585											
586	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution										
587				KM Mean (logged)	0.725				KM Geo Mean	2.065	
588				KM SD (logged)	0.422				95% Critical H Value (KM-Log)	1.995	
589				KM Standard Error of Mean (logged)	0.121				95% H-UCL (KM -Log)	2.851	
590				KM SD (logged)	0.422				95% Critical H Value (KM-Log)	1.995	
591				KM Standard Error of Mean (logged)	0.121						
592											
593	DL/2 Statistics										
594				DL/2 Normal					DL/2 Log-Transformed		
595				Mean in Original Scale	2.214				Mean in Log Scale	0.713	
596				SD in Original Scale	0.902				SD in Log Scale	0.434	
597				95% t UCL (Assumes normality)	2.641				95% H-Stat UCL	2.85	
598	DL/2 is not a recommended method, provided for comparisons and historical reasons										
599											
600	Nonparametric Distribution Free UCL Statistics										
601	Detected Data appear Normal Distributed at 1% Significance Level										
602											
603	Suggested UCL to Use										
604				95% KM (t) UCL	2.677						
605											
606	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
607	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.										
608	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
609											
610	Benzo[g,h,i]perylene										
611											
612	General Statistics										
613				Total Number of Observations	14				Number of Distinct Observations	13	
614									Number of Missing Observations	14	
615				Number of Detects	13				Number of Non-Detects	1	
616				Number of Distinct Detects	12				Number of Distinct Non-Detects	1	
617				Minimum Detect	0.771				Minimum Non-Detect	3	
618				Maximum Detect	2.84				Maximum Non-Detect	3	
619				Variance Detects	0.298				Percent Non-Detects	7.143%	
620				Mean Detects	1.576				SD Detects	0.545	
621				Median Detects	1.63				CV Detects	0.346	
622				Skewness Detects	0.564				Kurtosis Detects	1.501	
623				Mean of Logged Detects	0.396				SD of Logged Detects	0.368	
624											
625	Normal GOF Test on Detects Only										
626				Shapiro Wilk Test Statistic	0.915				Shapiro Wilk GOF Test		
627				1% Shapiro Wilk Critical Value	0.814				Detected Data appear Normal at 1% Significance Level		
628				Lilliefors Test Statistic	0.195				Lilliefors GOF Test		
629				1% Lilliefors Critical Value	0.271				Detected Data appear Normal at 1% Significance Level		
630	Detected Data appear Normal at 1% Significance Level										
631											
632	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
633				KM Mean	1.576				KM Standard Error of Mean	0.151	
634				90KM SD	0.524				95% KM (BCA) UCL	1.798	
635				95% KM (t) UCL	1.844				95% KM (Percentile Bootstrap) UCL	1.808	
636				95% KM (z) UCL	1.825				95% KM Bootstrap t UCL	1.872	

	A	B	C	D	E	F	G	H	I	J	K	L
637					90% KM Chebyshev UCL	2.03				95% KM Chebyshev UCL		2.236
638					97.5% KM Chebyshev UCL	2.521				99% KM Chebyshev UCL		3.081
639												
640					Gamma GOF Tests on Detected Observations Only							
641					A-D Test Statistic	0.571		Anderson-Darling GOF Test				
642					5% A-D Critical Value	0.734		Detected data appear Gamma Distributed at 5% Significance Level				
643					K-S Test Statistic	0.24		Kolmogorov-Smirnov GOF				
644					5% K-S Critical Value	0.237		Detected Data Not Gamma Distributed at 5% Significance Level				
645					Detected data follow Appr. Gamma Distribution at 5% Significance Level							
646												
647					Gamma Statistics on Detected Data Only							
648					k hat (MLE)	8.659				k star (bias corrected MLE)		6.712
649					Theta hat (MLE)	0.182				Theta star (bias corrected MLE)		0.235
650					nu hat (MLE)	225.1				nu star (bias corrected)		174.5
651					Mean (detects)	1.576						
652												
653					Gamma ROS Statistics using Imputed Non-Detects							
654					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
655					GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
656					For such situations, GROS method may yield incorrect values of UCLs and BTVs							
657					This is especially true when the sample size is small.							
658					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
659					Minimum	0.771				Mean		1.573
660					Maximum	2.84				Median		1.615
661					SD	0.524				CV		0.333
662					k hat (MLE)	9.308				k star (bias corrected MLE)		7.361
663					Theta hat (MLE)	0.169				Theta star (bias corrected MLE)		0.214
664					nu hat (MLE)	260.6				nu star (bias corrected)		206.1
665					Adjusted Level of Significance (β)	0.0312						
666					Approximate Chi Square Value (206.11, α)	173.9				Adjusted Chi Square Value (206.11, β)		170
667					95% Gamma Approximate UCL	1.864				95% Gamma Adjusted UCL		1.907
668												
669					Estimates of Gamma Parameters using KM Estimates							
670					Mean (KM)	1.576				SD (KM)		0.524
671					Variance (KM)	0.275				SE of Mean (KM)		0.151
672					k hat (KM)	9.047				k star (KM)		7.156
673					nu hat (KM)	253.3				nu star (KM)		200.4
674					theta hat (KM)	0.174				theta star (KM)		0.22
675					80% gamma percentile (KM)	2.039				90% gamma percentile (KM)		2.363
676					95% gamma percentile (KM)	2.654				99% gamma percentile (KM)		3.259
677												
678					Gamma Kaplan-Meier (KM) Statistics							
679					Approximate Chi Square Value (200.37, α)	168.6				Adjusted Chi Square Value (200.37, β)		164.8
680					95% KM Approximate Gamma UCL	1.873				95% KM Adjusted Gamma UCL		1.917
681												
682					Lognormal GOF Test on Detected Observations Only							
683					Shapiro Wilk Test Statistic	0.908		Shapiro Wilk GOF Test				
684					10% Shapiro Wilk Critical Value	0.889		Detected Data appear Lognormal at 10% Significance Level				
685					Lilliefors Test Statistic	0.258		Lilliefors GOF Test				
686					10% Lilliefors Critical Value	0.215		Detected Data Not Lognormal at 10% Significance Level				
687					Detected Data appear Approximate Lognormal at 10% Significance Level							
688												
689					Lognormal ROS Statistics Using Imputed Non-Detects							

	A	B	C	D	E	F	G	H	I	J	K	L
690					Mean in Original Scale	1.57					Mean in Log Scale	0.396
691					SD in Original Scale	0.525					SD in Log Scale	0.353
692				95% t UCL (assumes normality of ROS data)		1.818					95% Percentile Bootstrap UCL	1.806
693					95% BCA Bootstrap UCL	1.814					95% Bootstrap t UCL	1.833
694					95% H-UCL (Log ROS)	1.913						
695												
696					Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution							
697					KM Mean (logged)	0.396					KM Geo Mean	1.486
698					KM SD (logged)	0.353					95% Critical H Value (KM-Log)	1.94
699					KM Standard Error of Mean (logged)	0.102					95% H-UCL (KM -Log)	1.913
700					KM SD (logged)	0.353					95% Critical H Value (KM-Log)	1.94
701					KM Standard Error of Mean (logged)	0.102						
702												
703					DL/2 Statistics							
704					DL/2 Normal						DL/2 Log-Transformed	
705					Mean in Original Scale	1.571					Mean in Log Scale	0.397
706					SD in Original Scale	0.524					SD in Log Scale	0.353
707					95% t UCL (Assumes normality)	1.819					95% H-Stat UCL	1.914
708					DL/2 is not a recommended method, provided for comparisons and historical reasons							
709												
710					Nonparametric Distribution Free UCL Statistics							
711					Detected Data appear Normal Distributed at 1% Significance Level							
712												
713					Suggested UCL to Use							
714					95% KM (t) UCL	1.844						
715												
716					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
717					Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.							
718					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
719												
720												
721	Benzo[k]fluoranthene											
722												
723					General Statistics							
724					Total Number of Observations	14					Number of Distinct Observations	13
725											Number of Missing Observations	14
726					Minimum	0.67					Mean	2.005
727					Maximum	3.41					Median	1.955
728					SD	0.935					Std. Error of Mean	0.25
729					Coefficient of Variation	0.466					Skewness	0.316
730												
731					Normal GOF Test							
732					Shapiro Wilk Test Statistic	0.926					Shapiro Wilk GOF Test	
733					1% Shapiro Wilk Critical Value	0.825					Data appear Normal at 1% Significance Level	
734					Lilliefors Test Statistic	0.147					Lilliefors GOF Test	
735					1% Lilliefors Critical Value	0.263					Data appear Normal at 1% Significance Level	
736					Data appear Normal at 1% Significance Level							
737												
738					Assuming Normal Distribution							
739					95% Normal UCL						95% UCLs (Adjusted for Skewness)	
740					95% Student's-t UCL	2.447					95% Adjusted-CLT UCL (Chen-1995)	2.438
741											95% Modified-t UCL (Johnson-1978)	2.45
742												

