FISH AND WILDLIFE IMPACT ANALYSIS STEP IIC INVESTIGATION REPORT

DYNO NOBEL SITE PORT EWEN, NEW YORK

Prepared for:

Ashland Incorporated
500 Hercules Road
Wilmington, Delaware 19808-1599

Dyno Nobel North America
161 Ulster Ave
Ulster Park, New York 12487

Prepared by:

URS Corporation
335 Commerce Drive
Fort Washington, PA 19034

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ACRONYMS

ANOVA	Analysis of Variance
AOC	Area of Concern
AUF	Area Use Factor
BAP	Biological Assessment Profile
BW	Body Weight
CMS	Corrective Measures Study
COPECs	Constituents of Potential Ecological Concern
DF	Dietary Fraction
DFWMR	Division of Fish, Wildlife, and Marine Resources
ECSM	Ecological Conceptual Site Model
EDDs	Estimated Daily Doses
EPCs	Exposure Point Concentrations
EPH	Extractable Petroleum Hydrocarbons
EPT	Ephemeroptera, Plecoptera, Trichoptera
FWIA	Fish and Wildlife Impact Analysis
GPS	Global Positioning System
HBI	Hilsenhoff Biotic Index
HQs	Hazard Quotients
HSD	Honestly Significant Difference
ICP_MS	Inductively Coupled Plasma Mass Spectrometry
IR	Ingestion Rate
LCP	License to Collect or Possess
LEL	Lowest Effects Level
LER	Low Effect Residue
LOAELs	Low Observable Adverse Effect Levels
LOE	Line of Evidence
MADEP	Massachusetts Department of Environmental Protection
MS/SD	Matrix Spike/Spike Duplicate
NABS	North American Benthic Society
NAVD88	North American Vertical Datum of 1988
NCO	Non-chironomid and oligochaete
NER	No Effect Residue
NOAELs	No Observable Adverse Effect Levels
NYSDEC	New York State Department of Environmental Conservation
OECD	Organisation for Economic Co-operation and Development
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
SEL	Severe Effects Level
SEL-Q	Severe Effect Level Quotient
SOPs	Standard Operating Procedures
SQGs	Sediment Quality Guidelines
SQT	Sediment Quality Triad
SVOC	Semi-volatile Organic Compound

SWQS	Surface Water Quality Standards
TAL	Target Analyte List
TCL	Target Compound List
TOC	Total Organic Carbon
TRVs	Toxicity Reference Values
UCL_{95}	95 Percent Upper Confidence Limit
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This document presents the findings of the New York State Department of Environmental Conservation (NYSDEC) Fish and Wildlife Impact Analysis (FWIA) Step IIC Investigations conducted at the Dyno Nobel Port Ewen Site (Site) located in Port Ewen, New York. The overall purpose of the FWIA Step IIC investigations was to collect adequate and representative data to assess potential ecological impacts to support the establishment of site remedial objectives for consideration in the Corrective Measures Study (CMS) developed for the Site.

Two separate ecological exposure areas, based upon cover type, habitat value, probability of receptor use, and frequency of disturbance were evaluated for the purposes of the FWIA Step IIC investigation:

- Solid Waste Management Unit (SWMU) 1/22 Wetland Complex: Wetland and successional forest area to the east of the railroad tracks; and
- Active Plant Area: Industrial cover type includes the Active Plant Area to the west of the railroad tracks.

Ecological investigations in the SWMU 1/22 Wetland Complex were conducted to evaluate potential ecological impacts associated with site-related metals in surface water, sediment, and biological tissues. Specific investigation tasks completed in the SWMU 1/22 Wetland Complex as part of the Step IIC Investigation included:

- Sediment quality triad (SQT) investigation (i.e., invertebrate toxicity testing, benthic community analyses and sediment chemistry);
- Surface water characterization;
- Fish community evaluation; and
- Biological tissue sampling.

The results of investigations conducted in the SWMU 1/22 Wetland Complex support the following conclusions regarding potential ecological exposure and risk:

- The SQT weight-of-evidence evaluation indicated that impacts to benthic invertebrate communities occurred at stations adjacent to SWMU 22 that contained the greatest concentrations of target metals in sediments; impacts to benthic invertebrate communities decreased with increasing distance from SWMU 22;
- The incidence of significant lethal and sublethal effects on benthic test organisms in sediment toxicity tests were most consistent with concentration gradients of selenium and lead;
- Levels of target metals in surface water were generally below surface water criteria; therefore, exposure of fish and other aquatic life to target metals in surface water is not likely to result in adverse community-level effects; and

- Potential risks to wildlife exposed to target metals were limited to receptors that forage exclusively within the exposure area; the potential for adverse effects was greatest for tree swallow, however, the estimation of the dose to tree swallow was highly uncertain.

The findings of the exposure evaluation for the SWMU 1/22 Wetland Complex provide adequate and representative data for the development of preliminary sediment remedial goals for the protection of ecological receptors. The weight-of-evidence evaluation of SQT investigations may be used to derive preliminary sediment remedial goals for the protection of benthic invertebrate communities; dose rate models based on site-specific sediment-to-biota bioaccumulation relationships may be used to derive preliminary remedial goals for the protection of semi-aquatic wildlife. These preliminary sediment remedial goals may be used to modify the current CMS to include pathway elimination for sediments exceeding preliminary remedial goals derived for benthic invertebrate communities and assure that exposure point concentrations in residual sediments do not exceed preliminary remedial goals derived for wildlife.

Investigations in the Active Plant Area were designed to evaluate potential terrestrial bioaccumulation and wildlife ingestion pathways for site-related metals in soils. Co-located biological tissue samples (small mammal and earthworm) and soil samples were analyzed to evaluate potential ingestion pathways for terrestrial wildlife foraging at the margins of the Active Plant Area.

The exposure evaluation in the Active Plant Area indicated that exposure to selenium from the consumption of earthworms and small mammal represents the greatest potential risk to terrestrial wildlife receptors. Potential risks associated with wildlife exposure to selenium were greatest in the northern portion of the Site (grids N1 and N3), which is associated with burning areas used to combust off-specification and waste materials. Bioaccumulation of selenium from soil to biological tissues was highly variable and uncertain. As a result, bioaccumulation relationships derived from site-specific data are not reliable for developing preliminary remedial goals for soil. Further understanding of selenium bioaccumulation and toxicity are needed prior to making informed remedial decisions regarding selenium exposure to wildlife.

In addition to the investigations in SWMU 1/22 Wetland Complex and the Active Plant Area, concentrations of site-related metals were further characterized in soil and sediments in areas of the Site that lack existing data. Metal concentrations in sediment were characterized in two drainage features that traverse the Active Plant Area and concentrations of target metals were characterized in sediments downstream of the SWMU 1/22 Wetland Complex. Additional characterization of soils at the perimeter of SWMU 35 was conducted to evaluate the potential migration of metals to adjacent surficial soils.

1.0 INTRODUCTION

This document presents the findings of the New York State Department of Environmental Conservation (NYSDEC) Fish and Wildlife Impact Analysis (FWIA) Step IIC Investigations conducted at the Dyno Nobel Port Ewen Site (Site) located in Port Ewen, New York (Figure 1). Ecological investigations have been on-going at the Site since 2007 as part of the NYSDEC FWIA process. The overall objective of the FWIA process at the Site is to assess potential ecological impacts for the establishment of remedial objectives and the ultimate remedial actions outlined in the Corrective Measures Study (CMS), as defined in NYSDEC Subpart 375-6: Remedial Program Soil Clean-up Objectives and the draft NYSDEC Remediation Program Guidance (November 2009).

The FWIA investigation was conducted in accordance with the NYSDEC *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites* guidance document (NYSDEC, 1994). The scope of the investigations documented in this report was consistent with Step IIC of the FWIA guidance, which analyses the toxic effects of contaminants with identified pathways to fish and wildlife resources. Steps I, IIA, and IIB of the FWIA process for the Site have been documented in previous submittals to NYSDEC. An Ecological Evaluation Site Description Report (Site Description Report), which included Step I and components of Step IIA of the FWIA guidance, was previously submitted to NYSDEC Division of Fish, Wildlife, and Marine Resources (DFWMR) in December 2007 (URS, 2007). An FWIA Step IIB Report (Step IIB Report) was submitted in April 2009.

The FWIA Step IIC Report documents investigations conducted at the Site in accordance with the *Fish and Wildlife Impact Analysis Step IIC Work Plan* (Work Plan) that received conditional approval from the NYSDEC DFWMR on April 15, 2010 (URS, 2010). The scope of work for Step IIC investigations was developed based on the FWIA Step IIB Report (Step IIB Report) and subsequent correspondence with NYSDEC DFWMR that culminated in the approval of the Work Plan.

Following the approval of the Work Plan, the implementation of FWIA Step IIC field investigations and the subsequent data evaluation phase leading to the development of this report were conducted in coordination and consultation with NYSDEC DFWMR. Key milestones and correspondence documenting the coordination of field investigation and data evaluation efforts since the approval of the Work Plan include:

- May 13, 2010: Site walk with NYSDEC DFWMR to evaluate proposed sampling stations and candidate reference sampling areas;
- May 26, 2010: Memorandum from URS to NYSDEC documenting modifications to the sampling program presented in the Work Plan;
- June 17, 2010: Meeting at the Site with NYSDEC during the field investigation; meeting minutes approved July 30, 2010;
- July 9, 2010: Memorandum from EHS Support to NYSDEC characterizing the results of sediment analysis for station SQT-03 as proposed in the Work Plan;
- September, 15, 2010: Meeting at NYSDEC offices to review preliminary data from Step IIC investigations; meeting minutes approved October, 8, 2010;

- January 3, 2011: Memorandum from URS to NYSDEC documenting the results of sediment sampling downstream of the SWMU 1/22 Wetland Complex;
- January 25, 2011: Conference call with NYSDEC to discuss the results of the sediment sampling effort downstream of the SWMU 1/22 Wetland Complex;
- February 23, 2011: Meeting at NYSDEC offices to review the preliminary conclusions of the Step IIC data evaluation; meeting minutes approved March 16, 2011;
- March 4, 11, and 18, 2011: Conference calls with NYSDEC DFWMR to discuss the approach for FWIA data evaluation.

Memoranda and meeting summaries documenting discussions with NYSDEC regarding the FWIA process are included as Appendix A of the report.

1.1 FWIA Step IIC Study Objectives

The purpose of FWIA Step IIC investigations was to collect adequate and representative data to assess potential ecological impacts at the Site. FWIA Step IIC investigations were intended to satisfy the following study objectives:

- Evaluate potential impacts to sediment-dwelling invertebrate communities in the SWMU 1/22 Wetland Complex based on a Sediment Quality Triad (SQT) approach;
- Evaluate potential impacts to aquatic communities exposed to site-related metals in surface water in the SWMU 1/22 Wetland Complex;
- Evaluate potential impacts to wildlife foraging in the SWMU 1/22 Wetland Complex based on the bioconcentration/bioaccumulation of site-related metals in benthic invertebrate and fish prey;
- Evaluate potential impacts to wildlife foraging on terrestrial prey at the margins of the Active Plant Area based on the bioaccumulation of site-related metals in small mammal and earthworm tissue; and
- Characterize concentrations of site-related metals in surficial sediments and soils in specific areas identified by DFWMR that lack existing data.

1.2 Report Outline

The FWIA Step IIC Report is organized into the following sections:

- Section 2: Site Background and Ecological Setting
- Section 3: Ecological Conceptual Site Model
- Section 4: SWMU 1/22 Wetland Complex Investigations
- Section 5: Active Plant Investigations
- Section 6: Additional Media Characterization
- Section 7: Exposure Evaluation Approach

- Section 8: SWMU 1/22 Exposure Evaluation and Risk Characterization
- Section 9: Active Plant Exposure Evaluation
- Section 10: Uncertainty Analysis
- Section 11: Conclusions and Recommendations
- Section 12: References

2.0 SITE BACKGROUND AND ECOLOGICAL SETTING

The Dyno Nobel facility is located at 161 Ulster Avenue, Ulster Park, New York, approximately one mile south of the village of Port Ewen in Ulster County. As shown on Figure 1, the Site is approximately 1.5 miles west of the Hudson River and is situated along the eastern base of Hussey Hill.

The Site is located in the Central Hudson subzone of the Hudson Valley ecozone as defined by Reschke (1990) and Edinger (2002). This subzone extends along the Hudson River and is bordered by the Taconic Highlands ecozone to the east and the Appalachian Plateau ecozone to the west. The Shawangunk Hills subzone also lies within the Hudson Valley ecozone, to the west of the Site.

Most of the Site is at an approximate elevation of 160 feet[1]; however, Hussey Hill rises to an elevation of approximately 760 feet at a roughly 1.5:1 slope, along the western border of the Site.

2.1 Site History

The Site is an active manufacturing facility that currently produces electric detonators. Historically, the Site has been involved with production of various explosives and related materials since 1912. The plant was originally constructed by Brewster Explosives Company, sold to Aetna Explosives Company in 1915, and then subsequently sold to Hercules Incorporated in 1922. Hercules Incorporated sold the plant to IRECO, Incorporated in 1985; IRECO was renamed Dyno Nobel, Inc. in 1993 (Eckenfelder, 2000). The manufacturing of explosives at the Site continued through each ownership transfer.

Remedial investigations have been conducted at the Site since the early 1990s under the oversight of both the U.S. Environmental Protection Agency (USEPA) and NYSDEC. Data collected as part of these investigations and the CMS were used to evaluate ecological exposure at the Site. Key milestones in the remedial investigation of the Site include:

- ❑ August 1994: Resource Conservation and Recovery Act (RCRA) Facility Assessment finalized (Eckenfelder, 1994);
- ❑ July 2000: RCRA Facility Investigation Report (Eckenfelder/Brown and Caldwell, 1999) approved by NYSDEC;
- ❑ December 2000: CMS submitted to NYSDEC (Eckenfelder, 2000);
- ❑ October 2005: Supplement to CMS submitted to NYSDEC (HydroQual, 2005); and
- ❑ September 2006: Revisions to CMS screening criteria submitted to NYSDEC (HydroQual, 2006).

The FWIA process was initiated at the Site in 2007 to address potential ecological exposures to site-related constituents, which had not been included as part of previous

[1] All elevations are in North American Vertical Datum of 1988 (NAVD88).

remedial investigations or the CMS. This request followed NYSDEC review of the revised CMS dated September 2006 (HydroQual, 2006).

2.2 Ecological Setting

Two separate ecological exposure areas, based upon cover type, habitat value, probability of receptor use, and frequency of disturbance were evaluated for the purposes of this FWIA:

- SWMU 1/22 Wetland Complex: Wetland and successional forest area to the east of the railroad tracks; and
- Active Plant Area: Industrial cover type includes the Active Plant Area to the west of the railroad tracks.

The following sections provide a brief description of the ecological setting of the two ecological exposure areas identified for the Site. Further detail regarding fish and wildlife resources in these areas was provided in the Step IIB Report (URS, 2009).

2.2.1 SWMU 1/22 Wetland Complex

The SWMU 1/22 Wetland Complex is a common reedgrass (*Phragmites australis*)-dominated marsh on the eastern side of the railroad tracks that intersect the Site. This wetland complex drains generally to the north to an unnamed tributary of Rondout Creek; near the downstream extent of the Site, hydrology in the wetland has been altered by beaver activity. An open water area is located within the wetland (SWMU 1); the open water area was used as a shooting pond during plant operations for underwater detonation of off-specification explosives and process waste.

Portions of the SWMU 1/22 Wetland Complex have the potential to support permanent aquatic communities. Perennial water is likely to exist in normal years north of the site access road and is capable of supporting benthic invertebrate communities and limited warmwater fish communities. Fish and wildlife resources likely forage within the SWMU 1/22 wetland system. The hydrological connectivity of this area to downstream fish and wildlife resources such as Rondout Creek increases its habitat value. Limiting factors associated with the habitat value of SWMU 1/22 include the dominance of the invasive species *Phragmites*, which provides poor habitat for wildlife relative to wetlands with more diverse vegetative communities.

2.2.2 Active Plant Area

The Active Plant Area is primarily characterized as an industrial cover type. This portion of the Site provides limited overall habitat value due to the regular disturbance by Site activities from facility operations to the maintenance (mowing) of vegetation. Potential ecological exposure is likely associated with wildlife that may occasionally move into the margins of the industrial cover type to forage from adjacent habitats. Drainage from the Active Plant Area of the Site is generally from west to east. Two drainages originate at the base of the slope along the western side of the Site and traverse the active portion of the Site towards the SWMU 1/22 Wetland Complex.

3.0 ECOLOGICAL CONCEPTUAL SITE MODEL

An ecological conceptual site model (ECSM) was previously developed in the FWIA Step IIB Report to identify potentially complete exposure pathways and potential receptors that may warrant further ecological evaluation. The ECSM has been further refined based on comments received from NYSDEC on the Step IIB report (comment letter dated December 10, 2009 in Appendix A) and observations made during the implementation of FWIA Step IIC investigations.

The ECSM describes potential contaminant migration and ecological exposure pathways for the two ecological exposure areas evaluation in the FWIA: the SWMU 1/22 Wetland Complex and the Active Plant Area. The ECSM consists of the following components:

- Contaminant sources and migration pathways: Identified sources of contamination with potentially complete migration pathways to ecological exposure areas;
- Ecological exposure pathways: Identified ecological receptors and exposure pathways for those receptors; and
- Assessment and measurement endpoints: Assessment endpoints are explicit statements of ecological resources (entities) and attributes of those entities that are important to protect (USEPA, 1998). Measurement endpoints represent quantifiable ecological characteristics that can be measured, interpreted, and related to ecological resources chosen as assessment endpoints.