	A	B	C	D	E	F	G	H	I	J	K	L
743	Gamma GOF Test											
744				A-D Test Statistic		0.284	Anderson-Darling Gamma GOF Test					
745				5% A-D Critical Value		0.739	Detected data appear Gamma Distributed at 5% Significance Level					
746				K-S Test Statistic		0.131	Kolmogorov-Smirnov Gamma GOF Test					
747				5% K-S Critical Value		0.23	Detected data appear Gamma Distributed at 5% Significance Level					
748	Detected data appear Gamma Distributed at 5% Significance Level											
749												
750	Gamma Statistics											
751				k hat (MLE)		4.511	k star (bias corrected MLE)					3.592
752				Theta hat (MLE)		0.444	Theta star (bias corrected MLE)					0.558
753				nu hat (MLE)		126.3	nu star (bias corrected)					100.6
754				MLE Mean (bias corrected)		2.005	MLE Sd (bias corrected)					1.058
755							Approximate Chi Square Value (0.05)					78.44
756				Adjusted Level of Significance		0.0312	Adjusted Chi Square Value					75.85
757												
758	Assuming Gamma Distribution											
759				95% Approximate Gamma UCL		2.57	95% Adjusted Gamma UCL					2.658
760												
761	Lognormal GOF Test											
762				Shapiro Wilk Test Statistic		0.939	Shapiro Wilk Lognormal GOF Test					
763				10% Shapiro Wilk Critical Value		0.895	Data appear Lognormal at 10% Significance Level					
764				Lilliefors Test Statistic		0.134	Lilliefors Lognormal GOF Test					
765				10% Lilliefors Critical Value		0.208	Data appear Lognormal at 10% Significance Level					
766	Data appear Lognormal at 10% Significance Level											
767												
768	Lognormal Statistics											
769				Minimum of Logged Data		-0.4	Mean of logged Data					0.581
770				Maximum of Logged Data		1.227	SD of logged Data					0.519
771												
772	Assuming Lognormal Distribution											
773				95% H-UCL		2.741	90% Chebyshev (MVUE) UCL					2.891
774				95% Chebyshev (MVUE) UCL		3.285	97.5% Chebyshev (MVUE) UCL					3.83
775				99% Chebyshev (MVUE) UCL		4.902						
776												
777	Nonparametric Distribution Free UCL Statistics											
778	Data appear to follow a Discernible Distribution											
779												
780	Nonparametric Distribution Free UCLs											
781				95% CLT UCL		2.415	95% BCA Bootstrap UCL					2.426
782				95% Standard Bootstrap UCL		2.401	95% Bootstrap-t UCL					2.5
783				95% Hall's Bootstrap UCL		2.45	95% Percentile Bootstrap UCL					2.404
784				90% Chebyshev(Mean, Sd) UCL		2.754	95% Chebyshev(Mean, Sd) UCL					3.093
785				97.5% Chebyshev(Mean, Sd) UCL		3.564	99% Chebyshev(Mean, Sd) UCL					4.49
786												
787	Suggested UCL to Use											
788				95% Student's-t UCL		2.447						
789												
790	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
791	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
792	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
793												
794												
795	Chrysene											

796												
797	General Statistics											
798				Total Number of Observations		14				Number of Distinct Observations		13
799										Number of Missing Observations		14
800					Minimum	1.12				Mean		2.699
801					Maximum	4.7				Median		2.25
802					SD	1.144				Std. Error of Mean		0.306
803					Coefficient of Variation	0.424				Skewness		0.47
804												
805	Normal GOF Test											
806					Shapiro Wilk Test Statistic	0.901				Shapiro Wilk GOF Test		
807					1% Shapiro Wilk Critical Value	0.825				Data appear Normal at 1% Significance Level		
808					Lilliefors Test Statistic	0.246				Lilliefors GOF Test		
809					1% Lilliefors Critical Value	0.263				Data appear Normal at 1% Significance Level		
810	Data appear Normal at 1% Significance Level											
811												
812	Assuming Normal Distribution											
813				95% Normal UCL						95% UCLs (Adjusted for Skewness)		
814					95% Student's-t UCL	3.241				95% Adjusted-CLT UCL (Chen-1995)		3.243
815										95% Modified-t UCL (Johnson-1978)		3.247
816												
817	Gamma GOF Test											
818					A-D Test Statistic	0.579				Anderson-Darling Gamma GOF Test		
819					5% A-D Critical Value	0.737				Detected data appear Gamma Distributed at 5% Significance Level		
820					K-S Test Statistic	0.199				Kolmogorov-Smirnov Gamma GOF Test		
821					5% K-S Critical Value	0.229				Detected data appear Gamma Distributed at 5% Significance Level		
822	Detected data appear Gamma Distributed at 5% Significance Level											
823												
824	Gamma Statistics											
825					k hat (MLE)	5.872				k star (bias corrected MLE)		4.661
826					Theta hat (MLE)	0.46				Theta star (bias corrected MLE)		0.579
827					nu hat (MLE)	164.4				nu star (bias corrected)		130.5
828					MLE Mean (bias corrected)	2.699				MLE Sd (bias corrected)		1.25
829										Approximate Chi Square Value (0.05)		105.1
830					Adjusted Level of Significance	0.0312				Adjusted Chi Square Value		102.1
831												
832	Assuming Gamma Distribution											
833					95% Approximate Gamma UCL	3.351				95% Adjusted Gamma UCL		3.45
834												
835	Lognormal GOF Test											
836					Shapiro Wilk Test Statistic	0.917				Shapiro Wilk Lognormal GOF Test		
837					10% Shapiro Wilk Critical Value	0.895				Data appear Lognormal at 10% Significance Level		
838					Lilliefors Test Statistic	0.181				Lilliefors Lognormal GOF Test		
839					10% Lilliefors Critical Value	0.208				Data appear Lognormal at 10% Significance Level		
840	Data appear Lognormal at 10% Significance Level											
841												
842	Lognormal Statistics											
843					Minimum of Logged Data	0.113				Mean of logged Data		0.905
844					Maximum of Logged Data	1.548				SD of logged Data		0.443
845												
846	Assuming Lognormal Distribution											
847					95% H-UCL	3.49				90% Chebyshev (MVUE) UCL		3.692
848					95% Chebyshev (MVUE) UCL	4.138				97.5% Chebyshev (MVUE) UCL		4.757

	A	B	C	D	E	F	G	H	I	J	K	L
849				99% Chebyshev (MVUE) UCL		5.973						
850												
851					Nonparametric Distribution Free UCL Statistics							
852					Data appear to follow a Discernible Distribution							
853												
854					Nonparametric Distribution Free UCLs							
855				95% CLT UCL		3.202			95% BCA Bootstrap UCL		3.214	
856				95% Standard Bootstrap UCL		3.186			95% Bootstrap-t UCL		3.305	
857				95% Hall's Bootstrap UCL		3.22			95% Percentile Bootstrap UCL		3.177	
858				90% Chebyshev(Mean, Sd) UCL		3.616			95% Chebyshev(Mean, Sd) UCL		4.032	
859				97.5% Chebyshev(Mean, Sd) UCL		4.608			99% Chebyshev(Mean, Sd) UCL		5.741	
860												
861					Suggested UCL to Use							
862				95% Student's-t UCL		3.241						
863												
864	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
865	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
866	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
867												
868	Dibenz(a,h)anthracene											
869												
870					General Statistics							
871				Total Number of Observations		14			Number of Distinct Observations		13	
872									Number of Missing Observations		14	
873				Number of Detects		10			Number of Non-Detects		4	
874				Number of Distinct Detects		10			Number of Distinct Non-Detects		3	
875				Minimum Detect		0.208			Minimum Non-Detect		0.26	
876				Maximum Detect		0.91			Maximum Non-Detect		3	
877				Variance Detects		0.0316			Percent Non-Detects		28.57%	
878				Mean Detects		0.481			SD Detects		0.178	
879				Median Detects		0.455			CV Detects		0.37	
880				Skewness Detects		1.425			Kurtosis Detects		4.303	
881				Mean of Logged Detects		-0.791			SD of Logged Detects		0.365	
882												
883					Normal GOF Test on Detects Only							
884				Shapiro Wilk Test Statistic		0.846			Shapiro Wilk GOF Test			
885				1% Shapiro Wilk Critical Value		0.781			Detected Data appear Normal at 1% Significance Level			
886				Lilliefors Test Statistic		0.248			Lilliefors GOF Test			
887				1% Lilliefors Critical Value		0.304			Detected Data appear Normal at 1% Significance Level			
888					Detected Data appear Normal at 1% Significance Level							
889												
890					Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs							
891				KM Mean		0.418			KM Standard Error of Mean		0.0548	
892				90KM SD		0.187			95% KM (BCA) UCL		0.518	
893				95% KM (t) UCL		0.515			95% KM (Percentile Bootstrap) UCL		0.51	
894				95% KM (z) UCL		0.508			95% KM Bootstrap t UCL		0.532	
895				90% KM Chebyshev UCL		0.582			95% KM Chebyshev UCL		0.657	
896				97.5% KM Chebyshev UCL		0.76			99% KM Chebyshev UCL		0.963	
897												
898					Gamma GOF Tests on Detected Observations Only							
899				A-D Test Statistic		0.582			Anderson-Darling GOF Test			
900				5% A-D Critical Value		0.726			Detected data appear Gamma Distributed at 5% Significance Level			
901				K-S Test Statistic		0.202			Kolmogorov-Smirnov GOF			

	A	B	C	D	E	F	G	H	I	J	K	L
902					5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level					
903	Detected data appear Gamma Distributed at 5% Significance Level											
904												
905	Gamma Statistics on Detected Data Only											
906					k hat (MLE)	8.696			k star (bias corrected MLE)			6.154
907					Theta hat (MLE)	0.0553			Theta star (bias corrected MLE)			0.0781
908					nu hat (MLE)	173.9			nu star (bias corrected)			123.1
909					Mean (detects)	0.481						
910												
911	Gamma ROS Statistics using Imputed Non-Detects											
912	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
913	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
914	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
915	This is especially true when the sample size is small.											
916	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
917					Minimum	0.17			Mean			0.416
918					Maximum	0.91			Median			0.419
919					SD	0.188			CV			0.452
920					k hat (MLE)	5.487			k star (bias corrected MLE)			4.359
921					Theta hat (MLE)	0.0759			Theta star (bias corrected MLE)			0.0955
922					nu hat (MLE)	153.6			nu star (bias corrected)			122
923					Adjusted Level of Significance (β)	0.0312						
924					Approximate Chi Square Value (122.04, α)	97.53			Adjusted Chi Square Value (122.04, β)			94.63
925					95% Gamma Approximate UCL	0.521			95% Gamma Adjusted UCL			0.537
926												
927	Estimates of Gamma Parameters using KM Estimates											
928					Mean (KM)	0.418			SD (KM)			0.187
929					Variance (KM)	0.0351			SE of Mean (KM)			0.0548
930					k hat (KM)	4.971			k star (KM)			3.953
931					nu hat (KM)	139.2			nu star (KM)			110.7
932					theta hat (KM)	0.084			theta star (KM)			0.106
933					80% gamma percentile (KM)	0.577			90% gamma percentile (KM)			0.699
934					95% gamma percentile (KM)	0.812			99% gamma percentile (KM)			1.054
935												
936	Gamma Kaplan-Meier (KM) Statistics											
937					Approximate Chi Square Value (110.69, α)	87.41			Adjusted Chi Square Value (110.69, β)			84.67
938					95% KM Approximate Gamma UCL	0.529			95% KM Adjusted Gamma UCL			0.546
939												
940	Lognormal GOF Test on Detected Observations Only											
941					Shapiro Wilk Test Statistic	0.896	Shapiro Wilk GOF Test					
942					10% Shapiro Wilk Critical Value	0.869	Detected Data appear Lognormal at 10% Significance Level					
943					Lilliefors Test Statistic	0.22	Lilliefors GOF Test					
944					10% Lilliefors Critical Value	0.241	Detected Data appear Lognormal at 10% Significance Level					
945	Detected Data appear Lognormal at 10% Significance Level											
946												
947	Lognormal ROS Statistics Using Imputed Non-Detects											
948					Mean in Original Scale	0.422			Mean in Log Scale			-0.94
949					SD in Original Scale	0.18			SD in Log Scale			0.41
950					95% t UCL (assumes normality of ROS data)	0.508			95% Percentile Bootstrap UCL			0.506
951					95% BCA Bootstrap UCL	0.512			95% Bootstrap t UCL			0.531
952					95% H-UCL (Log ROS)	0.533						
953												
954	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											

955				KM Mean (logged)		-0.971				KM Geo Mean		0.379
956				KM SD (logged)		0.447				95% Critical H Value (KM-Log)		2.004
957				KM Standard Error of Mean (logged)		0.131				95% H-UCL (KM -Log)		0.537
958				KM SD (logged)		0.447				95% Critical H Value (KM-Log)		2.004
959				KM Standard Error of Mean (logged)		0.131						
960												
961						DL/2 Statistics						
962				DL/2 Normal						DL/2 Log-Transformed		
963				Mean in Original Scale		0.482				Mean in Log Scale		-0.948
964				SD in Original Scale		0.357				SD in Log Scale		0.688
965				95% t UCL (Assumes normality)		0.651				95% H-Stat UCL		0.765
966						DL/2 is not a recommended method, provided for comparisons and historical reasons						
967												
968						Nonparametric Distribution Free UCL Statistics						
969						Detected Data appear Normal Distributed at 1% Significance Level						
970												
971						Suggested UCL to Use						
972				95% KM (t) UCL		0.515						
973												
974						Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						
975						Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.						
976						However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.						
977												
978												
979	Fluoranthene											
980												
981						General Statistics						
982				Total Number of Observations		14				Number of Distinct Observations		14
983										Number of Missing Observations		14
984				Minimum		1.5				Mean		5.261
985				Maximum		10				Median		4.51
986				SD		2.586				Std. Error of Mean		0.691
987				Coefficient of Variation		0.491				Skewness		0.402
988												
989						Normal GOF Test						
990				Shapiro Wilk Test Statistic		0.941				Shapiro Wilk GOF Test		
991				1% Shapiro Wilk Critical Value		0.825				Data appear Normal at 1% Significance Level		
992				Lilliefors Test Statistic		0.169				Lilliefors GOF Test		
993				1% Lilliefors Critical Value		0.263				Data appear Normal at 1% Significance Level		
994						Data appear Normal at 1% Significance Level						
995												
996						Assuming Normal Distribution						
997				95% Normal UCL						95% UCLs (Adjusted for Skewness)		
998				95% Student's-t UCL		6.485				95% Adjusted-CLT UCL (Chen-1995)		6.477
999										95% Modified-t UCL (Johnson-1978)		6.498
1000												
1001						Gamma GOF Test						
1002				A-D Test Statistic		0.34				Anderson-Darling Gamma GOF Test		
1003				5% A-D Critical Value		0.74				Detected data appear Gamma Distributed at 5% Significance Level		
1004				K-S Test Statistic		0.166				Kolmogorov-Smirnov Gamma GOF Test		
1005				5% K-S Critical Value		0.23				Detected data appear Gamma Distributed at 5% Significance Level		
1006						Detected data appear Gamma Distributed at 5% Significance Level						
1007												