Potential contaminants in site media associated with SWMUs and AOCs are primarily associated with elevated concentrations of inorganic (metal) constituents. Previous environmental investigations of site media indicate that mercury, arsenic, and lead are the primary metals of concern associated with the Site. Other metals evaluated in previous investigations include: aluminum, antimony, barium, cadmium, chromium, cobalt, copper, selenium, silver, and zinc. The Step IIB Report and subsequent Work Plan identified the following target metals for investigation in the two ecological exposure areas:

- SWMU 1/22 Wetland Complex: cadmium, copper, lead, mercury (total and methyl), selenium, and zinc; and
- Active Plant Area: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, zinc.

3.1 SWMU 1/22 Wetland Complex

The ECSM developed for the SWMU 1/22 Wetland Complex is illustrated in Figure 2 and described in the following sections.

3.1.1 Contaminant Sources and Migration Pathways

The primary sources of contaminants to the SWMU 1/22 Wetland Complex are the SWMUs located within and adjacent to the wetland. SWMU 22 is a former landfill located near the center of the wetland complex (Figure 3); waste material disposed in this landfill represents a potential source of contaminants to the adjacent wetland. SWMU 1 is a former shooting pond used to detonate off-specification explosives and process waste. Underwater detonation of explosives and waste materials represents a potential source of contaminants to the surrounding areas. SWMUs located within the Active Plant Area of the Site represent secondary sources of contaminants to the SWMU 1/22 Wetland Complex.

As illustrated in the ECSM presented in Figure 2, contaminants may migrate from potential source areas to the SWMU 1/22 Wetland Complex through one or more of the following potential pathways and associated release and transport mechanisms:

- Transport via surface water erosion/runoff;
- Dissolution and leaching into groundwater;
- Migration of dissolved contaminants in shallow groundwater to sediment and surface water in adjacent wetlands and/or surface water bodies; and
- Trophic transfer of contaminants incorporated in the aquatic food chain.

Contaminants may be transported to the SWMU 1/22 Wetland Complex via surface erosion. A primary migration pathway is likely surface erosion and transport of site-related metals from SWMUs within the wetland complex. A second potential migration pathway to the SWMU 1/22 Wetland Complex is stormwater transport of particle-sorbed metals from the Active Plant Area to the downgradient wetlands areas via two intermittent drainage ditches. Metals may be sorbed to particles transported by stormwater and deposited in wetland sediments; disturbance of these sediments may subsequently re-suspend metals into surface water and re-deposit sediments locally in other areas of the wetland.

Groundwater represents a potential migration pathway to the SWMU 1/22 Wetland Complex; however, groundwater transport is expected to be minimal. The evaluation of the leachability of soil samples from multiple SWMUs indicated that metals exhibited a low degree of leachability from soils at most locations (Eckenfelder 2000). Furthermore, groundwater investigations at the Site concluded that the migration of metals from the active portion of the Site is limited by low permeability silty clays and clay deposits (Eckenfelder 2000). The investigations demonstrated that the Wetland Complex associated with the former shooting pond (SWMU 1) is the local discharge point for the limited groundwater flow from the Site (Eckenfelder 2000).

Trophic transfer is also a potential migration pathway for contaminants within the SWMU 1/22 Wetland Complex. Contaminants may bioaccumulate in the tissues of biota in direct contact with potentially impacted exposure media. Contaminants in the tissues of lower trophic organisms may be transferred to upper trophic consumers through ingestion pathways.

3.1.2 Ecological Exposure Pathways

Pathways by which ecological receptors using the SWMU 1/22 Wetland Complex may be exposed to contaminants are illustrated in Figure 2. Potential ecological receptors and routes of exposure are described below.

Potential Ecological Receptors

Because the FWIA cannot specifically evaluate the potential for adverse effects to each species that may be present and potentially exposed in the SWMU 1/22 Wetland Complex, receptors were selected to represent broader groups of organisms and those that are of high ecological value.

The SWMU 1/22 Wetland Complex potentially supports several categories of ecological receptors including:

- Emergent vegetation;
- Benthic macroinvertebrate community;
- Fish community;
- Omnivorous mammals: raccoon (*Procyon lotor*);
- Aerial insectivorous mammals: Indiana bat (*Myotis sodalis*);
- Piscivorous mammals: mink (*Mustela vison*);
- Invertivorous birds: mallard duck (*Anas platyrhynchos*);
- Semi-aquatic insectivorous birds: tree swallow (*Tachycineta bicolor*);
- Semi-aquatic insectivorous birds: Kentucky warbler (*Oporonis formosus*); and
- Piscivorous birds: great blue heron (*Ardea herodias*).

Indiana bat (state and federal endangered) and Kentucky warbler (state protected) were included as potential receptors in the Wetland Complex evaluation at the request of NYSDEC given their status as protected species (NYSDEC correspondence February 13, 2008 and June 16, 2008). As stated to NYSDEC in previous correspondence, neither species is likely to forage in the SWMU 1/22 Wetland Complex with regularity. Indiana bat and Kentucky warbler are conservatively included in the ECSM because potential exposure cannot be definitively dismissed; however, potential risk to these receptors will be characterized in the context of the probability of their occurrence in the exposure area.

Potential exposure to Indiana bat was quantitatively evaluated in the FWIA because no other mammalian aerial insectivores were included as receptors; potential exposure to Kentucky warbler was evaluated based on quantitative evaluations of exposure to tree swallow. Kentucky warbler, if present, is most likely to forage by gleaning and hawking terrestrial invertebrates (e.g., insects, caterpillars, spiders, moths) in leaf litter and on vegetation (McDonald, 1998); however, to evaluate potential exposure to warblers that may have a dietary component of aquatic-based adult insects, it was conservatively assumed that warblers would obtain a similar dose to tree swallow. This assumption likely overestimates the actual dose to Kentucky warbler, considering its preference for invertebrates in terrestrial habitats.

Potential Exposure Routes

The routes by which receptors may be exposed to contaminants in the SWMU 1/22 Wetland Complex are illustrated in the ECSM (Figure 2). Primary exposure pathways that will be quantitatively evaluated are illustrated by solid circles in the ECSM and described below for each receptor category:

- Benthic invertebrates: direct contact;
- Fish community: direct contact;
- Invertivorous wildlife: direct ingestion of surface water and contaminated biota and incidental ingestion of sediment (mallard only);
- Aerial insectivorous wildlife: direct ingestion of contaminated biota (Indiana bat and tree swallow only);
- Piscivorous wildlife: direct ingestion of surface water and contaminated biota (mink, belted kingfisher, and great blue heron only); and
- Omnivorous wildlife: direct ingestion of contaminated surface water and contaminated biota and incidental ingestion of sediment (raccoon only).

Emergent vegetation was not quantitatively evaluated in the FWIA Step IIC Investigation. As described in Section 2.2.1, the SWMU 1/22 Wetland Complex is characterized as a monotypic stand of *Phragmites*. The dominance of *Phragmites* within the wetland is consistent with the physical disturbance of the wetland area associated with the creation of the SWMU 22 landfill and SWMU 1 Shooting Pond.

3.2 Active Plant Area

The ECSM developed for the Active Plant Area system is illustrated in Figure 2 and described in the following sections.

3.2.1 Contaminant Sources and Migration Pathways

The primary sources of contaminants within the Active Plant Area are the SWMUs and AOCs identified in the CMS (Eckenfelder 2000; HydroQual 2005; HydroQual 2006). As illustrated in the ECSM (Figure 2), contaminants may migrate from these potential source areas to adjacent soils primarily via surface migration. Bioaccumulation of metals in wildlife through consumption of food/prey (i.e., plants and soil invertebrates) exposed to metals in site media is also a potential migration pathway.

3.2.2 Ecological Exposure Pathways

As described in the Step IIB Report, ecological exposure pathways within the Active Plant Area are limited by the poor to low habitat value associated with SWMUs and AOCs (URS, 2009). However, potential wildlife exposure pathways were included as part the FWIA Step IIC investigations to address NYSDEC concerns regarding potential ecological exposure to wildlife that may occasionally forage at the margins of the Active Plant Area.

Pathways by which ecological receptors using the margins of the Active Plant Area may be exposed to contaminants are illustrated in Figure 2. Potential ecological receptors and routes of exposure are described below.

Potential Ecological Receptors

In the Active Plant Area, ecological receptors were selected to evaluate potential exposure to wildlife that may forage at the margins of the facility. Receptor categories were selected to represent low-level secondary consumers and top-tier predators to provide a range of potential wildlife exposure. Low-level secondary consumers were represented by invertivorous birds and mammals that forage primarily on earthworms:

- Small invertivorous mammals: Short-tailed shrew (*Blarina brevicauda*); and
- Invertivorous birds: American robin (*Turdus migratorius*).

Top-tier predators were represented by carnivorous birds and mammals that forage primarily on low-level secondary consumers:

- Carnivorous birds: Red-tailed hawk (*Buteo jamaicensis*); and
- Carnivorous mammals: Red fox (*Vulpes vulpes*).

Potential Exposure Routes

The routes by which ecological receptors may be exposed to contaminants in the Active Plant Area are illustrated in the ECSM (Figure 2). Primary exposure pathways that will be quantitatively evaluated in the FWIA are illustrated by solid circles in the ECSM and described below for each receptor category:

- Invertivorous wildlife: direct ingestion of contaminated biota and incidental ingestion of soil;
- Carnivorous mammals: direct ingestion of contaminated biota and incidental ingestion of soil; and

- Carnivorous birds: direct ingestion of contaminated biota.

4.0 SWMU 1/22 WETLAND COMPLEX INVESTIGATIONS

Consistent with the approved Work Plan (URS, 2010), further investigations were conducted in the SWMU 1/22 Wetland Complex to evaluate potential ecological impacts associated with site-specific metals. Ecological investigations in the SWMU 1/22 Wetland Complex were designed to evaluate potential direct contact exposure to sediment and surface water and wildlife exposure through ingestion pathways. Specific investigation tasks completed in the SWMU 1/22 Wetland Complex as part of the Step IIC Investigation included:

- SQT investigation (i.e., invertebrate toxicity testing, benthic community analyses and sediment chemistry);
- Surface water characterization;
- Fish community evaluation; and
- Biological tissue sampling.

Biological samples from the SWMU 1/22 Wetland Complex were collected and processed in accordance with the procedures detailed in the Work Plan under a project-specific NYSDEC *License to Collect or Possess (LCP)* permit for the lawful collection of samples for scientific purposes (Permit #1643, effective date 5/28/10). The following sections provide detailed descriptions of these investigations and a summary of investigation results. Ecological exposure evaluations conducted based on the data collected as part of Step IIC investigations are presented in Sections 7.0 and 8.0.

4.1 Sediment Quality Triad (SQT) Investigation

An SQT investigation was conducted to evaluate potential risk to sediment-dwelling invertebrates in the SWMU 1/22 Wetland Complex. The SQT is a weight-of-evidence approach that evaluates sediment quality by integrating spatially- and temporally-matched sediment chemistry, biological, and toxicological information (Long and Chapman 1985; Chapman et al. 1987). The SQT investigation for the SWMU 1/22 Wetland Complex and associated reference area consisted of the following lines-of-evidence:

- Chemical analyses of bulk sediment;
- Benthic invertebrate community analysis; and
- Toxicity testing using bulk sediment.

The overall objective of the SQT studies conducted in the SWMU 1/22 Wetland Complex was to incorporate site-specific ecological effects information to determine the concentrations of site-related metals in sediments that may result in unacceptable risk to benthic invertebrate receptors. Benthic invertebrate community analysis and sediment toxicity testing provide site-specific information regarding potential ecological effects to benthic invertebrates; the integration of these lines of evidence supplements traditional sediment chemistry data to provide a more relevant, site-specific assessment of potential ecological impacts. The findings of the SQT studies were integrated into a weight-of-evidence evaluation that may be used to support further assessment or remedial decision-making. The study design, sampling approach, and summary of results for SQT studies in the SWMU 1/22 Wetland Complex are described in the following sections.

4.1.1 Study Design

The reliability of the SQT approach is dependent on the collection of representative spatially- and temporally-matched sediment chemistry, benthic invertebrate community, and sediment toxicity data at both study and reference stations. Because these datasets were integrated into a weight-of-evidence evaluation, consistency in data collection was essential for comparability among the various lines of evidence. The following sections provide an overview of the SQT study design, including the selection and distribution of SQT sampling stations.

Selection of SWMU 1/22 Wetland Complex SQT Stations

A key objective in determining the number and distribution of SQT stations was to ensure that the spatial coverage of samples reflected a gradient of metals concentrations in sediments within the SWMU 1/22 Wetland Complex. A distribution of sampling stations across a range of metals concentrations was necessary to elucidate reliable exposure-response relationships between sediment metals concentrations and ecological effects where they may exist. Reliable exposure-response relationships are necessary to identify a range of potential ecological effects thresholds that may be considered in further assessment or remedial decision making.

Sediment chemistry data collected in previous investigations were used to guide the selection of prospective SQT sampling stations within the SWMU 1/22 Wetland Complex. The evaluation of historical data conservatively assumed that concentrations of detected metals were bioavailable and potentially toxic to benthic invertebrates. As presented in the Work Plan (URS, 2010), existing surficial sediment data were rank-ordered for the target metals: cadmium, copper, lead, mercury, selenium, and zinc. Eight (8) prospective SQT stations were identified in the Work Plan, with direction from DFWMR (April 15, 2010 comment letter), based on concentration gradients.

The final selection of prospective stations for SQT studies was determined based on a habitat evaluation/reconnaissance survey conducted May 11 – 12, 2010 and subsequent discussions with DFWMR during a site walk on May 13, 2010. Based on the reconnaissance survey and site walk, two (2) SQT stations were relocated due to limited inundation or habitat for benthic invertebrates (Appendix A; May 26, 2010 URS memorandum). An additional station (PE-SQT-03) was re-located approximately 75 feet to the southwest during the June 2010 sampling event following the identification of organic constituents in surficial sediment; this station was not included in SQT studies due to the potential confounding influence of non-metal stressors in interpreting community analyses and sediment toxicity testing. Figure 3 illustrates the locations of the eight (8) SQT stations, as sampled during the investigation.

Selection of Reference SQT Stations

Three (3) reference stations were selected for inclusion in SQT studies to evaluate potential impacts to benthic invertebrate communities associated with sediment metals concentrations. During the May 2010 reconnaissance survey, candidate reference wetlands having similar habitat characteristics to the SWMU 1/22 Wetland Complex and no known or potential sources of contamination beyond regional background were identified. General selection criteria for candidate reference wetlands included:

- No known or potential sources of contamination beyond regional background;
- Located in a wetland consistent with NYSDEC Class 3 wetland classification and dominated by common reedgrass (*Phragmites australis*);
- Substrate characteristics (grain size, organic content, etc.) similar to the SWMU 1/22 Wetland Complex;
- Comparable water depths and inundation periodicity to the SWMU 1/22 Wetland Complex; and
- Accessible for sampling.

The candidate reference wetland selected for comparison with the SWMU 1/22 Wetland Complex in SQT studies was identified during a site walk with DFWMR on May 13, 2010. The selected reference wetland is located approximately five (5) miles south of the Site on conservation land owned by Scenic Hudson, Inc. (Figure 4). Similar to the SWMU 1/22 Wetland Complex, the selected reference wetland is a *Phragmites*-dominated wetland with limited open water habitat. The reference wetland complex is located in a rural setting with no known or potential sources of contamination beyond regional background. Based on the comparability of the reference wetland to the SWMU 1/22 Wetland Complex and the limited potential for contaminant stressors beyond regional background, DFWMR agreed that the Scenic Hudson property was an appropriate reference wetland for SQT studies.

Three (3) SQT stations were located within the reference wetland to represent a similar range of habitat conditions observed in the SWMU 1/22 Wetland Complex (Figure 4). Stations were placed on a gradient of inundation, with SQT-9 representing areas of limited inundation (water depth ~ 1 foot) with dense *Phragmites* and SQT-11 representing deeper habitats (water depth ~ 3 feet) with less *Phragmites* and greater open water habitat.

4.1.2 Sampling Approach

A systematic sampling approach was used to collect sediment samples to support the multiple lines-of-evidence evaluated in the SQT investigation. The following sediment samples were collected at each SQT station:

- Composite sediment samples of cores from 0 – 1 foot for toxicity testing and chemical analyses; and
- Discrete grab samples (*n* = 3) for benthic invertebrate community analyses.

At each SQT station, samples for chemical analyses were collected as subsamples of the sediment volume collected for toxicity testing. Disturbance of sediment cores collected for toxicity testing were minimized to preserve *in situ* redox conditions to the greatest extent practicable. To this end, a non-homogenized composite sample of minimally disturbed sediment was collected at each SQT location and submitted to EnviroSystems, Inc. (Hampton, NH) for toxicity testing. At the toxicity testing laboratory, sediments were homogenized in a nitrogen atmosphere to minimize oxidation of the sediments. An aliquot of the homogenized sample was collected and submitted to Test America, Inc. (Pittsburgh, PA) for chemical analysis; the remaining volume of the homogenized sample was used for toxicity testing.