1008	Gamma Statistics											
1009					k hat (MLE)	3.994				k star (bias corrected MLE)		3.186
1010					Theta hat (MLE)	1.317				Theta star (bias corrected MLE)		1.652
1011					nu hat (MLE)	111.8				nu star (bias corrected)		89.2
1012					MLE Mean (bias corrected)	5.261				MLE Sd (bias corrected)		2.948
1013										Approximate Chi Square Value (0.05)		68.42
1014					Adjusted Level of Significance	0.0312				Adjusted Chi Square Value		66.01
1015												
1016	Assuming Gamma Distribution											
1017					95% Approximate Gamma UCL	6.859				95% Adjusted Gamma UCL		7.109
1018												
1019	Lognormal GOF Test											
1020					Shapiro Wilk Test Statistic	0.933				Shapiro Wilk Lognormal GOF Test		
1021					10% Shapiro Wilk Critical Value	0.895				Data appear Lognormal at 10% Significance Level		
1022					Lilliefors Test Statistic	0.167				Lilliefors Lognormal GOF Test		
1023					10% Lilliefors Critical Value	0.208				Data appear Lognormal at 10% Significance Level		
1024	Data appear Lognormal at 10% Significance Level											
1025												
1026	Lognormal Statistics											
1027					Minimum of Logged Data	0.405				Mean of logged Data		1.53
1028					Maximum of Logged Data	2.303				SD of logged Data		0.56
1029												
1030	Assuming Lognormal Distribution											
1031					95% H-UCL	7.493				90% Chebyshev (MVUE) UCL		7.813
1032					95% Chebyshev (MVUE) UCL	8.936				97.5% Chebyshev (MVUE) UCL		10.49
1033					99% Chebyshev (MVUE) UCL	13.55						
1034												
1035	Nonparametric Distribution Free UCL Statistics											
1036	Data appear to follow a Discernible Distribution											
1037												
1038	Nonparametric Distribution Free UCLs											
1039					95% CLT UCL	6.398				95% BCA Bootstrap UCL		6.469
1040					95% Standard Bootstrap UCL	6.351				95% Bootstrap-t UCL		6.619
1041					95% Hall's Bootstrap UCL	6.475				95% Percentile Bootstrap UCL		6.38
1042					90% Chebyshev(Mean, Sd) UCL	7.335				95% Chebyshev(Mean, Sd) UCL		8.274
1043					97.5% Chebyshev(Mean, Sd) UCL	9.577				99% Chebyshev(Mean, Sd) UCL		12.14
1044												
1045	Suggested UCL to Use											
1046					95% Student's-t UCL	6.485						
1047												
1048	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1049	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
1050	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1051												
1052	Fluorene											
1053												
1054	General Statistics											
1055					Total Number of Observations	14				Number of Distinct Observations		14
1056										Number of Missing Observations		14
1057					Number of Detects	12				Number of Non-Detects		2
1058					Number of Distinct Detects	12				Number of Distinct Non-Detects		2
1059					Minimum Detect	0.0418				Minimum Non-Detect		0.26
1060					Maximum Detect	2.2				Maximum Non-Detect		3

106					Variance Detects	0.353				Percent Non-Detects		14.29%
106					Mean Detects	0.369				SD Detects		0.594
106					Median Detects	0.142				CV Detects		1.613
106					Skewness Detects	3.123				Kurtosis Detects		10.23
106					Mean of Logged Detects	-1.634				SD of Logged Detects		1.054
106												
106					Normal GOF Test on Detects Only							
106					Shapiro Wilk Test Statistic	0.535			Shapiro Wilk GOF Test			
106					1% Shapiro Wilk Critical Value	0.805			Detected Data Not Normal at 1% Significance Level			
107					Lilliefors Test Statistic	0.346			Lilliefors GOF Test			
107					1% Lilliefors Critical Value	0.281			Detected Data Not Normal at 1% Significance Level			
107					Detected Data Not Normal at 1% Significance Level							
107												
107					Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs							
107					KM Mean	0.348				KM Standard Error of Mean		0.16
107					90KM SD	0.551				95% KM (BCA) UCL		0.65
107					95% KM (t) UCL	0.631				95% KM (Percentile Bootstrap) UCL		0.641
107					95% KM (z) UCL	0.611				95% KM Bootstrap t UCL		1.366
107					90% KM Chebyshev UCL	0.827				95% KM Chebyshev UCL		1.044
108					97.5% KM Chebyshev UCL	1.346				99% KM Chebyshev UCL		1.937
108												
108					Gamma GOF Tests on Detected Observations Only							
108					A-D Test Statistic	0.9			Anderson-Darling GOF Test			
108					5% A-D Critical Value	0.76			Detected Data Not Gamma Distributed at 5% Significance Level			
108					K-S Test Statistic	0.224			Kolmogorov-Smirnov GOF			
108					5% K-S Critical Value	0.253			Detected data appear Gamma Distributed at 5% Significance Level			
108					Detected data follow Appr. Gamma Distribution at 5% Significance Level							
108												
108					Gamma Statistics on Detected Data Only							
109					k hat (MLE)	0.917				k star (bias corrected MLE)		0.744
109					Theta hat (MLE)	0.402				Theta star (bias corrected MLE)		0.496
109					nu hat (MLE)	22.02				nu star (bias corrected)		17.84
109					Mean (detects)	0.369						
109												
109					Gamma ROS Statistics using Imputed Non-Detects							
109					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
109					GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
109					For such situations, GROS method may yield incorrect values of UCLs and BTVs							
109					This is especially true when the sample size is small.							
110					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
110					Minimum	0.01				Mean		0.331
110					Maximum	2.2				Median		0.142
110					SD	0.556				CV		1.683
110					k hat (MLE)	0.803				k star (bias corrected MLE)		0.678
110					Theta hat (MLE)	0.412				Theta star (bias corrected MLE)		0.487
110					nu hat (MLE)	22.47				nu star (bias corrected)		18.99
110					Adjusted Level of Significance (β)	0.0312						
110					Approximate Chi Square Value (18.99, α)	10.11				Adjusted Chi Square Value (18.99, β)		9.261
110					95% Gamma Approximate UCL	0.621				95% Gamma Adjusted UCL		0.678
111												
111					Estimates of Gamma Parameters using KM Estimates							
111					Mean (KM)	0.348				SD (KM)		0.551
111					Variance (KM)	0.304				SE of Mean (KM)		0.16

1114					k hat (KM)	0.399				k star (KM)	0.361	
1115					nu hat (KM)	11.16				nu star (KM)	10.1	
1116					theta hat (KM)	0.873				theta star (KM)	0.965	
1117					80% gamma percentile (KM)	0.554				90% gamma percentile (KM)	1	
1118					95% gamma percentile (KM)	1.498				99% gamma percentile (KM)	2.764	
1119												
1120					Gamma Kaplan-Meier (KM) Statistics							
1121					Approximate Chi Square Value (10.10, α)	4.006				Adjusted Chi Square Value (10.10, β)	3.512	
1122					95% KM Approximate Gamma UCL	0.878				95% KM Adjusted Gamma UCL	1.001	
1123												
1124					Lognormal GOF Test on Detected Observations Only							
1125					Shapiro Wilk Test Statistic	0.932				Shapiro Wilk GOF Test		
1126					10% Shapiro Wilk Critical Value	0.883				Detected Data appear Lognormal at 10% Significance Level		
1127					Lilliefors Test Statistic	0.172				Lilliefors GOF Test		
1128					10% Lilliefors Critical Value	0.223				Detected Data appear Lognormal at 10% Significance Level		
1129					Detected Data appear Lognormal at 10% Significance Level							
1130												
1131					Lognormal ROS Statistics Using Imputed Non-Detects							
1132					Mean in Original Scale	0.336				Mean in Log Scale	-1.683	
1133					SD in Original Scale	0.553				SD in Log Scale	0.984	
1134					95% t UCL (assumes normality of ROS data)	0.598				95% Percentile Bootstrap UCL	0.61	
1135					95% BCA Bootstrap UCL	0.761				95% Bootstrap t UCL	1.32	
1136					95% H-UCL (Log ROS)	0.641						
1137												
1138					Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution							
1139					KM Mean (logged)	-1.688				KM Geo Mean	0.185	
1140					KM SD (logged)	0.994				95% Critical H Value (KM-Log)	2.782	
1141					KM Standard Error of Mean (logged)	0.29				95% H-UCL (KM -Log)	0.652	
1142					KM SD (logged)	0.994				95% Critical H Value (KM-Log)	2.782	
1143					KM Standard Error of Mean (logged)	0.29						
1144												
1145					DL/2 Statistics							
1146					DL/2 Normal					DL/2 Log-Transformed		
1147					Mean in Original Scale	0.432				Mean in Log Scale	-1.517	
1148					SD in Original Scale	0.63				SD in Log Scale	1.122	
1149					95% t UCL (Assumes normality)	0.731				95% H-Stat UCL	1.045	
1150					DL/2 is not a recommended method, provided for comparisons and historical reasons							
1151												
1152					Nonparametric Distribution Free UCL Statistics							
1153					Detected Data appear Approximate Gamma Distributed at 5% Significance Level							
1154												
1155					Suggested UCL to Use							
1156					95% KM Bootstrap t UCL	1.366				95% Hall's Bootstrap	0.652	
1157												
1158					The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.							
1159					Please verify the data were collected from random locations.							
1160					If the data were collected using judgmental or other non-random methods,							
1161					then contact a statistician to correctly calculate UCLs.							
1162												
1163					When a data set follows an approximate distribution passing only one of the GOF tests,							
1164					it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL							
1165												
1166					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							

1167	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
1168	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1169												
1170	Indeno[1,2,3-cd]pyrene											
1171												
1172	General Statistics											
1173					Total Number of Observations	14			Number of Distinct Observations	12		
1174									Number of Missing Observations	14		
1175					Number of Detects	13			Number of Non-Detects	1		
1176					Number of Distinct Detects	11			Number of Distinct Non-Detects	1		
1177					Minimum Detect	0.711			Minimum Non-Detect	3		
1178					Maximum Detect	2.82			Maximum Non-Detect	3		
1179					Variance Detects	0.283			Percent Non-Detects	7.143%		
1180					Mean Detects	1.562			SD Detects	0.532		
1181					Median Detects	1.6			CV Detects	0.34		
1182					Skewness Detects	0.567			Kurtosis Detects	2.119		
1183					Mean of Logged Detects	0.388			SD of Logged Detects	0.369		
1184												
1185	Normal GOF Test on Detects Only											
1186					Shapiro Wilk Test Statistic	0.879			Shapiro Wilk GOF Test			
1187					1% Shapiro Wilk Critical Value	0.814			Detected Data appear Normal at 1% Significance Level			
1188					Lilliefors Test Statistic	0.244			Lilliefors GOF Test			
1189					1% Lilliefors Critical Value	0.271			Detected Data appear Normal at 1% Significance Level			
1190	Detected Data appear Normal at 1% Significance Level											
1191												
1192	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
1193					KM Mean	1.562			KM Standard Error of Mean	0.147		
1194					90KM SD	0.511			95% KM (BCA) UCL	1.77		
1195					95% KM (t) UCL	1.824			95% KM (Percentile Bootstrap) UCL	1.784		
1196					95% KM (z) UCL	1.805			95% KM Bootstrap t UCL	1.843		
1197					90% KM Chebyshev UCL	2.005			95% KM Chebyshev UCL	2.205		
1198					97.5% KM Chebyshev UCL	2.483			99% KM Chebyshev UCL	3.03		
1199												
1200	Gamma GOF Tests on Detected Observations Only											
1201					A-D Test Statistic	0.891			Anderson-Darling GOF Test			
1202					5% A-D Critical Value	0.734			Detected Data Not Gamma Distributed at 5% Significance Level			
1203					K-S Test Statistic	0.267			Kolmogorov-Smirnov GOF			
1204					5% K-S Critical Value	0.237			Detected Data Not Gamma Distributed at 5% Significance Level			
1205	Detected Data Not Gamma Distributed at 5% Significance Level											
1206												
1207	Gamma Statistics on Detected Data Only											
1208					k hat (MLE)	8.766			k star (bias corrected MLE)	6.794		
1209					Theta hat (MLE)	0.178			Theta star (bias corrected MLE)	0.23		
1210					nu hat (MLE)	227.9			nu star (bias corrected)	176.6		
1211					Mean (detects)	1.562						
1212												
1213	Gamma ROS Statistics using Imputed Non-Detects											
1214	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
1215	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
1216	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
1217	This is especially true when the sample size is small.											
1218	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
1219					Minimum	0.711			Mean	1.559		

1220					Maximum	2.82					Median	1.6
1221					SD	0.511					CV	0.328
1222					k hat (MLE)	9.423					k star (bias corrected MLE)	7.451
1223					Theta hat (MLE)	0.165					Theta star (bias corrected MLE)	0.209
1224					nu hat (MLE)	263.8					nu star (bias corrected)	208.6
1225					Adjusted Level of Significance (β)	0.0312						
1226					Approximate Chi Square Value (208.64, α)	176.2					Adjusted Chi Square Value (208.64, β)	172.3
1227					95% Gamma Approximate UCL	1.846					95% Gamma Adjusted UCL	1.889
1228												
1229					Estimates of Gamma Parameters using KM Estimates							
1230					Mean (KM)	1.562					SD (KM)	0.511
1231					Variance (KM)	0.261					SE of Mean (KM)	0.147
1232					k hat (KM)	9.355					k star (KM)	7.398
1233					nu hat (KM)	261.9					nu star (KM)	207.1
1234					theta hat (KM)	0.167					theta star (KM)	0.211
1235					80% gamma percentile (KM)	2.014					90% gamma percentile (KM)	2.329
1236					95% gamma percentile (KM)	2.611					99% gamma percentile (KM)	3.198
1237												
1238					Gamma Kaplan-Meier (KM) Statistics							
1239					Approximate Chi Square Value (207.14, α)	174.8					Adjusted Chi Square Value (207.14, β)	170.9
1240					95% KM Approximate Gamma UCL	1.851					95% KM Adjusted Gamma UCL	1.894
1241												
1242					Lognormal GOF Test on Detected Observations Only							
1243					Shapiro Wilk Test Statistic	0.866					Shapiro Wilk GOF Test	
1244					10% Shapiro Wilk Critical Value	0.889					Detected Data Not Lognormal at 10% Significance Level	
1245					Lilliefors Test Statistic	0.288					Lilliefors GOF Test	
1246					10% Lilliefors Critical Value	0.215					Detected Data Not Lognormal at 10% Significance Level	
1247					Detected Data Not Lognormal at 10% Significance Level							
1248												
1249					Lognormal ROS Statistics Using Imputed Non-Detects							
1250					Mean in Original Scale	1.556					Mean in Log Scale	0.388
1251					SD in Original Scale	0.511					SD in Log Scale	0.354
1252					95% t UCL (assumes normality of ROS data)	1.798					95% Percentile Bootstrap UCL	1.783
1253					95% BCA Bootstrap UCL	1.79					95% Bootstrap t UCL	1.813
1254					95% H-UCL (Log ROS)	1.899						
1255												
1256					Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution							
1257					KM Mean (logged)	0.388					KM Geo Mean	1.474
1258					KM SD (logged)	0.354					95% Critical H Value (KM-Log)	1.941
1259					KM Standard Error of Mean (logged)	0.102					95% H-UCL (KM -Log)	1.899
1260					KM SD (logged)	0.354					95% Critical H Value (KM-Log)	1.941
1261					KM Standard Error of Mean (logged)	0.102						
1262												
1263					DL/2 Statistics							
1264					DL/2 Normal						DL/2 Log-Transformed	
1265					Mean in Original Scale	1.558					Mean in Log Scale	0.389
1266					SD in Original Scale	0.511					SD in Log Scale	0.354
1267					95% t UCL (Assumes normality)	1.8					95% H-Stat UCL	1.901
1268					DL/2 is not a recommended method, provided for comparisons and historical reasons							
1269												
1270					Nonparametric Distribution Free UCL Statistics							
1271					Detected Data appear Normal Distributed at 1% Significance Level							
1272												