Discrete samples for benthic invertebrate community analysis were collected immediately adjacent to locations where composite sediment cores were collected for toxicity testing and chemical analysis. As described in detail in Section 4.5.1, additional bulk sediment was collected from adjacent areas, as needed, to obtain sufficient sample mass of benthic invertebrate tissue. At each SQT station, near-bottom surface water parameters, including temperature, pH, dissolved oxygen, and specific conductivity were measured *in situ* with a YSI 6920 multi-parameter water quality meter. Upon completion of SQT sampling, the approximate center of each sampling station was recorded using a sub-meter global positioning system (GPS) unit (Trimble GeoXH).

The detailed sampling approach for the sediment collection to support the three lines-of-evidence evaluated in the SQT is summarized in the following sections; standard operating procedures (SOPs) for bulk sediment and benthic community sample collection are provided in Appendices A and B, respectively of the Work Plan (URS, 2010).

Bulk Sediment Analyses

Bulk sediment samples were collected at SQT stations to provide representative metal concentrations for comparison to sediment quality guidelines (SQGs) and to evaluate the results of benthic community and sediment toxicity studies.

At the direction of DFWMR, sediment samples for chemical and toxicological analyses were collected from the 0 – 12 inch sediment interval. As was noted in the Work Plan (URS, 2010), this depth interval is not specified in the NYSDEC *Technical Guidance for Screening Contaminated Sediments* (NYSDEC 1999) and is deeper than the 0 to 10 – 15 centimeter (3.9 to 5.9 inch) depth interval recommended in USEPA *Methods for the Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses* (USEPA, 2001). This sample interval is deeper than the typical bioactive zone of benthic invertebrates (typically 0 – 6 inches), particularly in reducing wetland sediments.

As described in the preceding section, sediment samples for chemical analyses at SQT stations were subsampled from composite samples collected for sediment toxicity testing. Multiple sediment cores for the composite sample were collected from 0 – 1 foot with 3-inch diameter polycarbonate plastic cores. Large woody debris and vegetation that could be removed with minimal disturbance to the sediment core were removed and the individual sediment cores were composited in an opaque, laboratory-supplied two-gallon container with zero headspace; composite samples were not homogenized in the field. Composite samples were submitted to EnviroSystems for sediment toxicity testing where the samples were homogenized to similar color and texture under a nitrogen environment. An aliquot of the homogenized sample was collected at EnviroSystems and submitted to Test America for chemical and physical analyses.

The sample aliquot submitted to Test America for SQT stations was analyzed for target metals specified by DFWMR in its correspondence to Dyno Nobel dated June 25, 2009: cadmium, copper, lead, mercury, selenium, and zinc; additional sediment analyses included total organic carbon (TOC) and grain size. For reference SQT stations (SQT-09 through SQT-11), sediment samples were analyzed for a broader suite of analytical parameters to adequately characterize potential chemical stressors other than metals that may influence toxicity testing or benthic community results. The broader analytical suite included: target analyte list (TAL) metals, target compound list (TCL) volatile and semi-volatile organic compounds, and TCL pesticides; additional sediment analyses at reference locations included TOC and grain size distribution.

Benthic Invertebrate Community Analyses

The incorporation of benthic invertebrate community data into the SQT investigation provides an empirical dataset for *in situ* evaluations of potential toxicity. Benthic invertebrates are ideal bioindicators because they: 1) are abundant across a broad array of sediment types, 2) are relatively sedentary, completing most or all of their life cycle in the same microhabitat, 3) respond to the cumulative effects of various stressors having differing magnitudes and periods of exposure, and 4) integrate both the effects of stressors and the population compensatory mechanisms evolved over time to survive in a highly variable and stressful environment.

Benthic community sampling and analyses were performed at SQT stations from June 14 – 23, 2010, concurrent with sediment chemistry and toxicity testing studies; a second round of benthic community sampling was conducted from October 27 – 29, 2010 to provide an additional season of community data.

Three (3) discrete sediment samples for benthic community analysis were collected at each SQT station in undisturbed areas immediately adjacent to the location of cores collected for chemical and toxicological analyses. At the direction of DFWMR, benthic community samples were collected with a petite Ponar sampler. Samples for benthic community analysis were field-sieved in 500-µm bucket sieves to remove fine-grained sediments; large vegetation and woody debris were rinsed over the bucket sieve and discarded. Benthic invertebrates and residual material in the bucket sieve were transferred to clean sampling containers and preserved in 70 percent ethyl alcohol for transport to the EcoAnalysts, Inc. (Boise, ID) for taxonomic identification.

In the laboratory, benthic community samples were processed consistent with the NYSDEC (2009) *Standard Operating Procedure: Biological Monitoring of Surface Waters in New York State* and USEPA guidance (Barbour et al., 1999). Benthic community samples were subsampled based on a random 100-organism sub-count according to procedures outline in the Work Plan (URS, 2010). Organisms were identified to the lowest practicable taxon, consistent with the target taxonomic resolution recommended in NYSDEC (2009).

Laboratory quality assurance/quality control (QA/QC) procedures for the processing and identification of benthic invertebrate samples were consistent with or greater than the approach used in NYSDEC (2009) and Barbour et al. (1999). Twenty (20) percent of the residual material from the sorted subsample was re-examined and any organisms missed by the sorter were enumerated to ensure a maximum of 10 percent error in sorting efficiency. At least 10 percent of identified samples were re-identified by a North American Benthic Society (NABS)-certified taxonomist to ensure a maximum of 10 percent error in taxonomic determinations.

Sediment Toxicity Testing

Sediment toxicity testing provides an *ex situ* evaluation of toxicity by exposing laboratory-reared organisms to sediment from SQT stations under controlled laboratory conditions. Sediment samples for toxicity testing consisted of a composite of sediment cores to obtain at least two (2) gallons of sediment required to implement both toxicity testing protocols and to provide an aliquot for chemical analysis, as previously described.

At the direction of DFWMR, sediment samples for toxicity testing were collected from the 0 – 12 inch sediment interval. As noted in the Work Plan, this depth interval is deeper than the interval recommended in USEPA (2000) *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates: Second Edition* and USEPA (2001), which indicates that samples should be collected from a depth that will represent expected exposure, typically the 0 to 2 – 15 centimeter (1 to 5.9 inch) depth interval.

As previously stated, the disturbance of sediment cores collected for toxicity testing was minimized to preserve *in situ* redox conditions to the greatest extent practicable. Sediment from core samples was composited, but not field-homogenized, in opaque, laboratory-supplied containers and filled to zero headspace. The composite samples were held at 4°C and transported to the EnviroSystems as soon as practicable. In the laboratory, sediments were homogenized and toxicity tests were set up in a nitrogen atmosphere to minimize oxidation of the sediments.

The following chronic sediment toxicity tests were conducted on sediments from SQT stations:

- 42-day *Hyalella azteca* Test for Measuring the Effects of Sediment-Associated Contaminants on Survival, Growth, and Reproduction (USEPA Method 100.4; USEPA, 2000); and

- 28-day *Chironomus riparius* test evaluating survival, growth, and emergence consistent with Organisation for Economic Co-operation and Development (OECD) Guideline 218 (OECD, 2004)[2].

The toxicity testing laboratory performed the designated tests on SQT and control sediments in accordance with test protocols established in USEPA (2000) and OECD (2004). Laboratory reports detailing the specific procedures of each test are provided in Appendix B. Overlying water quality was monitored for temperature, dissolved oxygen, pH, hardness, alkalinity, conductivity, and ammonia at the frequency specified for each test. At the conclusion of the tests, the following endpoints were reported:

- 42-day *Hyalella azteca*: mean survival (Day 28, Day 35, and Day 42),growth as mean dry weight (Day 28 and Day 42), growth as mean dry biomass (Day 28 and Day 42), juvenile production on Day 35 and Day 42 (per surviving amphipod and per surviving female); and
- 28-day *Chironomus riparius*: mean survival – Day 10, growth (ash free dry weight and ash free dry biomass), percent emergence and mean time to emergence.

The performance of sediment toxicity testing was evaluated consistent with test protocols provided in USEPA (2000) and OECD (2004). Test acceptability was based on the performance of laboratory control samples through the duration of the test. As described in the reports provided in Appendix B, laboratory performance criteria were satisfied for each endpoint evaluated in the 42-day *Hyalella azteca* and *Chironomus riparius* tests.

4.1.3 Results

The following sections summarize the results of the SQT studies conducted in the SWMU 1/22 Wetland Complex and reference wetland. An evaluation of benthic invertebrate community exposure is based on the results summarized below is presented in Section 8.1.

In-Situ Physio-Chemical Parameters

Table 1 presents near-bottom surface water quality parameters measured *in situ* during the June 2010 SQT and October 2010 benthic community sampling events. Physical descriptions of sediments observed at SQT stations are also provided in Table 1.

Bulk Sediment Analyses

The results of bulk sediment analyses of target metals at SQT stations are summarized in Table 2 and presented in Figure 5. A summary of sediment analytical data is provided in Appendix C. For reference, sample results are presented relative to NYSDEC sediment criteria for metals (NYSDEC 1999). Sample results exceeding the lowest effect level (LEL) are presented in bold; results exceeding the severe effects level (SEL) are shaded and bold.

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[2] OECD Guideline 218 is the only standard method that could be identified for long term sediment toxicity testing using *Chironomus riparius*, the test organism specified by DFWMR in April 15, 2010 comments on the draft work plan. Standard *C. riparius* test methods have not been established and fully validated for life cycle exposures previously requested by DFWMR.

In general, greater concentrations of target metals were observed at SQT stations in close proximity to SWMU 22 (SQT-03 through SQT-06) relative to stations with increasing distance from SWMU 22. Maximum concentrations of target metals were associated with SQT-03 (selenium), SQT-05 (lead), or SQT-06 (cadmium, copper, mercury, and zinc). Concentrations of cadmium, copper, and zinc, were generally lower at stations upstream of SWMU 1 (SQT-01 and SQT-02) when compared to stations downstream of SWMU 22 (SQT-06 through SQT-08); concentrations of lead, mercury, and selenium at upstream stations were generally comparable to or greater than concentrations at downstream stations.

The co-occurrence of target metals in sediment at SQT stations within the SWMU 1/22 Wetland Complex was evaluated using a Pearson correlation analysis based on Shapiro-Wilk normality testing of the underlying data distribution. Pearson correlation coefficients (r) generated as the result of the analysis are presented as a matrix in Table 3. Values of r can range from -1, indicating a perfect negative linear relationship between variables to 0 indicating no relationship to 1, indicating a perfect positive linear relationship. For the purposes of the analysis, r values less than -0.7 or greater than 0.7 were considered indicative of strong negative or positive linear relationships, respectively.

As shown in Table 3, the strongest positive linear relationship was observed between selenium and lead concentrations in sediment ($r = 0.973$) followed by the positive linear relationship between cadmium and zinc ($r = 0.88$). Other strong positive linear relationships were observed between sediment concentrations of copper with mercury, cadmium, and zinc ($r > 0.7$). The results of the correlation analysis indicate positive linear relationships between the concentrations of target metals, particularly lead and selenium, in the SWMU 1/22 Wetland Complex.

Analyses of non-target metal constituents in sediments from reference SQT stations did not indicate the presence of chemical stressors at concentrations that are likely to impact benthic invertebrate communities. Table 4 presents detected constituents from TAL metals, TCL VOC and SVOC, and TCL pesticide analyses conducted at the reference stations; a complete summary of analytical results from reference SQT stations is provided in Appendix C. As described in Section 4.1.2, these additional analyses were conducted to evaluate whether chemical stressors were impacting benthic invertebrate communities in the reference wetland. Five pesticides, three VOCs, and five SVOCs were detected in sediments from at least one of the reference SQT stations (Table 4); 13 additional naturally-occurring TAL metals were also detected in reference wetland sediments. Comparisons of these detected constituents to available sediment screening criteria (NYSDEC, 1999), indicated only two slight exceedances for arsenic and manganese; concentrations of detected organic constituents were below available criteria (Table 4). Based on these results, impacts to benthic invertebrate communities in the reference wetland due to chemical stressors are not likely. These findings confirm the suitability of the reference wetland as a control for SQT studies designed to assess potential impacts associated with site-specific metals.

An additional characterization of chemical constituents in sediments was conducted during the June 2010 sampling event at the proposed location of SQT-03 in the SWMU 1/22 Wetland Complex. As previously discussed in Section 4.1.1, organic constituents were noted in sediments at the proposed location of station SQT-03. A sample of these sediments (PE-SD-SQT-03) was collected and analyzed to characterize the nature of the organic constituents. Samples were initially analyzed for VOCs (Method 8260B), SVOCs (8270B), total sulfides (Method 9030B/9034), and sulfate (Method 9056A). Additional characterization of organic constituents was conducted using Extractable Petroleum Hydrocarbons (EPH) analysis based on the Massachusetts Department of Environmental Protection (MADEP) method (Test America, Westfield, MA).

The results of these analyses indicated minor detections of VOCs and no detections of SVOCs in sample PE-SD-SQT-03; however, the presence of other petroleum hydrocarbon compounds was confirmed by the EPH analysis. Carbon disulfide, 1,2,4-trichlorobenzene, and toluene were detected at low concentrations relative to the reporting limit (Table 5). No SVOC compounds were detected in the sample; however, elevated detections limits (650 µg/kg to 17,000 µg/kg) were noted in the test. EPH analyses indicated elevated concentrations of aromatic and aliphatic compounds (Table 6), with the presence of aromatic compounds indicating that these compounds are likely petrogenic in nature. C11- C22 aromatics (comprising of polycyclic aromatic hydrocarbons and other undefined ring structures) were detected at a combined concentration of 2,600 mg/kg. Heavy end aliphatic compounds were also detected at an elevated concentration of 13,000 mg/kg. The results of these analyses confirm the presence of non-metal stressors in the vicinity of PE-SD-SQT-03 and served as the basis for excluding this station from the SQT evaluation. As previously stated, station SQT-03 was relocated approximately 75 feet to the southwest of sample PE-SD-SQT-03.

Benthic Invertebrate Community Analyses

The following sections describe the benthic invertebrate communities sampled at SQT stations during sampling events in June and October 2010. The approach for integrating benthic invertebrate community analyses results into a weight-of-evidence evaluation of benthic community exposure is presented in Section 8.1.

June 2010

A total of 99 distinct macroinvertebrate taxa were identified in 33 samples collected from SQT stations in June 2010. Of the 99 taxa identified, 89 were collected from SQT stations from the SWMU 1/22 Wetland Complex, and 39 taxa were collected from reference SQT stations (Table 7). Among the SWMU 1/22 SQT samples, 39 distinct taxa were identified in more than 10 percent of the samples. Two taxa, the non-biting midge *Chironomus* sp. and the freshwater isopod *Caecidotea* sp., were identified in more than 50 percent of the samples. *Caecidotea* sp. was the most commonly observed taxon, appearing in 18 of the 24 SWMU 1/22 SQT samples. The distribution and high relative abundance of *Caecidotea sp.* is consistent with stations characterized by substrates containing a surficial layer of *Phragmites* root mat; *Caecidotea sp.*is a detritivore that is commonly found in high abundance in dense stands of vegetation with large quantities of decaying coarse particulate organic matter (King and Richardson, 2007). Invertebrate density at SWMU 1/22 SQT stations ranged from 1,391 organisms per m^2 (SQT-06, Replicate C) to 52,195 organisms per m^2 (SQT-05, Replicate B).

Among the reference SQT samples, 39 distinct taxa were identified in more than 10 percent of the samples. The non-biting midges *Ablabesmyia peleensis* and *Chironomus* sp., the gastropods *Gyraulus* sp. and *Physa* sp., the isopod *Caecidotea* sp., and the amphipod *Hyalella* sp. were identified in more than 50 percent of the samples. *Physa* sp. and *Caecidotea* sp. were the only taxa identified in all reference SQT samples. Densities of invertebrates were generally lower at reference SQT stations relative to SWMU 1/22 SQT stations, ranging from 826 organisms per m^2 (SQT-10, Replicate B) to 4,609 organisms per m^2 (SQT-11, Replicate A).

October 2010

Community samples collected in October 2010 were relatively depauperate of benthic invertebrates. Densities ranged from 0 organisms per m^2 at SQT-03 (all three replicates), SQT-06 (Replicate A), and SQT-11 (Replicate C) to 5,204 organisms per m^2 at SQT-02 (Replicate C) (Table 8). A total of 72 distinct taxa were identified in 32 samples[3] analyzed from SQT stations in October 2010. Sixty-four (64) of the 72 taxa identified were collected from SWMU 1/22 SQT stations, and 25 taxa were collected from reference SQT stations. Among the SWMU 1/22 SQT samples, 13 distinct taxa were identified in more than 10 percent of the samples; no taxon was present in more than 50 percent of the samples. *Caecidotea* sp. was the most commonly observed taxon, appearing in 9 of the 23 SWMU 1/22 SQT samples. Among the reference SQT samples, 25 distinct taxa were identified in more than 10 percent of the samples. *Caecidotea* sp. was the most commonly observed taxon, appearing in six of nine samples.

Sediment Toxicity Testing

Summaries of toxicity testing endpoints for the 42-day *Hyalella azteca* and *Chironomus riparius* toxicity tests are presented in Tables 9 and 10, respectively. Significant toxicity endpoints are illustrated in Figure 5 for each SQT station within the SWMU 1/22 Wetland Complex. The approach for integrating sediment toxicity results into a weight-of-evidence evaluation of benthic community exposure is presented in Section 7.1.1.