1273	Suggested UCL to Use											
1274					95% KM (t) UCL	1.824						
1275												
1276	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1277	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
1278	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1279												
1280	Naphthalene											
1281												
1282	General Statistics											
1283					Total Number of Observations	14			Number of Distinct Observations	13		
1284									Number of Missing Observations	14		
1285					Number of Detects	8			Number of Non-Detects	6		
1286					Number of Distinct Detects	8			Number of Distinct Non-Detects	5		
1287					Minimum Detect	0.0341			Minimum Non-Detect	0.16		
1288					Maximum Detect	0.37			Maximum Non-Detect	3		
1289					Variance Detects	0.013			Percent Non-Detects	42.86%		
1290					Mean Detects	0.0929			SD Detects	0.114		
1291					Median Detects	0.048			CV Detects	1.226		
1292					Skewness Detects	2.653			Kurtosis Detects	7.191		
1293					Mean of Logged Detects	-2.743			SD of Logged Detects	0.781		
1294												
1295	Normal GOF Test on Detects Only											
1296					Shapiro Wilk Test Statistic	0.564			Shapiro Wilk GOF Test			
1297					1% Shapiro Wilk Critical Value	0.749			Detected Data Not Normal at 1% Significance Level			
1298					Lilliefors Test Statistic	0.357			Lilliefors GOF Test			
1299					1% Lilliefors Critical Value	0.333			Detected Data Not Normal at 1% Significance Level			
1300	Detected Data Not Normal at 1% Significance Level											
1301												
1302	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
1303					KM Mean	0.0777			KM Standard Error of Mean	0.0262		
1304					90KM SD	0.0867			95% KM (BCA) UCL	0.124		
1305					95% KM (t) UCL	0.124			95% KM (Percentile Bootstrap) UCL	0.124		
1306					95% KM (z) UCL	0.121			95% KM Bootstrap t UCL	0.333		
1307					90% KM Chebyshev UCL	0.156			95% KM Chebyshev UCL	0.192		
1308					97.5% KM Chebyshev UCL	0.241			99% KM Chebyshev UCL	0.338		
1309	Note: KM UCLs may be biased low with this dataset. Other substitution method recommended											
1310												
1311	Gamma GOF Tests on Detected Observations Only											
1312					A-D Test Statistic	1.157			Anderson-Darling GOF Test			
1313					5% A-D Critical Value	0.728			Detected Data Not Gamma Distributed at 5% Significance Level			
1314					K-S Test Statistic	0.322			Kolmogorov-Smirnov GOF			
1315					5% K-S Critical Value	0.299			Detected Data Not Gamma Distributed at 5% Significance Level			
1316	Detected Data Not Gamma Distributed at 5% Significance Level											
1317												
1318	Gamma Statistics on Detected Data Only											
1319					k hat (MLE)	1.508			k star (bias corrected MLE)	1.026		
1320					Theta hat (MLE)	0.0616			Theta star (bias corrected MLE)	0.0906		
1321					nu hat (MLE)	24.12			nu star (bias corrected)	16.41		
1322					Mean (detects)	0.0929						
1323												
1324	Gamma ROS Statistics using Imputed Non-Detects											
1325	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											

1326	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
1327	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
1328	This is especially true when the sample size is small.											
1329	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
1330					Minimum	0.0223				Mean	0.0765	
1331					Maximum	0.37				Median	0.0522	
1332					SD	0.0869				CV	1.135	
1333					k hat (MLE)	1.967				k star (bias corrected MLE)	1.593	
1334					Theta hat (MLE)	0.0389				Theta star (bias corrected MLE)	0.048	
1335					nu hat (MLE)	55.08				nu star (bias corrected)	44.61	
1336					Adjusted Level of Significance (β)	0.0312						
1337					Approximate Chi Square Value (44.61, α)	30.29				Adjusted Chi Square Value (44.61, β)	28.73	
1338					95% Gamma Approximate UCL	0.113				95% Gamma Adjusted UCL	0.119	
1339												
1340	Estimates of Gamma Parameters using KM Estimates											
1341					Mean (KM)	0.0777				SD (KM)	0.0867	
1342					Variance (KM)	0.00752				SE of Mean (KM)	0.0262	
1343					k hat (KM)	0.802				k star (KM)	0.678	
1344					nu hat (KM)	22.47				nu star (KM)	18.99	
1345					theta hat (KM)	0.0968				theta star (KM)	0.115	
1346					80% gamma percentile (KM)	0.128				90% gamma percentile (KM)	0.196	
1347					95% gamma percentile (KM)	0.267				99% gamma percentile (KM)	0.437	
1348												
1349	Gamma Kaplan-Meier (KM) Statistics											
1350					Approximate Chi Square Value (18.99, α)	10.11				Adjusted Chi Square Value (18.99, β)	9.259	
1351					95% KM Approximate Gamma UCL	0.146				95% KM Adjusted Gamma UCL	0.159	
1352	Note: KM UCLs may be biased low with this dataset. Other substitution method recommended											
1353												
1354	Lognormal GOF Test on Detected Observations Only											
1355					Shapiro Wilk Test Statistic	0.77				Shapiro Wilk GOF Test		
1356					10% Shapiro Wilk Critical Value	0.851				Detected Data Not Lognormal at 10% Significance Level		
1357					Lilliefors Test Statistic	0.268				Lilliefors GOF Test		
1358					10% Lilliefors Critical Value	0.265				Detected Data Not Lognormal at 10% Significance Level		
1359	Detected Data Not Lognormal at 10% Significance Level											
1360												
1361	Lognormal ROS Statistics Using Imputed Non-Detects											
1362					Mean in Original Scale	0.0772				Mean in Log Scale	-2.807	
1363					SD in Original Scale	0.0859				SD in Log Scale	0.591	
1364					95% t UCL (assumes normality of ROS data)	0.118				95% Percentile Bootstrap UCL	0.122	
1365					95% BCA Bootstrap UCL	0.148				95% Bootstrap t UCL	0.299	
1366					95% H-UCL (Log ROS)	0.103						
1367												
1368	Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution											
1369					KM Mean (logged)	-2.839				KM Geo Mean	0.0585	
1370					KM SD (logged)	0.621				95% Critical H Value (KM-Log)	2.24	
1371					KM Standard Error of Mean (logged)	0.201				95% H-UCL (KM -Log)	0.104	
1372					KM SD (logged)	0.621				95% Critical H Value (KM-Log)	2.24	
1373					KM Standard Error of Mean (logged)	0.201						
1374	Note: KM UCLs may be biased low with this dataset. Other substitution method recommended											
1375												
1376	DL/2 Statistics											
1377	DL/2 Normal						DL/2 Log-Transformed					
1378					Mean in Original Scale	0.207				Mean in Log Scale	-2.274	

1379				SD in Original Scale	0.382					SD in Log Scale		1.028
1380				95% t UCL (Assumes normality)	0.388					95% H-Stat UCL		0.392
1381	DL/2 is not a recommended method, provided for comparisons and historical reasons											
1382												
1383	Nonparametric Distribution Free UCL Statistics											
1384	Data do not follow a Discernible Distribution											
1385												
1386	Suggested UCL to Use											
1387				95% KM (t) UCL	0.124							
1388												
1389	The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.											
1390	Please verify the data were collected from random locations.											
1391	If the data were collected using judgmental or other non-random methods,											
1392	then contact a statistician to correctly calculate UCLs.											
1393												
1394	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1395	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
1396	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1397												
1398												
1399	Phenanthrene											
1400												
1401	General Statistics											
1402				Total Number of Observations	14					Number of Distinct Observations		13
1403										Number of Missing Observations		14
1404				Minimum	0.81					Mean		3.212
1405				Maximum	12					Median		2.075
1406				SD	2.964					Std. Error of Mean		0.792
1407				Coefficient of Variation	0.923					Skewness		2.281
1408												
1409	Normal GOF Test											
1410				Shapiro Wilk Test Statistic	0.721					Shapiro Wilk GOF Test		
1411				1% Shapiro Wilk Critical Value	0.825					Data Not Normal at 1% Significance Level		
1412				Lilliefors Test Statistic	0.309					Lilliefors GOF Test		
1413				1% Lilliefors Critical Value	0.263					Data Not Normal at 1% Significance Level		
1414	Data Not Normal at 1% Significance Level											
1415												
1416	Assuming Normal Distribution											
1417				95% Normal UCL						95% UCLs (Adjusted for Skewness)		
1418				95% Student's-t UCL	4.615					95% Adjusted-CLT UCL (Chen-1995)		5.031
1419										95% Modified-t UCL (Johnson-1978)		4.695
1420												
1421	Gamma GOF Test											
1422				A-D Test Statistic	0.68					Anderson-Darling Gamma GOF Test		
1423				5% A-D Critical Value	0.747					Detected data appear Gamma Distributed at 5% Significance Level		
1424				K-S Test Statistic	0.248					Kolmogorov-Smirnov Gamma GOF Test		
1425				5% K-S Critical Value	0.232					Data Not Gamma Distributed at 5% Significance Level		
1426	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
1427												
1428	Gamma Statistics											
1429				k hat (MLE)	1.905					k star (bias corrected MLE)		1.544
1430				Theta hat (MLE)	1.686					Theta star (bias corrected MLE)		2.08
1431				nu hat (MLE)	53.34					nu star (bias corrected)		43.24