4.2 Downstream Sediment Characterization

Based on the results of the June 2010 bulk sediment analyses, additional characterization of target metals in sediment downstream of the SWMU 1/22 Wetland Complex was conducted on October 28, 2010 and November 11, 2010. This additional sediment sampling was requested by NYSDEC to further characterize the concentrations of metals, particularly mercury, that were elevated in sediments at station SQT-08, the farthest downstream SQT station (Figure 5). The following sections describe the sampling approach and summarize the results of the downstream sediment characterization.

[3] The taxonomic laboratory inadvertently composited two replicates (B and C) from SQT-01 during the October 2010 sampling event. The composited sample was processed and analyzed, resulting in data for 32 of 33 samples collected.

4.2.1 Sampling Approach

Based on discussions with NYSDEC during a conference call on September 29, 2010, four sediment stations (PE-DNS-SD-01 through PE-DNS-SD-04) were established downstream of the SWMU 1/22 Wetland Complex (Figure 6). Sediment depositional features in the vicinity of the stations were targeted for sample collection based on field observations. Samples were collected at each station from 0 – 1.0 feet using 2-inch diameter butyrate plastic core liners. At the request of NYSDEC, collection of deeper sediment intervals was attempted at each station; however, recovery of deeper material (1.0 -1.5 feet) was only accomplished at station PE-SD-DNS-01. Samples were analyzed for target metals including cadmium, copper, lead, mercury, selenium, and zinc; additional sediment characterization included total organic carbon (TOC) content and grain size distribution.

4.2.2 Results

Analytical results of the downstream sediment sampling are provided in Table 11 and posted on Figure 6. For reference, sample results are presented relative to NYSDEC sediment criteria for metals (NYSDEC, 1999). Sample results exceeding the LEL are presented in bold; results exceeding the SEL are shaded and bold.

The results of the downstream sediment sampling indicate elevated concentrations of metals, particularly copper and mercury, in the surface interval at the first two downstream stations (PE-DNS-SD-01 and PE-DNS-SD-02). The deeper sediment interval at PE-DNS-SD-01 generally contained comparable concentrations to the surface interval for most metals, with the exception of mercury, which was elevated in the deeper interval relative to the surface interval. Concentrations of metals at PE-DNS-SD-01 and PE-DNS-SD-02 were generally consistent with concentrations observed in the surface interval at station SQT-08. Concentrations of metals, particularly copper and mercury, were substantially lower in sediments at downstream stations PE-DNS-SD-03 and PE-DNS-SD-04 relative to upstream stations.

The distribution of sediment metals in depositional areas downstream of the SWMU 1/22 Wetland Complex is generally consistent with channel morphology and flow conditions. The reach from SQT-08 to PE-DNS-SD-02 is characterized by a broad channel with limited stream velocity that is consistent with past beaver activity that impeded stream flow. As a result of limited flow, this reach represents a sediment depositional zone where fine-grained sediments have accumulated over time; the distribution of metals in sediments is typically associated with finer-grained sediments. The stream channel becomes narrower and the stream banks become more defined at downstream stations PE-DNS-SD-03 and PE-DNS-SD-04. Channel morphology in this downstream reach becomes more variable, with small riffle complexes becoming evident. Due to the change in channel morphology, sediment depositional areas at stations PE-DNS-SD-03 and PE-DNS-SD-04 are limited to the channel margins; the thickness of sediment depositional features is also reduced at these stations relative to the thickness of sediment deposition at upstream stations PE-DNS-SD-01 and PE-DNS-SD-02. Greater concentrations of metals observed at upstream stations PE-DNS-SD-01 and PE-DNS-SD-02 are consistent with a more extensive zone of sediment deposition immediately downstream of the SWMU 1/22 Wetland Complex; lower metals concentrations at stations PE-DNS-SD-03 and PE-DNS-SD-04 are consistent with more limited sediment deposition downstream.

4.3 Surface Water Investigation

Surface water sampling was conducted within the SWMU 1/22 Wetland Complex and at reference stations concurrent with SQT sampling. Surface water data were intended to support the following data objectives:

- Evaluation of potential ecological exposure to aquatic receptors, particularly the fish community; and
- Calculation of exposure point concentrations (EPCs) for surface water for input into dose rate models for wildlife receptors.

The following sections describe the surface water sampling approach and summarize the results of surface water analyses.

4.3.1 Sampling Approach

Surface water samples were collected from six (6) stations within the SWMU 1/22 Wetland Complex as illustrated in Figure 3. Three (3) additional surface water samples were collected at reference SQT stations. Surface water samples were collected from mid water column depth using grab sampling procedures detailed in the Work Plan (URS, 2010). To minimize the disturbance of bottom sediments when collecting surface water samples, sampling stations were approached from downcurrent and the sample was collected upcurrent of the physical location of the person collecting the sample.

Unfiltered and filtered surface water samples were submitted to Test America for analysis. Surface water samples were field-filtered using a 0.45 µm capsule filter. Unfiltered samples were analyzed for total hardness, total suspended solids, and target metals: cadmium, copper, lead, mercury, selenium, and zinc; filtered samples were analyzed for the list of target metals. Surface water parameters, including temperature, pH, dissolved oxygen, and specific conductivity were measured *in situ* with a YSI 6920 multi-parameter water quality meter. The location of surface water stations were recorded in the field using a Trimble GeoXH sub-meter GPS unit.

4.3.2 Results

Four (4) out of six (6) target metals were detected in filtered and unfiltered samples collected within the SWMU 1/22 Wetland Complex (Table 12). Detected metals included copper, lead, selenium, and zinc; concentrations of cadmium and mercury were below detection in all filtered and unfiltered samples.

Based on the results of the surface water analyses, target metals are not detected at concentrations likely to result in adverse chronic effects to aquatic life. Filtered surface water results for detected constituents were evaluated relative to hardness-adjusted chronic NYSDEC Surface Water Quality Standards (SWQS, Section 703.5). SWQS values for hardness-dependent metals (cadmium, copper, lead, zinc, etc.) were based on the lowest and most conservative hardness value from the SWMU 1/22 Wetland Complex (127 mg/L). As presented in Table 12, concentrations of metals in filtered samples did not exceed NYSDEC SWQS. These findings indicate that chronic exposure to metals concentrations in surface water within the SWMU 1/22 Wetland Complex are not likely to result in adverse effects to aquatic life.

4.4 Fish Community Evaluation

A presence/absence fish community survey was conducted to qualitatively evaluate potential fish community resources available in the SWMU 1/22 Wetland Complex and adjacent upstream and downstream areas. The following sections describe the sampling approach and summarize the findings of the fish community evaluation.

4.4.1 Sampling Approach

A qualitative, presence/absence fisheries survey was conducted utilizing methodologies consistent with those outlined in NYSDEC (2009). As illustrated in Figure 3, three (3) sampling reaches were established within and adjacent to the SWMU 1/22 Wetland Complex:

- Upstream of the site to the south of the plant entrance road;
- Within the SWMU 1/22 Wetland Complex; and
- Downstream of the SWMU 1/22 Wetland Complex.

Each reach was sampled by electrofishing, using a Smith-Root LR-24 backpack electrofishing unit for approximately 20 – 25 minutes (1215 – 1450 seconds) of electroshocking time. At the request of DFWMR, the upstream reach was sampled for an additional 23 minutes (1375 seconds) of electroshocking time to target upper trophic species (i.e., largemouth bass). Captured fish were held in a live well and evaluated for potential fish tissue sampling (See Section 4.5). Prior to release, captured fish were identified to the lowest practicable taxon, typically species. Lengths and weights of fish were recorded for the first 25 individuals of each taxon captured; remaining fish were enumerated. Representative fish samples were retained for tissue analyses as described further in Section 4.5.

4.4.2 Results

The results of the fish community presence/absence survey are summarized in Table 13. Three (3) fish taxa were collected during the electrofishing effort in the three reaches upstream, within, and downstream of the SWMU 1/22 Wetland Complex. Golden shiner (*Notemigonus crysoleucas*) was the numerically dominant taxon collected in each of the three reaches. One largemouth bass (*Micropterus salmoides*) was collected from the upstream reach and six (6) American eel (*Anguilla rostrata*) were collected from the downstream reach (Table 13).

4.5 Biological Tissue Sampling

Sampling and analysis of fish and benthic invertebrate tissues were conducted to provide site-specific tissue data as an input into dose rate models to evaluate potential exposure to wildlife consumers of these prey items. A secondary data objective was to evaluate potential bioaccumulation relationships between tissue and relevant exposure media.

4.5.1 Sampling Approach

In accordance with the Work Plan (URS, 2010), biological tissue sampling was conducted consistent with NYSDEC (2003) *Procedures for Collection and Preparation of Aquatic Biota for Contaminant Analysis*, as the guidance was applicable to project objectives. Tissue samples were collected concurrently with other investigations in the SWMU 1/22 Wetland Complex and reference areas. Benthic invertebrate tissue sampling was conducted as part of SQT investigations described in Section 4.1; fish tissue sampling was conducted as part of the fish community evaluation described in Section 4.4. Specific procedures relevant to the collection and analysis of each tissue type are described in the following sections.

Benthic Invertebrate Tissue

As described in the Work Plan, the most abundant invertebrate taxon present in the SWMU 1/22 Wetland Complex (e.g., chironomids, oligochaetes, etc.) was targeted for tissue analyses (URS, 2010). However, based on the findings of the May 2010 reconnaissance survey and the initial SQT sampling in June 2010, it was determined that there was insufficient sample mass of any one individual taxon to obtain the mass requirements for the selected analytical methods. To account for the limited invertebrate samples mass recovered in sediment samples, the procedures for the collection and analysis of benthic invertebrate tissue detailed in the Work Plan were modified as follows:

- ‘Market Basket’ Composite Sample: The procedures for collecting benthic invertebrate tissue samples at SQT stations were modified from a target taxon approach to a ‘market basket’ approach. A ‘market basket’ sample is a composite of all invertebrate taxa collected at a station, which provides a representative sample of the invertebrate tissue that invertivorous wildlife may encounter when foraging in sediments at a given SQT station.
- Reference Composite Sample: Insufficient benthic invertebrate sample mass was recovered from ‘market basket’ composite samples collected in the reference wetland. To obtain sufficient sample mass for analysis, ‘market basket’ samples of benthic invertebrates from the three (3) reference stations were composited into one representative reference sample.
- Analytical Method: The analytical methods proposed in the Work Plan required approximately 2.5 grams of tissue. Despite the modifications to the sample compositing procedures described above, attainment of the minimum sample mass was not possible at all stations. Therefore, a modified analytical method was proposed by Brooks Rand Laboratories (Seattle, WA) for samples with a mass less than 1.5grams. The modified analytical method for low mass samples used a shared nitric digestion and with analysis by inductively coupled plasma mass spectrometry (ICP-MS).

These modifications to the benthic invertebrate sampling and analysis approach were proposed to DFWMR during a June 17, 2010 meeting. DFWMR approved the proposed modifications to the sampling approach during the meeting and subsequently approved the modification to the analytical method in an email received on June 18, 2010 (M. Crance, email communication 6/18/10 in Appendix A).

Samples for benthic invertebrate tissue analyses were collected from SQT stations after sediment samples were collected to support toxicity testing and benthic community evaluations. Sediment from undisturbed areas in close proximity to the SQT station was collected and field-sieved in 500-µm bucket sieves to remove fine grained sediments. The residual material retained in the bucket sieves was sorted in the field and visible benthic invertebrates were removed using decontaminated tweezers. Benthic invertebrates were composited to obtain sufficient tissue for analysis, as described above. Sufficient sample mass was collected at each SQT station, with the exception of SQT-03; field-sorting of residual material at SQT-03 did not yield any invertebrate sample mass.

Once the requisite mass of invertebrate tissue was obtained at each SQT station, the composite invertebrate sample was rinsed with de-ionized water, placed in a clean, laboratory-supplied sampling container, and frozen until shipment to Brooks Rand Laboratories for analysis. Figure 7 illustrates the taxonomic composition of benthic tissue composite samples submitted for analysis. At the direction of DFWMR in the April 15, 2010 comment letter on the draft work plan, benthic invertebrate samples collected for analyses were not depurated to excrete residual sediment from the gut tract prior to analysis. Non-depurated benthic invertebrate tissue samples were analyzed for target metals including: cadmium, copper, lead, total mercury, methylmercury, selenium, and zinc. The mass of benthic invertebrate tissue samples submitted to the laboratory was insufficient to quantify percent moisture; therefore, sample results were reported on a wet weight basis.

Fish Tissue

Fish tissue sampling was conducted concurrently with the fish community evaluation described in Section 4.4. As discussed in Section 4.4.1, fish community sampling reaches were established upstream, downstream, and within the SWMU 1/22 Wetland Complex. During the electrofishing effort at each station, captured fish were retained in a live well and evaluated for potential tissue analyses.

As specified in the Work Plan, five (5) composite samples of forage fish and five (5) individual samples of piscivorous fish were targeted at each of the three sampling reaches established for the qualitative fish community evaluation (See Section 4.4). All fish collected in the three sampling reaches were kept in the live well prior to sampling for tissue analyses in order to select appropriate target species based on common denominators amongst all stations. Target species for tissue analyses were selected with concurrence from DFWMR (M. Crance, personal communication) based on the available catch from all three reaches.

As discussed in Section 4.4.2, the results of the electrofishing effort yielded one forage species (golden shiner) in each sampling reach. Piscivorous species were limited to American eel in the downstream reach and largemouth bass in the upstream reach. Based on the available catch, the following fish tissue samples were submitted for analysis with concurrence from DFWMR:

Species	Trophic Status	Upstream	Site	Downstream
Golden shiner *Notemigonus crysoleucas*	Forage	5 (composites)	5 (composites)	5 (composites)
American eel *Anguilla rostrata*	Piscivore			5 (individuals)
Largemouth bass *Micropterus salmoides*	Piscivore	1 (individual)		

Fish tissue samples were processed consistent with NYSDEC (2003), as detailed in the Work Plan (URS, 2010). Fish selected for tissue analysis were placed in a clean plastic bag, labeled with the appropriate collection information. Samples were placed on ice until the end of the sampling effort, when the samples were frozen. Samples were shipped frozen on dry ice to Brooks Rand Laboratories under appropriate chain-of-custody forms.

Fish tissue samples were analyzed for target metals including: cadmium, copper, lead, total mercury, methylmercury, selenium, and zinc. In addition, percent moisture was measured to facilitate conversion between wet weight and dry weight concentrations.

4.5.2 Results

The results of biological tissue sampling in the SWMU 1/22 Wetland Complex are presented in the following section. The approach for using benthic invertebrate and fish tissue to evaluate potential risks to semi-aquatic wildlife in the SWMU 1/22 Wetland Complex is presented in the Section 7.1.3. Evaluation of semi-aquatic wildlife exposure to metals in small mammal tissues is presented in Section 8.0.

Benthic Invertebrate Tissue

As described in the preceding section, concentrations of target metals were analyzed in ‘market basket’ composite samples of benthic invertebrates collected from SQT stations. The results of the benthic invertebrate tissue analyses are presented in Table 14; a complete summary of the analytical data is presented in Appendix C.

Relative to reference samples, concentrations of cadmium, copper, lead, total mercury, methylmercury, selenium, and zinc were generally elevated in most samples from SWMU 1/22 SQT samples (Figure 8). Although direct comparisons of tissue concentrations between sampling stations are confounded by the varied composition of the ‘market basket’ samples (Figure 7), relative comparisons were made to assess general metal accumulation in benthic invertebrates available at each station. Benthic invertebrate tissue concentrations were relatively low in samples from SQT-01, which contained comparable concentrations to reference samples, with the exception of total mercury. Bioaccumulation of total mercury was variable with sediment mercury concentration, with the stations containing lowest (SQT-05) and greatest (SQT-06) concentrations of mercury in sediments having comparable concentrations in benthic invertebrate tissue samples. Methylmercury concentrations in benthic tissue samples were comparable to or lower than the reference samples for all SQT stations, except SQT-07.

Ratios of methylmercury to total mercury concentrations in benthic invertebrate tissue samples ranged from 0.06 to 0.75 and generally decreased with increasing mercury concentrations in sediments (Figure 8). Low methylmercury concentrations relative to total mercury concentrations in tissues, particularly at higher sediment mercury concentrations may be indicative of mercury adsorbed to sediment particles in the gut tract of non-depurated samples.

Concentrations of target metals in non-depurated benthic invertebrate tissues were evaluated relative to co-located sediment metal concentrations to assess sediment-invertebrate bioaccumulation (Figure 8). Although strongly influenced by sample points at elevated sediment and tissue concentrations, positive linear relationships ($R^2 > 0.8$) were of observed between tissue and sediment concentrations of cadmium, copper, and lead. Relationships between tissue and sediment concentrations of total mercury, selenium, and zinc were largely variable over the range of sediment concentrations. Concentrations of methylmercury in tissue were generally consistent at five (5) of eight (8) stations across a range of sediment total mercury concentrations; methylmercury concentrations were variable with sediment concentrations in samples from the remaining SQT stations.

Fish Tissue

Concentrations of target metals were analyzed in whole body fish tissue samples from three sampling reaches upstream, within, and downstream of the SWMU 1/22 Wetland Complex (Figure 3). The results of the fish tissue analyses are provided in Table 15 and presented graphically by sampling reach and species in Figure 9; a summary of analytical data for fish tissue analyses is presented in Appendix C.