1432					MLE Mean (bias corrected)	3.212				MLE Sd (bias corrected)		2.585
1433										Approximate Chi Square Value (0.05)		29.16
1434					Adjusted Level of Significance	0.0312				Adjusted Chi Square Value		27.64
1435												
1436					Assuming Gamma Distribution							
1437					95% Approximate Gamma UCL	4.762				95% Adjusted Gamma UCL		5.026
1438												
1439					Lognormal GOF Test							
1440					Shapiro Wilk Test Statistic	0.939				Shapiro Wilk Lognormal GOF Test		
1441					10% Shapiro Wilk Critical Value	0.895				Data appear Lognormal at 10% Significance Level		
1442					Lilliefors Test Statistic	0.196				Lilliefors Lognormal GOF Test		
1443					10% Lilliefors Critical Value	0.208				Data appear Lognormal at 10% Significance Level		
1444					Data appear Lognormal at 10% Significance Level							
1445												
1446					Lognormal Statistics							
1447					Minimum of Logged Data	-0.211				Mean of logged Data		0.882
1448					Maximum of Logged Data	2.485				SD of logged Data		0.745
1449												
1450					Assuming Lognormal Distribution							
1451					95% H-UCL	5.234				90% Chebyshev (MVUE) UCL		5.076
1452					95% Chebyshev (MVUE) UCL	5.965				97.5% Chebyshev (MVUE) UCL		7.199
1453					99% Chebyshev (MVUE) UCL	9.623						
1454												
1455					Nonparametric Distribution Free UCL Statistics							
1456					Data appear to follow a Discernible Distribution							
1457												
1458					Nonparametric Distribution Free UCLs							
1459					95% CLT UCL	4.515				95% BCA Bootstrap UCL		5.141
1460					95% Standard Bootstrap UCL	4.468				95% Bootstrap-t UCL		6.118
1461					95% Hall's Bootstrap UCL	9.087				95% Percentile Bootstrap UCL		4.557
1462					90% Chebyshev(Mean, Sd) UCL	5.588				95% Chebyshev(Mean, Sd) UCL		6.664
1463					97.5% Chebyshev(Mean, Sd) UCL	8.158				99% Chebyshev(Mean, Sd) UCL		11.09
1464												
1465					Suggested UCL to Use							
1466					95% Adjusted Gamma UCL	5.026						
1467												
1468					When a data set follows an approximate distribution passing only one of the GOF tests,							
1469					it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL							
1470												
1471					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
1472					Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.							
1473					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
1474												
1475												
1476	Pyrene											
1477												
1478					General Statistics							
1479					Total Number of Observations	14				Number of Distinct Observations		14
1480										Number of Missing Observations		14
1481					Minimum	1.6				Mean		5.065
1482					Maximum	8.8				Median		4.225
1483					SD	2.519				Std. Error of Mean		0.673
1484					Coefficient of Variation	0.497				Skewness		0.318

1485												
1486						Normal GOF Test						
1487					Shapiro Wilk Test Statistic	0.899			Shapiro Wilk GOF Test			
1488					1% Shapiro Wilk Critical Value	0.825			Data appear Normal at 1% Significance Level			
1489					Lilliefors Test Statistic	0.18			Lilliefors GOF Test			
1490					1% Lilliefors Critical Value	0.263			Data appear Normal at 1% Significance Level			
1491						Data appear Normal at 1% Significance Level						
1492												
1493						Assuming Normal Distribution						
1494					95% Normal UCL				95% UCLs (Adjusted for Skewness)			
1495					95% Student's-t UCL	6.257			95% Adjusted-CLT UCL (Chen-1995)	6.234		
1496									95% Modified-t UCL (Johnson-1978)	6.267		
1497												
1498						Gamma GOF Test						
1499					A-D Test Statistic	0.434			Anderson-Darling Gamma GOF Test			
1500					5% A-D Critical Value	0.74			Detected data appear Gamma Distributed at 5% Significance Level			
1501					K-S Test Statistic	0.173			Kolmogorov-Smirnov Gamma GOF Test			
1502					5% K-S Critical Value	0.23			Detected data appear Gamma Distributed at 5% Significance Level			
1503						Detected data appear Gamma Distributed at 5% Significance Level						
1504												
1505						Gamma Statistics						
1506					k hat (MLE)	3.984			k star (bias corrected MLE)	3.178		
1507					Theta hat (MLE)	1.271			Theta star (bias corrected MLE)	1.594		
1508					nu hat (MLE)	111.6			nu star (bias corrected)	88.99		
1509					MLE Mean (bias corrected)	5.065			MLE Sd (bias corrected)	2.841		
1510									Approximate Chi Square Value (0.05)	68.24		
1511					Adjusted Level of Significance	0.0312			Adjusted Chi Square Value	65.83		
1512												
1513						Assuming Gamma Distribution						
1514					95% Approximate Gamma UCL	6.605			95% Adjusted Gamma UCL	6.847		
1515												
1516						Lognormal GOF Test						
1517					Shapiro Wilk Test Statistic	0.921			Shapiro Wilk Lognormal GOF Test			
1518					10% Shapiro Wilk Critical Value	0.895			Data appear Lognormal at 10% Significance Level			
1519					Lilliefors Test Statistic	0.152			Lilliefors Lognormal GOF Test			
1520					10% Lilliefors Critical Value	0.208			Data appear Lognormal at 10% Significance Level			
1521						Data appear Lognormal at 10% Significance Level						
1522												
1523						Lognormal Statistics						
1524					Minimum of Logged Data	0.47			Mean of logged Data	1.492		
1525					Maximum of Logged Data	2.175			SD of logged Data	0.554		
1526												
1527						Assuming Lognormal Distribution						
1528					95% H-UCL	7.144			90% Chebyshev (MVUE) UCL	7.466		
1529					95% Chebyshev (MVUE) UCL	8.529			97.5% Chebyshev (MVUE) UCL	10.01		
1530					99% Chebyshev (MVUE) UCL	12.91						
1531												
1532						Nonparametric Distribution Free UCL Statistics						
1533						Data appear to follow a Discernible Distribution						
1534												
1535						Nonparametric Distribution Free UCLs						
1536					95% CLT UCL	6.172			95% BCA Bootstrap UCL	6.19		
1537					95% Standard Bootstrap UCL	6.137			95% Bootstrap-t UCL	6.367		

1538				95% Hall's Bootstrap UCL		6.148			95% Percentile Bootstrap UCL			6.161
1539				90% Chebyshev(Mean, Sd) UCL		7.085			95% Chebyshev(Mean, Sd) UCL			8
1540				97.5% Chebyshev(Mean, Sd) UCL		9.27			99% Chebyshev(Mean, Sd) UCL			11.76
1541												
1542						Suggested UCL to Use						
1543				95% Student's-t UCL		6.257						
1544												
1545	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1546	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
1547	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1548												
1549												
1550	Total PAHs											
1551												
1552						General Statistics						
1553				Total Number of Observations		14			Number of Distinct Observations			14
1554									Number of Missing Observations			14
1555				Minimum		11.7			Mean			32.46
1556				Maximum		63.4			Median			26.85
1557				SD		16.07			Std. Error of Mean			4.295
1558				Coefficient of Variation		0.495			Skewness			0.724
1559												
1560						Normal GOF Test						
1561				Shapiro Wilk Test Statistic		0.915			Shapiro Wilk GOF Test			
1562				1% Shapiro Wilk Critical Value		0.825			Data appear Normal at 1% Significance Level			
1563				Lilliefors Test Statistic		0.195			Lilliefors GOF Test			
1564				1% Lilliefors Critical Value		0.263			Data appear Normal at 1% Significance Level			
1565						Data appear Normal at 1% Significance Level						
1566												
1567						Assuming Normal Distribution						
1568				95% Normal UCL					95% UCLs (Adjusted for Skewness)			
1569				95% Student's-t UCL		40.06			95% Adjusted-CLT UCL (Chen-1995)			40.41
1570									95% Modified-t UCL (Johnson-1978)			40.2
1571												
1572						Gamma GOF Test						
1573				A-D Test Statistic		0.329			Anderson-Darling Gamma GOF Test			
1574				5% A-D Critical Value		0.739			Detected data appear Gamma Distributed at 5% Significance Level			
1575				K-S Test Statistic		0.145			Kolmogorov-Smirnov Gamma GOF Test			
1576				5% K-S Critical Value		0.23			Detected data appear Gamma Distributed at 5% Significance Level			
1577						Detected data appear Gamma Distributed at 5% Significance Level						
1578												
1579						Gamma Statistics						
1580				k hat (MLE)		4.411			k star (bias corrected MLE)			3.514
1581				Theta hat (MLE)		7.358			Theta star (bias corrected MLE)			9.238
1582				nu hat (MLE)		123.5			nu star (bias corrected)			98.38
1583				MLE Mean (bias corrected)		32.46			MLE Sd (bias corrected)			17.32
1584									Approximate Chi Square Value (0.05)			76.5
1585				Adjusted Level of Significance		0.0312			Adjusted Chi Square Value			73.94
1586												
1587						Assuming Gamma Distribution						
1588				95% Approximate Gamma UCL		41.74			95% Adjusted Gamma UCL			43.18
1589												
1590						Lognormal GOF Test						