The results of forage fish tissue analyses were assessed by reach to evaluate potential spatial relationships in concentrations (Figure 9). Concentrations of selenium and mercury (total and methyl[4]) in fish tissue increased with increasing distance from upstream to downstream sampling reaches. Concentrations of cadmium and copper were generally consistent between upstream and site reaches, but were elevated at the downstream sampling reach. Concentrations of lead and zinc were elevated at the site reach relative to upstream; however, concentrations in downstream samples were not elevated relative to the upstream results.

A limited number of piscivorous fish samples were collected from the three sampling reaches. Concentrations of cadmium and selenium in American eel samples collected in the downstream reach were elevated relative to forage fish from the same reach (Figure 9). Concentrations of methylmercury, copper, and zinc were generally lower in American eel samples when compared to forage fish. Concentrations of other target metals in American eel were comparable to concentrations measured in forage fish. Concentrations of target metals in the one largemouth bass sample collected in the upstream reach were generally within the range of the error associated with mean forage fish concentrations (Figure 9).

[4] An average of 94 percent of total mercury concentrations in forage fish tissue and 87 percent of total mercury in piscivorous fish tissue was present as methylmercury.

5.0 ACTIVE PLANT AREA INVESTIGATIONS

At the request of DFWMR, several ecological investigations were conducted in the Active Plant Area of the Site. Investigations in the Active Plant Area were designed to evaluate potential terrestrial bioaccumulation and wildlife ingestion pathways. The following sections provide details of these investigations.

5.1 Terrestrial Bioaccumulation Evaluation

At the request of DFWMR, co-located biological tissue and soil samples were collected at the margins of the Active Plant Area to evaluate potential terrestrial bioaccumulation and wildlife ingestion pathways for site-related metals. Samples of small mammal tissue, earthworm tissue, and surficial soils were analyzed to provide site-specific tissue data to represent exposure point concentrations for dose rate exposure models to evaluate potential ingestion pathways for predators of small mammals and vermivorous wildlife. Biological samples from the Active Plant Area were collected and processed in accordance with the procedures detailed in the Work Plan under a project-specific NYSDEC LCP permit for the lawful collection of samples for scientific purposes (Permit #1643, effective date 5/28/10). The following sections describe the sampling approach and summarize the analytical data.

5.1.1 Sampling Approach

Small mammal and earthworm tissue collections were spatially- and temporally- matched with the collection of surficial soil samples in the six (6) sampling grids designated by DFWMR (URS, 2010): three (3) grids near the northern extent of the Active Plant Area and three (3) grids near the southern extent (Figure 10). Each sampling grid was approximately one hectare in area. The sampling approach for the collection of biological tissue and soil from designated sampling grids within the Active Plant Area is summarized in the following sections; specific procedures relevant to the collection and analysis of small mammal and earthworm tissue and soil samples are provided in the Work Plan (URS, 2010).

Small Mammal Tissue

Eighty (80) Sherman traps were deployed on June 21, 2010 and retrieved on June 24, 2010. Traps were set in transects approximately within each designated sampling grid (Figure 10). Transects were oriented relative to optimal small mammal habitat, biasing areas that favor predatory small mammals (e.g., shrews), such as high grass or bushy areas, along or under fallen logs, along visible trails, and/or along edge habitat within the sampling grid. As directed by DFWMR, traps were not deployed within the boundaries of SWMUs and/or AOCs or in areas of disturbance that lack ecological habitat (e.g., gravel or paved areas). The number of transects, number of traps per transect, and the orientation of transects were customized to each sampling grid depending on habitat availability and probability of trapping success. Traps were numbered (1 – 80) and the orientation of traps along each transect was recorded; GPS positions were recorded at the locations of small mammal traps at both ends of each transect.

The three (3) night sampling event resulted in a total effort of 240 trap-nights per sampling grid (80 traps x 3 nights = 240 trap-nights) and 1440 total trap-nights for the sampling effort (240 trap-nights/grid x 6 grids = 1440 total trap-nights). Traps were baited with a mixture of bacon grease, peanut butter, and oats and checked in the early morning and late afternoon. Animals captured in the traps were field-identified and assigned an individual identification number, indicating the sampling grid, trap number, and date/time of capture. Captured animals were either retained for tissue analysis or released and the trap was re-set, re-baited, and returned to its position on the transect.

A total of five (5) small mammal samples were targeted for whole body tissue analyses in each sampling grid. The Work Plan prioritized predatory small mammals, particularly shrews (*Blarina* spp.), for tissue analyses (URS, 2010); however no predatory small mammals were captured during the 1440 trap-night effort. The first five (5) specimens of each small mammal taxon captured in each sampling grid were identified, sacrificed by asphyxiation using dry ice, and retained in a freezer for potential tissue analysis. When five (5) specimens of a given species were captured within a sampling grid, any additional specimens of that species captured within the sampling grid were identified and released. The location of capture, species, and age were recorded for each captured animal; body length, body weight, and sex were recorded for each animal sacrificed for tissue analysis.

At the end of the sampling effort, specimens from each sampling grid were inventoried and the following target species were identified for tissue analysis:

Species	Northern Grids			Southern Grids		
	N1	**N2**	**N3**	**S1**	**S2**	**S3**
White-footed mouse *Peromyscus leucopus*	5	5	2	2	2	0
Meadow Jumping Mouse *Zapus hudsonius*	0	0	1	1	0	0
Meadow Vole *Microtus pennsylvanicus*	0	0	2	1	0	1
Total:	**5**	**5**	**5**	**5**	**2**	**1**

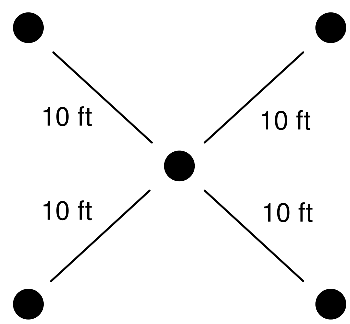
Specimens selected for tissue analyses were frozen and shipped to Test America Laboratories (Pittsburgh, PA) on dry ice. Whole body samples were processed and analyzed for the 12 metal constituents of potential ecological concern (COPECs) identified for the Active Plant Area in the Step IIB Report: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, and zinc. Percent moisture was measured for each sample to facilitate conversions between wet weight and dry weight concentrations.

Earthworm Tissue and Surficial Soil

After the completion of small mammal trapping, representative samples of earthworm tissue and soil were obtained on June 24 and 25, 2010. Earthworm tissue and soil samples were collected from within each sampling grid using a composite sample design. Five (5) composite earthworm tissue and composite soil samples were targeted from quasi-randomly selected small mammal trapping locations within the sampling grid. As stated in the Work Plan, the objective of the sampling design was to provide spatial representation of earthworm tissue and soil samples within the trapping area, while retaining randomization in the sampling design (URS, 2010).

As described in detail in the Work Plan, random number generation was used to identify targeted earthworm tissue and soil sample locations from the 80 numbered small mammal traps deployed within the each sampling grid. The locations of earthworm tissue and soil samples identified by the random number generation were adjusted, as necessary, based on the discretion of the field team leader if earthworms were not present in the soil or if there was inadequate spatial coverage of the trapping area. Earthworm tissue and soil sampling locations are illustrated in Figure 10.

Composite samples for earthworm tissue and soil consisted of subsamples from five (5) sample points distributed around the randomly selected trap location as follows:



At each sample point, a decontaminated shovel was used to collect surficial samples (0 – 1 foot) from the five (5) soil sampling points illustrated in the above diagram. Aliquots containing approximately equal volumes of each of the five (5) soil sampling points were homogenized to similar color and texture. The homogenized soil composite were placed in laboratory-supplied glassware and stored on ice for shipment to Test America Laboratories (Pittsburgh, PA). Soil samples were analyzed for 12 site-specific metals identified as COPECs in the Step IIB Report: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, and zinc. The position of the center sampling point was recorded with Trimble GeoXH sub-meter GPS unit.

After the collection of the composite soil sample, composite earthworm samples were collected from the five (5) sample points by digging, as necessary, with a decontaminated shovel. Approximately equal masses of earthworms from each sample point were composited until at least 15 – 20 total grams of tissue were obtained for standard metals analyses (e.g., USEPA SW-846 6020 and 7471A). Once a sufficient sample mass was collected, composite earthworm samples were rinsed in distilled/deionized water to remove residual soil, padded dry, placed in clean sample jars. At the direction of DFWMR, earthworm samples collected for metals analyses were not depurated to excrete residual soil from the gut tract prior to analysis. Non-depurated samples were frozen and shipped to Test America Laboratories (Pittsburgh, PA) for analysis. Earthworm samples were analyzed for the 12 site-specific metal COPECs analyzed in soil and small mammals.

5.1.2 Results

The following sections present the results of small mammal and earthworm tissue sampling in the Active Plant Area. The approach for using small mammal tissue to evaluate potential risks to small mammal predators in the Active Plant Area is presented in the Section 7.2.1. Evaluation of terrestrial wildlife exposure to metals in small mammal and earthworm tissues is presented in Section 9.0.

Small Mammal Tissue

Concentrations of site-related metals were analyzed in whole body tissue samples of the three species of small mammals (meadow jumping mouse, meadow vole, and white-footed mouse) captured during the June 2010 sampling event within the Active Plant Area (Figure 10). The results of the small mammal tissue analyses are presented graphically by sampling grid and species in Figure 11. Summary statistics of small mammal tissue data are provided in Table 16; a complete summary of analytical data is presented in Appendix C.

The results of tissue sampling indicated variable results for most metals by sampling grid, with the exception of lead, selenium, and zinc. Elevated concentrations of lead and zinc were observed in samples of white-footed mouse from grid N3 relative to other sampling grids; grid N3 also contained greater concentrations of zinc in meadow vole and meadow jumping mouse samples. Concentrations of selenium were also elevated in white-footed mouse samples from grids N1 and N3 relative to other grids. Concentrations of other metals in white-footed mouse did not differ substantially between grids; low samples sizes limit spatial comparisons of metals concentrations in meadow jumping mouse and meadow vole.

Earthworm Tissue

Site-specific metal concentrations were analyzed in non-depurated earthworm tissue from co-located soil and earthworm sampling stations within the Active Plant Area (Figure 10). The results of the earthworm tissue analyses are presented relative to corresponding soil concentrations in Figure 12. Summary statistics of earthworm tissue and corresponding soil data are provided in Tables 17 and 18, respectively. Complete summaries of analytical data for earthworm tissue and soil data are provided in Appendix C.

Concentrations of target metals in earthworm tissues were evaluated relative to co-located soil metal concentrations to assess soil-invertebrate bioaccumulation (Figure 12). Based on non-depurated results, bioaccumulation was highly variable for all metals, with the possible exception of copper and mercury. Concentrations of copper and mercury generally increased in earthworm tissues with increasing soil concentrations. Uptake of other metals was highly variable, with a wide range of concentrations observed in earthworm tissues that were collected from stations with similar soil concentrations. Some of the highest variability in bioaccumulation was observed in the relationship between selenium concentrations in earthworms and soil. Selenium concentrations in earthworms ranged from 4.5 to 197.9 mg/kg (dry weight) in soils containing 0.8 to 2.5 mg/kg of selenium.

6.0 ADDITIONAL MEDIA CHARACTERIZATION

In addition to the investigations described in the preceding sections that were designed to evaluate potential fish and wildlife impacts, NYSDEC requested further characterization of metals concentrations in soil and sediments in specific areas of the site that lacked existing data. The following sections describe the sampling conducted to characterize surficial soils adjacent to SWMU 35 and sediments in the two drainages that traverse the site and discharge to the SWMU 1/22 Wetland Complex.

6.1 SWMU 35 Surficial Soil Sampling

At the request of DFWMR, surficial soil sampling was conducted on June 18, 2010 at the perimeter of SWMU 35, a former landfill that potentially contains explosive wastes. Surficial soil samples were collected at the perimeter of SWMU 35 near the toe of landfill slope to evaluate the potential migration of metals to surficial soils adjacent to and downgradient of the landfill. As specified in the Work Plan, sampling was not conducted within the boundary of SWMU 35 due to health and safety concerns associated with sampling soils in landfills potentially containing explosive wastes (URS, 2010). The following sections describe the sampling approach and summarize the data collected to characterize soils at the perimeter of SWMU 35.

6.1.1 Sampling Approach

Five (5) surficial soil samples were collected from the perimeter of SWMU 35 (Figure 13). Samples were collected from 0 - 1 foot using a hand auger. Samples were analyzed for target metals including: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, and zinc. Sampling locations adjacent to SWMU 35 were recorded with a sub-meter Trimble GeoXH GPS unit.

6.1.2 Results

A summary of SWMU 35 perimeter sampling results is provided in Table 19; individual sample results are posted on Figure 13.

The results of soil sampling at the perimeter of SWMU 35 indicate that metals are not migrating downgradient of the landfill and are not likely to result in adverse effects to ecological receptors. As shown in Table 19, surficial soil concentrations of target metals were low relative to available NYSDEC Soil Cleanup Objectives for the Protection of Ecological Resources (Subpart 375-6) or the minimum USEPA Eco-SSL value (antimony and cadmium only; USEPA, 2007a). Antimony, cadmium, and cobalt slightly exceeded the soil screening criteria at one location for each metal. Antimony and cadmium exceeded criteria at the southern-most location PE-35-SO-01 (Figure 13); the antimony concentration at this station (0.31 mg/kg) was comparable to the minimum Eco-SSL (0.27 mg/kg). The concentration of cobalt at PE-35-SO-04(17.1 mg/kg) was also comparable to the minimum Eco-SSL (13 mg/kg). Based on the low concentrations of metals relative to screening soil criteria, it is not likely that the SWMU 35 landfill is a source of metals to downgradient surface soils. Furthermore, the limited exceedances of conservative soil screening criteria indicate that concentrations of metals in soils at the perimeter of SWMU 35 are not likely to result in adverse effects to ecological receptors.

6.2 Site Drainage Sediment Characterization

At the request of DFWMR, sediment samples were collected on June 23 and 28, 2010 from two (2) site drainages that traverse the Active Plant Area and discharge to the SWMU 1/22 Wetland Complex (Figure 14). Analytical data do not exist for sediments in these drainages; therefore, the purpose of these samples was to characterize concentrations of site-related metals in sediments within the drainage channels. The following sections describe the sampling approach and summarize the results of the site drainage sediment sampling.

6.2.1 Sampling Approach

Bulk sediment samples were collected at five (5) stations within each drainage for a total of 10 stations. Sediment samples were collected with a coring device to a depth of 24 inches, as prescribed by DFWMR. At each station, samples were collected at the following four (4) depth intervals: 0 – 6, 6 – 12, 12 – 18, and 18 – 24 inches. Each sample interval was homogenized to similar color and texture and placed in laboratory-supplied containers for analysis by Test America Laboratories (Pittsburgh, PA). Sediment samples were analyzed for the 12 site-specific metals identified as COPECs in the Step IIB Report: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, and zinc; additional sediment analyses included TOC and grain size.

6.2.2 Results

The results of the site drainage sediment characterization are illustrated in Figure 14. In the ditch traversing the northern portion of the Site, concentrations of metals did not indicate a distinct trend along the flow path or with sampling depth. The maximum concentration of mercury in the surface sampling interval (0 – 0.5’) was observed at the farthest upstream sampling station (PE-DRN-SD-01); concentrations of mercury varied by station and depth in the remaining samples. At station near the discharge to the SWMU 1/22 Wetland Complex (PE-DRN-SD-05), concentrations of copper, mercury, selenium, silver, and zinc were elevated in the surficial 0-0.5 foot sample.

In the ditch traversing the southern portion of the Site, greater concentrations of metals were observed at stations downgradient (east) of the railroad tracks relative to stations on the Active Plant (Figure 14). The greatest concentrations were observed at the two stations near the discharge to the wetlands, PE-DRN-SD-07 and PE-DRN-SD-06. Sediments at these stations generally had the greatest concentrations of copper, lead, mercury and zinc at all depths when compared to other stations within the drainage ditch. In total, these results indicate that the two drainage ditches that traverse the Site may represent historic migration pathways of site-related metals.

7.0 EXPOSURE EVALUATION APPROACH

The following sections present the approach used to evaluate data collected as part of the FWIA Step IIC investigations described in Section 4.0 for the SWMU 1/22 Wetland Complex and Section 5.0 for the Active Plant Area. The framework that is presented for evaluating ecological exposure and potential ecological impacts associated with metals in site media was initially established in the Work Plan (URS, 2010) and refined through subsequent discussions with DFWMR in meetings (September 15, 2010 and February 24, 2011) and multiple teleconferences (March 4, 11, and 18, 2011).

7.1 SWMU 1/22 Exposure Evaluation

Consistent with the ECSM presented in Section 3.1, the framework for evaluating ecological exposure in the SWMU 1/22 Wetland Complex included quantitative exposure evaluations for the following receptor categories:

- Benthic invertebrate community;
- Fish community; and
- Semi-aquatic wildlife community.

As described above in Section 4.0 and the Work Plan, FWIA Step IIC investigations conducted in the SWMU 1/22 Wetland Complex were designed to provide the necessary data to evaluate exposure and potential ecological impacts to these receptor categories (URS, 2010). The following sections describe the approach for evaluating exposure to each receptor category.

7.1.1 Benthic Invertebrate Community Exposure Assessment

The following sections describe the approach to evaluating potential impacts to benthic invertebrate communities associated with concentrations of site-related metals in sediments. As discussed in Section 4.1, an SQT investigation was conducted to evaluate potential risk to sediment-dwelling invertebrates in the SWMU 1/22 Wetland Complex based on a weight-of-evidence evaluation of spatially- and temporally- matched sediment chemistry, benthic community, and toxicity testing data. The following sections describe the data analysis procedures used to evaluate each line of evidence in the SQT investigation; the integration of the findings of each SQT line-of-evidence into a weight-of-evidence evaluation is also discussed.

Bulk Sediment Chemistry

The results of bulk sediment analyses were evaluated in accordance with NYSDEC *Technical Guidance for Screening Contaminated Sediments* (1999). NYSDEC guidance establishes freshwater sediment screening values based on the lowest criterion developed by Persaud et al. (1992) or Long and Morgan (1990). Measured concentrations of target metals, with the exception of selenium, were evaluated based on these two risk levels:

- Lowest Effects Level (LEL): Lowest value of either the Persaud et al. (1992) LEL or the Long and Morgan (1990) Effect Range-Low; and

- Severe Effects Level (SEL): Lowest value of either the Persaud et al. (1992) SEL or the Long and Morgan (1990) Effect Range-Median.

No LEL or SEL exists for selenium; therefore, an SQG developed for British Columbia by Nagpal et al. (1995) was used to evaluate measured concentrations of selenium.

The magnitude by which the measured concentration of a target metal exceeded its respective SQG was represented for each station as the quotient of the measured concentration to the SEL (SEL-Q). For selenium, the magnitude of exceedances was represented as the quotient of the measured concentration to the SQG developed for British Columbia by Nagpal et al. (1995). To represent concentrations of mixtures of target metals relative to SQGs, a mean SEL-quotient (SEL-Q_{mean}) was calculated for each station (Fairey et al., 2001). The mean SEL-quotient was calculated as the mean of the SEL-quotients calculated for individual target metals.

Benthic Invertebrate Community

Benthic invertebrate community data were evaluated consistent with the NYSDEC (2009), as the guidance applies to the collection of benthic invertebrates in a *Phragmites*-dominated wetland. A multi-metric approach was utilized to evaluate relative differences between SWMU 1/22 SQT and reference SQT stations. A subset of the benthic community metrics identified in the NYSDEC guidance that are applicable to wetland habitats were included in the evaluation. These metrics include:

- Taxa Richness;
- Non-chironomid and Oligochaete (NCO) Richness;
- Percent Model Affinity;
- Shannon-Weiner Diversity Index (H);
- Hilsenhoff Biotic Index (HBI); and
- Percent abundance of the dominant taxon.

The metrics listed above were quantified for the summer (June 2010) and the fall (October 2010) benthic invertebrate community sampling efforts. Mean values plus/minus the standard error for each metric were presented graphically to enable visual comparisons between SWMU 1/22 SQT stations and reference SQT stations.

Significant differences between metric values calculated for SQT stations were evaluated using parametric and non-parametric statistical methods. For the statistical analyses, reference stations (SQT-9, SQT-10, and SQT-11) were pooled and compared to SQT stations within the SWMU 1/22 Wetland Complex. The statistical method used to evaluate differences between stations was selected based on data distribution. Normally distributed datasets, as determined by the Shapiro-Wilk test for normality, were evaluated using parametric one-way analysis of variance (ANOVA). Non-normal data were log-transformed and re-evaluated for normality. Transformed data that satisfied the normality assumption were analyzed using parametric ANOVA; data that did not satisfy normality assumptions following transformation were analyzed using a non-parametric Kruskal-Wallis one-way ANOVA.

As described above parametric or non-parametric ANOVA was used to evaluate statistically significant differences between metric values from SQT stations. For metrics that were observed to have statistically significant differences between stations based on $\alpha=0.05$, for either season, a Tukey's Honestly Significant Difference (HSD) pairwise comparison test was performed to identify statistical differences ($\alpha=0.05$) between individual stations.

As requested by DFWMR, benthic community metrics calculated for SQT stations were also evaluated based on the NYSDEC Biological Assessment Profile (BAP) of index values for net jabs for slow, sandy streams (NYSDEC 2009). Specific metrics evaluated in the BAP for slow, sandy streams include:

- Species (taxa) Richness;
- Hilsenhoff Biotic Index (HBI);
- Ephemeroptera, Plecoptera, Trichoptera (EPT) Richness; and
- Non-Chironomidae and Oligochaete (NCO) Richness.

The BAP of index values is a method of standardizing values for these metrics to a common 10-scale, which enables plotting of metrics on a common scale of impacts. The mean value of the indices represents the assessed impact for each station. Potential benthic community impacts at SWMU 1/22 SQT stations were evaluated by comparing BAP scores at SWMU 1/22 SQT stations with BAP scores at reference SQT stations. BAP scores for June and October benthic community sampling at SQT stations were graphically displayed to enable qualitative comparisons of BAP scores.

Sediment Toxicity

As discussed in Section 4.1.1, sediment toxicity testing provides an *ex situ* evaluation of sediment toxicity at SWMU 1/22 SQT stations relative to reference SQT stations. Chronic test endpoints specified in Section 4.1.2, provided the basis for comparisons between SWMU 1/22 SQT and reference SQT stations. Survival, growth, reproduction (*Hyalella azteca* only) and emergence (*Chironomus riparius* only) endpoints were analyzed to determine statistically significant differences between sediments from SWMU 1/22 SQT stations and sediments from laboratory control and reference SQT stations. Statistical comparisons were conducted by EnviroSystems using CETIS® software. Parametric or non-parametric ANOVA and subsequent pairwise comparisons were used to evaluate statistical differences in the datasets depending on the normality of the distribution and the homogeneity of sample variance; statistical differences were evaluated at $\alpha=0.05$. Sediments from SWMU 1/22 SQT stations were considered toxic to benthic invertebrates in a given toxicity test if the test endpoint was significantly different than at least two (2) reference SQT stations. Further description of the evaluation of sediment toxicity data is provided in Appendix B.

SQT Weight-of-Evidence Evaluation

The multiple lines-of-evidence in the SQT investigation were integrated into a weight-of-evidence evaluation to assess benthic community impairment in the SWMU 1/22 Wetland Complex. The lines-of-evidence included in the SQT investigation vary in terms of relevance to the site-specific toxicity of sediments (Bay et al. 2007); therefore, the Work Plan established the relative weight of each line-of-evidence in the weight-of-evidence evaluation (URS, 2010). Table 20 provides the basis for the following weighting of SQT lines-of-evidence as presented in the Work Plan, listed in order of descending relative weight:

1) Benthic community analyses;
2) Sediment toxicity testing: 28-day *Chironomus riparius* and 42-day *Hyalella azteca* tests; and
3) Comparison of bulk sediment chemistry to SQGs.

As presented in Table 20, benthic community analyses provide the most relevant information regarding site-specific toxicity (Chapman 2007; Chapman and Anderson 2005; McPherson et al. 2008). Community studies are *in situ* evaluations of indigenous benthic invertebrates that have integrated the effects of chemical and physical stressors and have evolved over time to survive in a highly variable and stressful environment. Benthic community data are most relevant to site-specific exposure; therefore, these data were afforded the greatest weight in the SQT investigation.

Sediment toxicity testing is less relevant to site-specific toxicity when compared to benthic community analyses because it represents an *ex situ* evaluation of sediment toxicity that creates artificial exposure conditions (e.g., disruption of redox conditions, etc.) through the collection, transport, and manipulation of sediments. Furthermore, sediment toxicity testing is conducted using naive laboratory-reared organisms that are not as tolerant to a highly variable and stressful environment as are organisms living in the wild (Klerks et al., 1989; Johnston 2010) Of the available chronic endpoints from the *Hyalella* and *Chironomus* testing conducted in the SWMU 1/22 Wetland Complex, greater weight in the determination of sediment toxicity was assigned to lethal endpoints (i.e., survival) relative to sublethal endpoints (e.g., growth, reproduction). Lethal endpoints were afforded greater weight in the SQT evaluation because adverse effects observed in these test endpoints will likely result in greater effects on population stability (McPherson et al. 2008).

The lowest relative weight in the SQT evaluation was assigned to comparisons of bulk sediment concentrations to generic sediment screening values (e.g., LEL or SEL). Generic sediment screening values do not take into account site-specific factors that mitigate the toxicity and bioavailability of metals in sediments (NYSDEC 1999; McPherson et al. 2008; Chapman and Anderson 2005). As a result, these comparisons are the least relevant to the site-specific toxicity of sediments when considered relative to benthic community analyses and sediment toxicity testing.

Consistent with the weighting of the lines-of-evidence described above, SQT data from the SWMU 1/22 Wetland Complex were evaluated based on the framework for interpreting SQT data proposed by (Bay and Weisberg, 2010). The framework for integrating the three lines-of-evidence into a station-specific assessment of impacts is based on a three step process:

- **Step 1**: The response for each line-of-evidence is assigned into one of four categories:
  1. No difference from reference conditions (i.e., minimal response);
  2. A minor response that might not be statistically distinguishable from reference (i.e., low response);
  3. A response that is clearly distinguishable from reference (i.e., moderate response); and
  4. A severe response indicative of extreme conditions (i.e., high response).

  For the SQT lines-of-evidence evaluated in the SWMU 1/22 Wetland Complex, the response category for each line of evidence was assigned based on the following criteria for each line-of-evidence:

  - **Sediment chemistry:** Exposure to target metals concentrations at each station was evaluated relative to SQGs using SEL-Q values for individual metals and SEL-Q_{mean} values calculated for mixtures of target metals at each station. Potential exposure to target metals in sediments at each SQT station was categorized as minimal (SEL-Q_{mean} <1), low (SEL-Q_{mean} 1-5), moderate (SEL-Q_{mean} 5-15), or high (SEL-Q_{mean} >15).
  - **Sediment toxicity testing:** Potential benthic community-level responses associated with toxicity tests were assigned based on survival endpoints in the most sensitive chronic toxicity test, *i.e*. the 42-day *Hyalella azteca* test. *Hyalella* is a more sensitive indicator of survival relative to *Chironomus*, which only had significant survival effects at SQT-03. Therefore, the use of *Hyalella* endpoints is a conservative representation of sediment toxicity at SQT stations within the SWMU 1/22 Wetland Complex.

    As previously stated, greater weight is afforded to survival endpoints because adverse effects observed in these test endpoints will likely result in greater effects on population stability (McPherson et al., 2008). Test organism survival at SWMU 1/22 SQT stations was evaluated based on relative to survival at reference stations (relative survival) by dividing the mean survival at the study station relative to mean survival at the combined reference stations. Potential responses were assigned to each SWMU 1/22 station based on comparisons of the relative survival of *Hyalella azteca*. Potential toxicity at each SQT station was categorized as nontoxic (> 80 percent relative survival and not statistically different from reference survival), low (60 – 80 percent relative survival), moderate (30 – 60 percent relative survival), or high (< 30 percent relative survival).

- **Benthic invertebrate community data:** Impacts or disturbances to benthic communities were evaluated based on relative comparisons of mean BAP index values for the June sampling event[5]. Differences between mean BAP index values at SWMU 1/22 and reference SQT stations were evaluated as the ratio of mean BAP index values for SWMU 1/22 SQT stations to the mean BAP index values for the combined reference SQT stations. Ratios of mean BAP index values (BAP-Q) less than 1.0 were indicative of a disturbance or impact at SWMU 1/22 stations relative to reference conditions. Potential benthic community disturbance at each SQT station was categorized as: reference (BAP-Q >1), low (BAP-Q = 0.8 – 1.0), moderate (BAP-Q = 0.4 – 0.8), or high (BAP-Q < 0.4). In addition to mean BAP index values, the number of community metrics that were significantly different at SWMU 1/22 stations relative to reference stations was considered in assigning response categories.

- **Step 2:** Based on the responses assigned for each line-of-evidence at the SQT stations, the individual lines-of-evidence were integrated to address two key questions: 1) Is the degradation of benthic community structural metrics evident at SWMU 1/22 SQT stations, and 2) Are concentrations of target metals sufficiently elevated in sediments to explain the observed degradation? The framework for addressing these questions is presented in Table 21, as developed by (Bay and Weisberg, 2010). The process for implementing the framework is presented below:

  - **Classifying the Severity of Effects:** As presented in the Table 21A, the process for classifying the severity of effects integrates the results of sediment toxicity testing and benthic community analyses. Based on the response categories assigned in Step 1 for each respective line-of-evidence, the severity of biological effects was classified for each SWMU 1/22 SQT station using the matrix presented in Table 21A.

  - **Potential for Chemically Mediated Effects:** The potential for observed biological effects to be associated with exposure to target metals in sediments was assessed based on the integration of the sediment chemistry and sediment toxicity testing lines-of-evidence. As illustrated in Table 21 B, response categories assigned in Step 1 for the sediment chemistry and sediment toxicity testing lines-of-evidence were used to identify the potential for chemically-mediated effects.

[5] Because of the low density of organisms collected during the October sampling event, the mean BAP index was greater than 1.0 for all stations except SQT-3 and SQT-6. It is likely that low invertebrate density at SWMU 1/22 and reference stations and the resulting high BAP was influenced by factors other than sediment chemistry; therefore, to be conservative, only the results from the June sampling event.

- **Step 3:** The final step in the weight-of-evidence evaluation of the SQT lines-of-evidence is the integration of the severity of effects classifications (Table 21A) and the potential for chemically-mediated effects (Table 21B). Using the matrix presented in Table 21C, station-specific impacts were assigned for each SWMU 1/22 SQT station based on the severity of biological effects and the potential for chemically-mediated effects classifications designated in Step 2 (Tables 21B and 21C). Integration of the SQT lines-of-evidence based on the framework described above was used to assign SWMU 1/22 SQT stations to one of six impact categories, as presented in Bay and Weisberg (2010):
  - **Unimpacted:** Confident that sediment contamination is not causing significant adverse impacts to aquatic life living in the sediment at the Site;
  - **Likely unimpacted:** Sediment contamination at the Site is not expected to cause adverse impacts to aquatic life, but some disagreement among the lines-of-evidence reduces certainty in classifying the site as unimpacted;
  - **Possibly impacted:** Sediment contamination at the Site may be causing adverse impacts to aquatic life, but these impacts are either small or uncertain because of disagreement between among the lines of evidence;
  - **Likely impacted:** Evidence for a contaminant-related impact to aquatic life at the Site is persuasive, even if there is some of disagreement among lines-of-evidence;
  - **Clearly impacted:** Sediment contamination at the Site is causing clear and severe adverse impacts to aquatic life.
  - **Inconclusive:** Disagreements among the lines-of-evidence suggest that either the data are suspect or that additional information is needed before a classification can be made.

7.1.2 Fish Community Exposure Assessment

The exposure assessment for the fish community in the SWMU 1/22 Wetland Complex was based on the following three lines of evidence:

- Comparison of surface water results to water quality criteria protective of aquatic life;
- Comparison of the fish presence/absence survey results from the SWMU 1/22 and downstream sampling reach to survey results from the upstream sampling reach; and
- Comparison of mercury concentrations in fish tissue to a conservative tissue residue benchmark for mercury.

Fish community exposure was evaluated based on comparisons of concentrations of target metals in filtered surface water samples to chronic NYSDEC SWQS for the protection of aquatic life. Direct contact exposure (gill absorption) with surface water is a primary route of exposure for fish in the SWMU 1/22 Wetland Complex.

Evaluation of the fish community was based on qualitative comparisons of fish taxa present within and downstream of the SWMU 1/22 Wetland Complex to taxa observed upstream of the wetland. The results of the presence/absence survey were evaluated to identify potential patterns in the distribution of taxa that was consistent with gradients of metals concentrations in sediment and/or surface water.

Potential adverse effects related to fish community exposure to mercury in the SWMU 1/22 Wetland Complex were evaluated based on comparisons of measured concentrations of mercury to a conservative tissue residue benchmark. Whole body fish tissue samples (wet weight) were compared to a tissue residue benchmark established by Beckvar et al. (2005). Based on studies with paired no effect and effect endpoints (e.g., survival, growth, reproduction, development, behavior), Beckvar et al. (2005) summarized no effect residue (NER) and low effect residue (LER) whole body burden thresholds for mercury for various fish life stages (e.g., eggs, larval, fry, adult, etc.). Based on the geometric mean of paired NER and LER values, Beckvar et al. (2005) recommended a whole body threshold effect concentration of 210 ng/g wet weight. This threshold effect concentration was considered protective of juvenile and adult fish due to the representation of multiple life stages in the supporting studies. Mercury concentrations in whole body fish tissues measured in the SWMU 1/22 Wetland Complex were evaluated relative to this benchmark as a conservative evaluation of potential effects.

7.1.3 Semi-Aquatic Wildlife Exposure Assessment

Simplified dose rate models were developed to evaluate wildlife ingestion pathways in the SWMU 1/22 Wetland Complex. Dose rate models were developed to calculate estimated daily doses (EDDs) of metals that select receptor groups may experience through exposure to site media. EDDs for wildlife receptors were calculated using: (1) EPCs based on site-specific measurements of metals in prey and abiotic media and (2) receptor-specific exposure parameters and food chain model assumptions. EDDs were calculated using EPCs and receptors-specific exposure parameters expressed on a dry weight basis[6].