159					Shapiro Wilk Test Statistic	0.946	Shapiro Wilk Lognormal GOF Test					
159					10% Shapiro Wilk Critical Value	0.895	Data appear Lognormal at 10% Significance Level					
159					Lilliefors Test Statistic	0.162	Lilliefors Lognormal GOF Test					
159					10% Lilliefors Critical Value	0.208	Data appear Lognormal at 10% Significance Level					
159					Data appear Lognormal at 10% Significance Level							
159												
159					Lognormal Statistics							
159					Minimum of Logged Data	2.46				Mean of logged Data	3.362	
159					Maximum of Logged Data	4.149				SD of logged Data	0.515	
160												
160					Assuming Lognormal Distribution							
160					95% H-UCL	43.99				90% Chebyshev (MVUE) UCL	46.45	
160					95% Chebyshev (MVUE) UCL	52.73				97.5% Chebyshev (MVUE) UCL	61.43	
160					99% Chebyshev (MVUE) UCL	78.54						
160												
160					Nonparametric Distribution Free UCL Statistics							
160					Data appear to follow a Discernible Distribution							
160												
160					Nonparametric Distribution Free UCLs							
161					95% CLT UCL	39.52				95% BCA Bootstrap UCL	40.04	
161					95% Standard Bootstrap UCL	39.28				95% Bootstrap-t UCL	41.97	
161					95% Hall's Bootstrap UCL	40.75				95% Percentile Bootstrap UCL	39.39	
161					90% Chebyshev(Mean, Sd) UCL	45.34				95% Chebyshev(Mean, Sd) UCL	51.18	
161					97.5% Chebyshev(Mean, Sd) UCL	59.28				99% Chebyshev(Mean, Sd) UCL	75.19	
161												
161					Suggested UCL to Use							
161					95% Student's-t UCL	40.06						
161												
161					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
162					Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.							
162					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
162												

Appendix D

ProUCL Background Assessment Output

t-Test Sample 1 vs Sample 2 Comparison for Uncensored Full Data Sets without NDs

User Selected Options	
Date/Time of Computation	ProUCL 5.2 2/13/2023 10:02:57 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Sample 1 Mean <= Sample 2 Mean (Form 1)
Alternative Hypothesis	Sample 1 Mean > the Sample 2 Mean

Sample 1 Data: HMW_Site Sediments

Sample 2 Data: HMW_Bkgrd Sediments

Raw Statistics

	Sample 1	Sample 2
Number of Valid Observations	14	14
Number of Missing Observations	13	13
Number of Distinct Observations	14	14
Minimum	10.1	6.937
Maximum	44.58	74.6
Mean	26.27	21.91
Median	23.27	17.53
SD	10.98	17.65
SE of Mean	2.935	4.718

Sample 1 vs Sample 2 Two-Sample t-Test

H0: Mean of Sample 1 - Mean of Sample 2 <= 0

Method	DF	t-Test Value	Critical t (0.05)	P-Value
Pooled (Equal Variance)	26	0.785	1.706	0.220
Welch-Satterthwaite (Unequal Vari	21.7	0.785	1.717	0.221

Pooled SD 14.701

Conclusion with Alpha = 0.050

Student t (Pooled) Test: Do Not Reject H0, Conclude Sample 1 <= Sample 2

Welch-Satterthwaite Test: Do Not Reject H0, Conclude Sample 1 <= Sample 2

Test of Equality of Variances

Variance of Sample 1	120.6
Variance of Sample 2	311.7

Numerator DF	Denominator DF	F-Test Value	P-Value
13	13	2.585	0.099

Conclusion with Alpha = 0.05

Two variances appear to be equal

t-Test Sample 1 vs Sample 2 Comparison for Uncensored Full Data Sets without NDs

User Selected Options	
Date/Time of Computation	ProUCL 5.2 2/13/2023 10:24:15 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Sample 1 Mean <= Sample 2 Mean (Form 1)
Alternative Hypothesis	Sample 1 Mean > the Sample 2 Mean

Sample 1 Data: LMW_Site Sediments

Sample 2 Data: LMW_Bkgrd Sediments

Raw Statistics

	Sample 1	Sample 2
Number of Valid Observations	14	14
Number of Missing Observations	13	13
Number of Distinct Observations	14	14
Minimum	1.374	1.149
Maximum	20.5	26.15
Mean	6.187	5.57
Median	3.592	3.732
SD	6.224	6.259
SE of Mean	1.663	1.673

Sample 1 vs Sample 2 Two-Sample t-Test

H0: Mean of Sample 1 - Mean of Sample 2 <= 0

Method	DF	t-Test Value	Critical t (0.05)	P-Value
Pooled (Equal Variance)	26	0.261	1.706	0.398
Welch-Satterthwaite (Unequal Vari	26.0	0.261	1.706	0.398

Pooled SD 6.242

Conclusion with Alpha = 0.050

Student t (Pooled) Test: Do Not Reject H0, Conclude Sample 1 <= Sample 2

Welch-Satterthwaite Test: Do Not Reject H0, Conclude Sample 1 <= Sample 2

Test of Equality of Variances

Variance of Sample 1	38.74
Variance of Sample 2	39.18

Numerator DF	Denominator DF	F-Test Value	P-Value
13	13	1.011	0.984

Conclusion with Alpha = 0.05

Two variances appear to be equal

t-Test Sample 1 vs Sample 2 Comparison for Uncensored Full Data Sets without NDs

User Selected Options	
Date/Time of Computation	ProUCL 5.2 2/13/2023 10:25:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0.000
Selected Null Hypothesis	Sample 1 Mean <= Sample 2 Mean (Form 1)
Alternative Hypothesis	Sample 1 Mean > the Sample 2 Mean

Sample 1 Data: Total PAH_Site Sediments

Sample 2 Data: Total PAH_Bkgrd Sediments

Raw Statistics

	Sample 1	Sample 2
Number of Valid Observations	14	14
Number of Missing Observations	13	13
Number of Distinct Observations	14	14
Minimum	11.67	8.086
Maximum	63.4	100.8
Mean	32.46	27.48
Median	26.83	21.74
SD	16.08	23.57
SE of Mean	4.296	6.3

Sample 1 vs Sample 2 Two-Sample t-Test

H0: Mean of Sample 1 - Mean of Sample 2 <= 0

Method	DF	t-Test Value	Critical t (0.05)	P-Value
Pooled (Equal Variance)	26	0.653	1.706	0.260
Welch-Satterthwaite (Unequal Vari	22.9	0.653	1.714	0.260

Pooled SD 20.176

Conclusion with Alpha = 0.050

Student t (Pooled) Test: Do Not Reject H0, Conclude Sample 1 <= Sample 2

Welch-Satterthwaite Test: Do Not Reject H0, Conclude Sample 1 <= Sample 2

Test of Equality of Variances

Variance of Sample 1	258.4
Variance of Sample 2	555.7

Numerator DF	Denominator DF	F-Test Value	P-Value
13	13	2.151	0.181

Conclusion with Alpha = 0.05

Two variances appear to be equal