Calculated EDDs were compared to toxicity reference values (TRVs) representing no observable adverse effect levels (NOAELs) or low observable adverse effect levels (LOAELs) to evaluate the potential for adverse ecological effects. Potential risks associated with estimated doses to wildlife receptors were expressed as hazard quotient (HQs), which represent the ratio of the calculated EDD to the TRV for wildlife ingestion pathways:

$$HQ = \frac{EDD}{TRV}$$

Potential risk may be characterized based on HQs, as follows:

[6] Wet weight tissue concentrations reported by analytical laboratories were converted to dry weight based on the measured moisture content of tissue samples. Measured tissue concentrations were input into the dose rate models to maintain consistency with exposure parameters (e.g, food and sediment ingestion rates) expressed on a dry weight basis.

- o HQs greater than 1.0 indicate that exposure exceeds a known threshold of effects, which could represent no adverse effects (e.g., NOAEL) or low adverse effects (e.g., LOAELs).
- o HQs less than 1.0 based on a NOAEL indicate that adverse effects are extremely unlikely because constituent concentrations result in a dose that has been demonstrated not to cause adverse ecological effects.
- ❑ HQs less than 1.0 based on a LOAEL indicate that constituent concentrations do not result in an exposure associated with adverse ecological effects to test organisms; HQs less than 1.0 based on a LOAEL are not likely to result in adverse effects to receptor populations.

Appendix D provides a detailed description of the dose rate model, including the derivation of exposure parameters, the calculation of exposure point concentrations, and the derivation of TRVs. A general overview of the model is provided below.

Dose Rate Model Overview

The total dose (EDD_{total}) experienced by each receptor was calculated as the sum of the doses obtained from the primary routes of exposure, the direct ingestion of dietary items, the direct ingestion of surface water, and the incidental ingestion of substrate (e.g., soil or sediment):

$$EDD_{total} = EDD_{diet} + EDD_{water} + EDD_{substrate}$$

In the model, the dose from each route of exposure was calculated individually as follows:

<u>Dietary Dose:</u>

As described in Section 4.5, concentrations of metals in dietary items of semi-aquatic wildlife receptors were directly measured in the SWMU 1/22 Wetland Complex. Representative EPCs for input into the dietary dose models were based on the upper 95 percent confidence limit of the mean concentrations (UCL_{95}) of the site-specific dry weight tissue datasets. UCL_{95} concentrations were calculated using USEPA ProUCL 4.00.02, as described in detail in Appendix D. Receptor-specific exposure parameters were used to estimate the dietary dose based on the tissue EPCs as follows:

$$EDD_{diet} = \frac{\sum(DIR \times C_{t\,i} \times DF_i) \times AUF}{BW}$$

where:

EDD_{diet}	= Dietary dose of constituent (mg/kg receptor body weight-day)
DIR	= Daily ingestion rate of dietary items (kg food ingested per day, dry weight)
$C_{t\,i}$	= UCL_{95} concentration of constituent in dietary item *i* (mg /kg food item, dry weight)
DF_i	= Dietary fraction of item *i* (proportion of dietary item in total diet)
AUF	= Area use factor (unitless)

BW = Body weight of the receptor, wet weight (kg)

Water Dose:

The dose associated with the direct ingestion of surface water was calculated based on maximum unfiltered surface water concentrations and receptor-specific exposure parameters as follows:

$$EDD_{water} = \frac{WIR \times C_{water} \times AUF}{BW}$$

EDD_{water} = Dose of constituent obtained through direct ingestion of surface water (mg/kg receptor body weight-day)

WIR = Drinking water ingestion rate (liters ingested per day)

C_{water} = Maximum constituent concentration in unfiltered surface water (mg/L)

AUF = Area use factor (unitless)

BW = Body weight of the receptor, wet weight (kg)

Substrate Dose:

The dose associated with the incidental ingestion of sediment was calculated based on calculated UCL_{95} sediment concentrations and receptor-specific exposure parameters as follows:

$$EDD_{substrate} = \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

$EDD_{substrate}$ = Dose of constituent obtained through incidental ingestion of substrate (mg/kg receptor body weight-day)

$SIR_{incidental}$ = Incidental ingestion rate of substrate (kg substrate ingested per day, dry weight)

$C_{substrate}$ = Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

AUF = Area use factor (unitless)

BW = Body weight of the receptor, wet weight (kg)

Based on the dose rate model described above, potential risks to wildlife receptors were evaluated based on two (2) scenarios:

- Maximum Area Use: Scenario conservatively assumes that individual wildlife receptors forage exclusively within the defined exposure area for their entire life span. For this scenario, the AUF input into the dose rate model is 1.0; and
- Area Use Adjusted Exposure: Scenario quantifies exposure based on the proportion of the time that a receptor is likely to forage within the exposure area as a function of its total foraging range. For this scenario, the AUF input into the dose rate model is the ratio of the size of the exposure area to the size of the receptor-specific foraging range (See Appendix D).

Further discussion of the exposure scenarios and the underlying assumptions used in the evaluation of wildlife exposure in the SWMU 1/22 Wetland Complex is provided in Appendix D.

Exposure Area

The wildlife exposure area for SWMU 1/22 Wetland Complex included the area from the plant entrance road to the farthest extent of the downstream sediment characterization sampling (Figure 15). In addition, at the request of DFWMR, portions of the site drainage ditches to the east of the railroad tracks were conservatively included in the exposure area. The area characterized by the downstream sediment sampling stations was included in the wildlife exposure area due to the elevated concentrations of site-related metals observed in sediments downstream of the site and the potential for wildlife foraging within the SWMU 1/22 Wetland Complex to forage downstream of the site. Based on these extents, the total exposure area for the SWMU 1/22 Wetland Complex comprises approximately 5.2 hectares and approximately 1.9 linear kilometers (Figure 15).

Selected Receptors

Consistent with the ECSM developed in Section 3.1, potential exposures to representative wildlife receptors in the SWMU 1/22 Wetland Complex were modeled to evaluate potential risk to the following trophic categories:

- Avian aerial insectivore: Tree swallow (*Tachycineta bicolor*);
- Avian piscivore (large): Great blue heron (*Ardea herodias*)
- Avian piscivore (small): Belted kingfisher (*Ceryle alcyon*);
- Avian invertivore: Mallard (*Anas platyrhynchos*)
- Mammalian aerial insectivore: Indiana bat (*Myotis sodalis*);
- Mammalian piscivore: Mink (*Mustela vison*); and
- Mammalian omnivore: Raccoon (*Procyon lotor*).

Receptor-specific parameters used to evaluate exposure to representative receptors are provided in Appendix D.

7.2 Active Plant Area Exposure Evaluation

The exposure evaluation in the Active Plant Area focused on potential risks to wildlife receptors that potentially forage on small mammals and earthworms along the margins of the facility. Terrestrial wildlife exposure was evaluated for the following scenarios for the Active Plant based on the sampling design described in Section 5.1:

- Northern sampling grids: maximum area use exposure;
- Southern sampling grids: maximum area use exposure; and
- Northern and Southern sampling grids: maximum area use and adjusted area use exposure for long-ranging receptors.

Maximum area use exposure was appropriate when evaluating the plant regions individually based on the foraging range of receptors. Short-ranging receptors (e.g., short-tailed shrew and American robin) would forage exclusively within the northern or southern grids based on limited home range; therefore, area use adjusted doses would not be appropriate for these receptors. The foraging area of these short-range receptors is not large enough to include both plant regions; therefore, only long-ranging receptors were evaluated in the combined northern and southern grid exposure scenario.

The combined data for the northern and southern grids were used to conservatively represent exposure throughout the approximately 42 hectares of the Active Plant Area. Area use adjusted exposure to long-ranging receptors (e.g., red-tailed hawk and red fox) was only evaluated in the combined northern and southern grids exposure evaluation because the foraging area of these receptors could include both plant regions. The following section describes the approach for evaluating wildlife exposure in the Active Plant Area.

7.2.1 Terrestrial Wildlife Exposure Assessment

The wildlife exposure assessment for the Active Plant Area was conducted using dose rate models. Consistent with the evaluation of wildlife exposure in the SWMU 1/22 Wetland Complex, calculated EDDs from dose rate models were compared to TRVs and potential risks to wildlife were expressed as HQs, representing the ratio of the calculated EDD to the TRV.

A detailed description of the dose rate model is provided in Appendix D, including the derivation of exposure parameters for terrestrial receptors, the calculation of exposure point concentrations, and the derivation of TRVs. A general overview of the model is provided below.

Dose Rate Model Overview

Based on the ECSM for the Active Plant Area (Section 3.2), the total dose (EDD_{total}) experienced by each select receptor was calculated as the sum of the doses obtained from the primary routes of exposure: the direct ingestion of dietary items and the incidental ingestion of substrate (e.g., soil):

$$EDD_{total} = EDD_{diet} + EDD_{substrate}$$

The dose from each route of exposure was calculated using the general form of the equations presented in Section 7.1.3. Input parameters specific to each exposure route for the terrestrial wildlife exposure evaluation include:

Dietary Dose:

As described in Section 5.1.1, concentrations of metals in earthworms and small mammals were directly measured from select areas on the margins of the Active Plant Area. Representative EPCs for input into the dietary dose models for predators of small mammals and vermivorous wildlife were based on the UCL_{95} concentrations calculated from the site-specific dry weight small mammal and earthworm tissue datasets, respectively. UCL_{95} concentrations were calculated using USEPA ProUCL 4.00.02, as described in detail in Appendix D. The estimated dietary dose was calculated based on the tissue EPCs using the dietary dose equation presented in Section 7.1.3 (See Appendix D).

<u>Substrate Dose:</u>

The estimated dose associated with the incidental ingestion of soil was calculated based on UCL_{95} soil concentrations and receptor-specific exposure parameters using the substrate dose equation presented in Section 7.1.3. Additional details regarding the calculation of estimated substrate doses are provided in Appendix D.

Selected Receptors

Consistent with the ECSM developed in Section 3.2, potential exposures to representative wildlife receptors in the Active Plant Area were modeled to evaluate potential risk to the following trophic categories:

- Red fox (*Vulpes vulpes*): carnivorous mammal;
- Red-tailed hawk (*Buteo jamaicensis*): carnivorous bird;
- Short-tailed shrew (*Blarina brevicauda*): vermivorous mammal; and
- American robin (*Turdus migratorius*): vermivorous bird.

Receptor-specific parameters used to evaluate exposure to representative receptors in the Active Plant Area are provided in Appendix D.

8.0 SWMU 1/22 EXPOSURE EVALUATION AND RISK CHARACTERIZATION

Based on the approach detailed in the preceding section, the results of the SWMU 1/22 Investigations (Section 4.0) were used to evaluate current ecological exposure to aquatic and semi-aquatic receptors potentially inhabiting the SWMU 1/22 Wetland Complex. The following sections present the results of the exposure evaluation for the receptor groups identified in the ECSM (Section 3.1):

- Benthic invertebrate community;
- Fish community; and
- Semi-aquatic wildlife community.

Potential risks to each receptor group are characterized based on the results of the exposure evaluation.

8.1 Benthic Invertebrate Community Exposure

Benthic invertebrate community exposure was evaluated based on a weight-of-evidence SQT approach integrating the bulk sediment chemistry, benthic invertebrate community, and sediment toxicity results presented in Section 4.1.3. The following sections present the results of the exposure evaluation for the SQT lines of evidence based on the evaluation approach established in Section 7.1. The findings of the exposure evaluation for each line of evidence is integrated into a weight-of-evidence assessment of benthic invertebrate community impacts in the SWMU 1/22 Wetland Complex.

8.1.1 Sediment Quality Triad Exposure Evaluation

The following sections present the findings of the exposure evaluation for each line of evidence in the SQT investigation.

Sediment Chemistry

Sediment chemistry results were evaluated relative to SQGs provided in NYSDEC guidance (NYSDEC, 1999). Measured concentrations of metals in sediment, with the exception of selenium, were compared to: 1) LEL values indicative of sediment contamination that can be tolerated by the majority of benthic organisms, but may cause toxicity to a few species; and 2) SEL values indicative of contamination that is expected to result in the disturbance of benthic invertebrate communities. No LEL or SEL exists for selenium; therefore, an SQG developed for British Columbia by Nagpal et al. (1995) was used as a representative LEL to evaluate selenium concentrations. The results of the comparisons of sediment metals concentrations to SQGs is presented in Table 2, and illustrated spatially in Figure 5.

Evaluation of target metals concentrations in SWMU 1/22 SQT sediments indicates exceedances of SQGs (Table 2). Measured concentrations of target metals at SQT stations exceeded LELs for all metals in each sample, with the exception of cadmium and zinc in SQT-03. SELs were exceeded in each sample for copper, lead, and mercury; four samples exceeded the SEL for zinc and only one sample exceeded the SEL for cadmium. SEL-Q and SEL-Q_{mean} values are presented in Table 22 for each SQT station. As previously stated for selenium, SEL-Q was represented as the quotient of the measured concentration to the SQG developed for British Columbia by Nagpal et al. (1995). Concentrations resulting in the greatest magnitude of SEL exceedances were observed in samples from stations SQT-03, SQT-04, and SQT-06. As previously stated, these stations are closest to the SWMU 22 landfill (Figure 5).

Concentrations of target metals measured at reference SQT stations exceeded LELs for most metals in most samples (Table 2); however no samples contained target metals concentrations exceeding an SEL (Table 22).

Benthic Invertebrate Community

As discussed in Section 7.1.1, benthic community data were evaluated based on a multi-metric approach consistent with NYSDEC (2009) and in consultation with DFWMR. Calculated metric values for the Summer (June) 2010 and Fall (October) 2010 sampling events are tabulated in Table 23 and presented graphically in Figure 16 for the following metrics:

- Taxa Richness;
- NCO Richness;
- Percent Model Affinity;
- Shannon-Weiner Diversity Index;
- Hilsenhoff Biotic Index (HBI); and
- Percent abundance of the dominant taxon.

Table 24 presents a summary of statistical comparisons of benthic community metrics at SWMU 1/22 Wetland Complex stations and pooled reference stations. Shaded p-values in Table 24 indicate statistically significant differences between SWMU 1/22 metric values and reference values that are consistent with benthic community degradation. The following sections present the evaluation of benthic invertebrate data for the June and October 2010 sampling events.

June 2010

For the June 2010 sampling event, metrics values calculated for stations SQT-01, SQT-02, and SQT-08 were not indicative of benthic community degradation when compared to reference metric values (Figure 16). Taxa richness, NCO richness, Shannon-Weiner diversity indices and percent model affinity values for these stations were greater than or comparable to richness values calculated for reference stations. Values for the percent abundance of the dominant taxon and HBI were comparable to reference stations. None of the metric values calculated for these stations were statistically different than metric values from pooled reference samples.

The statistical evaluation of June 2010 benthic community metrics indicates significant differences in metric values at select SWMU 1/22 Wetland Complex stations when compared to reference stations. Benthic communities at stations SQT-03, SQT-04, SQT-05, and SQT-07 were characterized by significantly greater relative abundance of the dominant taxon and lower diversity when compared to reference stations. Taxa and NCO richness values at stations SQT-03, SQT-04, SQT-05, and SQT-06 were consistent with the lower portion of the range of richness values for reference samples (Figure 16), although only NCO richness at SQT-04 was statistically lower than reference (Table 24). Percent model affinity values at stations SQT-03, SQT-05, and SQT-07 were also significantly lower than reference stations. Samples from stations SQT-03 and SQT-04 contained a more tolerant community relative to reference stations based on statistically greater HBI values.

Benthic community metrics calculated for SQT stations in June 2010 were also evaluated based on the NYSDEC BAP of index values for net jabs for slow, sandy streams (NYSDEC, 2009). As described in Section 7.1.1, the BAP for slow, sandy streams standardizes metric values for taxa richness, HBI, EPT richness, and NCO richness into a common 10-scale. The mean value of the metrics presents an index value to assess impacts at each SWMU 1/22 SQT station relative to index values from reference SQT stations. The BAP of index values for the June sampling event are tabulated in Table 25 and presented graphically in Figure 17.

The results of the BAP are generally consistent with the findings of the multi-metric statistical evaluation describe above. As presented in Figure 17, mean index values for SQT-01, SQT-02, SQT-07, and SQT-08 were greater than or equal to the greatest index value for the reference stations (SQT-11), indicating that benthic community condition at these stations is equivalent to or greater than the condition of the reference community. Values for individual metrics included in the index value were also generally comparable to or greater than reference values for these stations. Mean index values for SQT-03, SQT-04, SQT-05, and SQT-06 were lower than the lowest reference index value (SQT-09), indicating that benthic community condition at these stations is degraded relative to the reference community.

October 2010

As described in Section 4.1.3, benthic community samples from the October 2010 sampling event were generally depauperate at SWMU 1/22 and reference SQT stations relative to June 2010 samples. Samples from station SQT-03 were completely depauperate in October; no benthic invertebrate organisms were present in any of the replicate samples collected in October at SQT-03. Metric values calculated for the October sampling event reflect this general decline in benthic community condition (Table 23; Figure 16).

Statistical evaluations of metric values from October 2010 indicate limited significant differences in metric values between SWMU 1/22 and reference stations (Table 24). The only statistical difference between metric values at SWMU 1/22 SQT stations and the pooled reference data was the HBI value at SQT-06, which was significantly greater than values at reference stations. Greater variability was observed in October reference values for the metrics that resulted in statistically significant differences in the June data (percent dominant taxon, Shannon-Weiner diversity index, and percent model affinity). The lack of statistically significant differences between these metrics in the October data evaluation is likely attributed to the broad variability in reference metric values.

Despite the lack of statistical significance, SQT stations with metric values that were not indicative of degradation in June were generally not indicative of degradation in October. Richness metrics and percent model affinity were generally comparable or greater than reference values at all SQT stations except SQT-03 and SQT-06. Consistent with these results, the percent abundance of the dominant taxon and HBI values were comparable to or lower than reference values at all stations except SQT-06; no values were calculated for these metrics at SQT-03 because no organisms were recovered from this station.

The results of the BAP for the October samples illustrate the general decline in benthic community condition at SWMU 1/22 and reference SQT stations relative to June samples. As presented in Figure 17, the range of mean index values for October samples were generally lower than range of values for June samples. Mean index values for stations SQT-02 and SQT-07 were substantially greater than values for all reference stations; index values for other stations except SQT-06 were comparable to or greater than values for reference stations. Mean index values for SQT-06 and SQT-03 were substantially lower than reference stations, indicating degraded benthic community condition at these stations relative to the reference community.

Sediment Toxicity Testing

The results of sediment toxicity tests indicate significant effects to test organisms at several stations within the SWMU 1/22 Wetland Complex. As discussed in Section 4.1, sediment toxicity was evaluated *ex situ* based on the following chronic tests:

- 42-day *Hyalella azteca* Test for Measuring the Effects of Sediment-Associated Contaminants on Survival, Growth, and Reproduction (USEPA Method 100.4; USEPA, 2000); and
- 28-day *Chironomus riparius* test evaluating survival, growth, and emergence consistent with (OECD) Guideline 218 (OECD, 2004).

Table 9 presents a summary of toxicity testing endpoints for the *Hyalella azteca* test; toxicity testing endpoints for the *Chironomus riparius* test are summarized in Table 10. The following sections present the evaluation of the sediment toxicity testing results for each test organism.

Hyalella Azteca Toxicity Test

The results of 42-day *Hyalella azteca* toxicity tests indicate significant effects on survival at select stations within the SWMU 1/22 Wetland Complex (Table 9). Significantly lower survival relative to reference samples was observed at stations SQT-01, SQT-03, SQT-04, SQT-05, and SQT-06 for each survival endpoint evaluated; no test organisms survived in toxicity tests containing sediment from SQT-03. *Hyalella* survival in samples from SQT-02 was consistently near 64 percent for each endpoint, resulting in statistical differences from reference samples at Day 28 and Day 35, but not at Day 42. Survival in samples from SQT-07 and SQT-08 was not statistically different than reference samples at any endpoint evaluated (Table 9).

Significant sublethal effects represented as decreased biomass and juvenile production per female amphipod were also observed in *Hyalella* test organisms at select stations within the SWMU 1/22 Wetland Complex (Table 9). Biomass and juvenile production endpoints were significantly lower in samples from SQT-02, SQT-03, SQT-04, SQT-05, and SQT-06 for each endpoint evaluated. Samples from SQT-01 resulted in significantly lower biomass at Day 42 relative to reference samples; however, biomass at Day 28 was not statistically different than reference samples. Juvenile production in samples from SQT-01 was not significantly different than reference samples. Biomass was significantly lower in SQT-07 samples at Day 28 and Day 42; however, it is important to note that SQT-07 biomass at Day 42 was greater than biomass observed in laboratory control samples (Table 9). Biomass and juvenile production in *Hyalella* test organisms at SQT-08 were not statistically different from reference samples at any endpoint evaluated in the test.

Comparisons of 42-day *Hyalella azteca* survival endpoints to target metals concentrations at SQT stations indicate potential exposure-response relationships for lead and selenium. As illustrated in Figure 18, percent survival of *Hyalella* test organisms at Day 42 generally declined with increasing concentrations of lead and selenium. Statistically significant decreases in percent survival relative to reference samples were observed along the concentration gradient between stations SQT-07 and SQT-01, which contained selenium concentrations of 33.2 mg/kg and 35.6 mg/kg, respectively and lead concentrations of 224 mg/kg and 251 mg/kg, respectively. Significant decreases in survival at SQT stations were not consistent with concentration gradients of other target metals, including mercury (Figure 18). Concentrations of other target metals that resulted in significant mortality in *Hyalella* exposures were lower than concentrations of the same metals that did not result in significant mortality for the same endpoint.

Comparisons of sublethal endpoints from the 42-day *Hyalella azteca* test to target metals concentrations at SQT stations indicate similar exposure-response relationships for lead and selenium. Biomass and juvenile production per female amphipod at Day 42 generally declined with increasing concentrations of lead and selenium (Figures 19 and 20, respectively). Statistically significant decreases in biomass relative to reference samples were observed along the concentration gradient between stations SQT-08 and SQT-07, which contained selenium concentrations of 16.4 mg/kg and 33.2 mg/kg, respectively and lead concentrations of 128 mg/kg and 224 mg/kg, respectively. Statistically significant decreases in juvenile production per female amphipod relative to reference samples were observed along the concentration gradient between stations SQT-08 and SQT-01, which corresponds to selenium concentrations of 33.2 mg/kg and 35.6 mg/kg, respectively and lead concentrations of 224 mg/kg and 251 mg/kg, respectively. Similar to survival results, significant sublethal effects were not consistent with concentration gradients of other target metals, including mercury (Figures 19 and 20).

Chironomus Riparius Toxicity Test

Chironomus riparius test organisms were less sensitive to chronic exposure to sediments from the SWMU 1/22 Wetland Complex than were *Hyalella azteca*. As presented in Table 10, *Chironomus* survival at Day 10 was statistically lower than reference survival at only one station, SQT-03; none of the test organisms exposed to sediments from SQT-03 survived to the Day 10 endpoint. Significant sublethal effects represented as biomass, time to emergence, and percent emergence were also observed in *Chironomus* test organisms in samples from SQT-03, SQT-04, and SQT-05. Day 10 biomass was significantly lower in samples from SQT-03 (no surviving organisms) and SQT-05. Time to emergence was significantly lower than reference samples at SQT-04 and SQT-05; however, it is important to note that mean time to emergence in samples from both stations exceeded the mean time of emergence for the laboratory control (Table 10). The percent of *Chironomus* test organisms emerging was significantly lower at SQT-03; time of *Chironomus* emergence was not statistically lower than reference samples for the remaining SWMU 1/22 SQT stations (Table 10).

Similar to the results of the 42-day *Hyalella azteca* exposure, comparisons of chronic *Chironomus riparius* survival endpoints to target metals concentrations at SQT stations indicate potential exposure-response relationships for lead and selenium. As illustrated in Figure 21, percent survival of *Chironomus* test organisms at Day 10 generally declined with increasing concentrations of lead and selenium. Mean survival at SQT-05 was lower than the range of standard error associated with reference survival; however, survival at this station was not statistically lower than reference due the large standard error associated with mean survival at SQT-05. The highest concentrations of selenium and lead at which survival was not significantly lower than reference survival in *Chironomus* exposures were 170 mg/kg and 2060 mg/kg, respectively. Concentrations of other target metals were not associated with significant decreases in *Chironomus* survival, as demonstrated by survival observed in samples from SQT-06. Samples at SQT-06 contained maximum concentrations of cadmium, copper, mercury, and zinc, yet Day 10 mean survival of *Chironomus* at SQT-06 (97.5 percent) was the maximum mean survival observed in all test samples including the reference and laboratory control samples (Table 10).

Comparisons of sublethal endpoints from the chronic *Chironomus riparius* test to target metals concentrations at SQT stations indicate similar exposure-response relationships for lead and selenium for biomass and no exposure-response relationship for percent emergence. Day 10 biomass generally declined with increasing concentrations of lead and selenium, with exposures to sediments at SQT-05 resulting in significantly lower biomass relative to reference samples (Figures 22). Mean percent emergence of *Chironomus* did not vary with target metal concentrations in sediment for stations other than SQT-03. Mean percent emergence in samples representing the maximum concentrations of cadmium, copper, mercury, zinc at (SQT-06) and lead and selenium (SQT-05) were consistent with all other samples, including reference and laboratory control samples (Figure 23; Table 10).

Toxicity Testing Summary

The results of *ex situ* sediment toxicity testing based on 42-day *Hyalella azteca* and chronic *Chironomus riparius* tests indicate toxicity to laboratory test organisms exposed to sediments at several SQT stations within the SWMU 1/22 Wetland Complex. As discussed in the preceding sections, *Hyalella* test organisms were more sensitive to sediment exposure when compared to *Chironomus* exposures. Based on the combined bioassay results, the most significant effects in lethal and sublethal endpoints were observed in samples from SQT-03, which did not have any surviving organisms at any survival endpoints in either test. For stations SQT-04 and SQT-05, significant lethal and sublethal effects were observed in *Hyalella* exposures and sublethal effects were observed in *Chironomus* exposures. In samples from stations SQT-01, SQT-02, and SQT-06, significant lethal and sublethal effects were observed in *Hyalella* exposures; however no significant differences in lethal or sublethal endpoints were observed relative to reference samples in *Chironomus* tests. Exposures to sediment from SQT-07 resulted in no significant reduction in survival and only minor decreases in biomass in *Hyalella* testing; lethal and sublethal endpoints in *Chironomus* exposures from SQT-07 were not statistically different than reference exposures. No significant differences in *Hyalella* or *Chironomus* endpoints were observed in samples from SQT-08, indicating no toxicity to test organisms at this station.

The incidence of lethal and sublethal endpoints in sediment toxicity tests was most consistent with concentration gradients of selenium and lead. Differentiating between selenium- and lead-associated effects in sediment toxicity tests based on bioassay results is uncertain due to the strong correlation between the concentrations of these metals in sediments from the SWMU 1/22 Wetland Complex. As discussed in Section 4.1.3, the strongest relationship between target metals concentrations in sediments was observed between selenium and lead ($r = 0.973$). Given the co-occurrence of these metals in sediments, mitigation of the potential toxicity of one metal should simultaneously address the potential toxicity of the other metal.

8.1.2 Weight-of-Evidence Sediment Quality Triad Assessment

The multiple lines-of-evidence in the SQT investigation were integrated into a weight-of-evidence evaluation to assess benthic community impairment in the SWMU 1/22 Wetland Complex based on the framework for interpreting SQT data proposed by (Bay and Weisberg, 2010).

As the first step in the weight-of-evidence evaluation, the response for each line-of-evidence was assigned one of four response categories relative to reference conditions. Table 26 summarizes the data used to assign response categories for each line-of-evidence; a discussion of the various response categories is provided below:

- **Sediment chemistry:** The evaluation of exposure to target metals in sediments was based on SEL-Q_{mean} values calculated for each station. SEL-Q_{mean} values were greatest at stations SQT-03, SQT-04, and SQT-06, ranging from 18.5 to 44.2; SEL-Q_{mean} values for other SQT stations ranged from 5.2 to 12.1. Stations with SEL-Q_{mean} values greater than 15 (SQT-03, SQT-04, and SQT-06) were classified as 'high exposure' for the sediment chemistry line of evidence; all other SQT stations had SEL-Q_{mean} values between 5 and 15 and were classified as 'moderate exposure'.
- **Sediment toxicity testing:** The results of sediment toxicity tests were assigned response categories based on relative survival, as compared to reference stations, for chronic *Hyalella azteca* exposures. As presented in Table 26, sediments from stations SQT-03 and SQT-05 were highly toxic in *Hyalella* exposures relative to reference; these stations were designated as 'high toxicity'. Exposure to sediments from stations SQT-01, SQT-04, and SQT-06 resulted in relative percent survival values ranging from 30 to 51.7 percent; these stations were classified as 'moderate toxicity'. *Hyalella* survival at Day 42 in sediments from stations SQT-02, SQT-07, and SQT-08 were not statistically different than survival in reference sediments; these stations were classified as 'nontoxic'.
- **Benthic community analyses:** Disturbance or impacts to benthic invertebrate communities were classified for each SQT station based on statistical comparisons of metric values and relative comparisons of mean BAP index values. As presented in Table 26, SQT-03 was classified as 'high disturbance' based on statistical differences in all metrics and lower BAP index values for the June samples relative to reference stations. Stations SQT-04, SQT-05, and SQT-06 were classified as 'moderate disturbance' based on statistical differences in more than one community metric or lower mean BAP index values less than 1.0. The mean BAP index value at station SQT-07 was greater than reference; however, the station was classified as 'low disturbance' based on statistically different metric values for three community metrics. Stations SQT-01, SQT-02, and SQT-08 were classified as 'reference' based on the lack of statistical differences in community metrics and mean BAP index values exceeding reference stations.

As discussed in Section 7.1.1, the second step in the SQT framework proposed by Bay and Weisberg (2010) includes the integration of the three lines of evidence to evaluate the severity of biological effects and the potential for chemically-mediated effects. The weight-of-evidence evaluation of the severity of biological effects and the potential that those biological effects may be associated with exposure to concentrations of target metals in sediments are presented in Table 27 and summarized below:

- **Classifying the Severity of Effects:** Table 27A presents the integration of sediment toxicity testing and benthic community lines-of-evidence to classify the severity of biological effects. The severity of biological impacts was classified based on the response classifications presented in Table 26 for each line-of-evidence and the assessment framework presented in Table 21A. Station SQT-03 was classified as 'high effect' based on high community disturbance and high toxicity. Stations SQT-04, SQT-05, and SQT-06 were classified as 'moderate effect' based on moderate community disturbance and moderate to high toxicity. Station SQT-01, SQT-02, and SQT-08 were classified as 'unaffected' based on reference benthic community classification; stations SQT-02 and SQT-08 were considered nontoxic, while SQT-01 was considered moderately toxic based on chronic *Hyalella* exposures. SQT-07 was classified also classified as 'unaffected' based on low benthic community disturbance and nontoxic sediment toxicity tests (Table 27A).
- **Potential for Chemically Mediated Effects:** Table 27B presents the integration of sediment chemistry and sediment toxicity testing lines-of-evidence to evaluate the potential for chemically-mediated biological effects. The potential for chemically-mediated effects was classified based on the response classifications for sediment chemistry and sediment toxicity testing presented in Table 26 and the assessment framework presented in Table 21B. Stations SQT-03, SQT-04, and SQT-06 were classified as 'high potential' for chemically-mediated effects based on high exposure to sediment metals concentrations and moderate to high toxicity. Stations SQT-01 and SQT-05 were classified as 'moderate potential' based on moderate exposure to metals concentrations in sediments and moderate to high toxicity in sediment toxicity tests. Stations SQT-02, SQT-07, and SQT-08 were classified as 'low potential' for chemically-mediated effects based on nontoxic responses in sediment toxicity tests, despite moderate exposure to target metals in sediment.

Based on the classification of the severity of biological effects and the potential for chemically-mediated effects, potential impacts to benthic invertebrate communities associated with elevated concentrations of target metals in sediments were assessed for each SWMU 1/22 SQT station. As presented in Table 27C, the final step of the weight-of-evidence evaluation of the SQT lines-of-evidence classified SWMU 1/22 SQT stations into four categories of relative impacts:

- **Clearly Impacted:** Stations SQT-03, SQT-04, and SQT-06 were classified as 'clearly impacted' based on moderate to high effects in community and toxicity data and high potential for chemically-mediated effects (Table 27C). June benthic community data at SQT-03 indicated a generally depauperate community dominated by a single taxon (*Chironomus sp.*); no organisms were recovered from benthic community samples collected in October from this station. Benthic community metrics at SQT-04 and SQT-06 were indicative of impairment relative to reference stations for the June and October sampling events. Toxicity tests conducted using sediments from SQT-03 resulted in 100 percent mortality for each survival endpoint. Toxicity testing based on sediments from SQT-04 resulted in significant lethal and sublethal effects to *Hyalella* and sublethal effects to *Chironomus*; toxicity testing using sediments from SQT-06 resulted in lethal and sublethal effects for *Hyalella*. SEL-Q_{mean} values for these stations ranged from 18.5 (SQT-04) to 44.2 (SQT-06).

- **Likely Impacted:** Station SQT-05 was classified as 'likely impacted' based on moderate severity of effects and moderate potential for chemically-mediated effects (Table 27C). Benthic community metrics at SQT-05, including percent dominant taxon, diversity, and percent model affinity, were indicative of impairment relative to reference stations for the June sampling event. Toxicity testing based on sediments from SQT-05 resulted in significant lethal and sublethal effects to *Hyalella* and sublethal effects to *Chironomus.* The SEL-Q_{mean} at SQT-05 was 12.1.

  Likely Unimpacted: Station SQT-01was classified as 'likely unimpacted' based on the absence of biological effects (i.e., unaffected), despite moderate potential for chemically-mediated effects. Benthic community metrics at SQT-01 consistently indicated benthic community condition that was comparable to or better than reference metrics; BAP index values for these stations were comparable to or greater than reference values for both benthic community sampling events. Toxicity tests for SQT-01 indicated moderate toxicity to *Hyalella*, but no significant effects for *Chironomus*. The SEL-Q_{mean} for SQT-01 was 10.1.

- **Unimpacted:** Stations SQT-02, SQT-07, and SQT-08 were classified as 'unimpacted' based on the absence of biological effects (i.e., unaffected) and low potential for chemically-mediated effects. Benthic community metrics at SQT-02 and SQT-08 consistently indicated benthic community condition that was comparable to or better than reference metrics; BAP index values for these stations were comparable to or greater than reference values for both benthic community sampling events. Chronic *Hyalella* and *Chironomus* toxicity testing based on sediments from SQT-08 did not result in statistically significant differences relative to reference samples for any lethal or sublethal endpoints; toxicity testing of sediments from SQT-02 resulted only in significant sublethal effects for *Hyalella*. Biological effects were not observed in site-specific benthic invertebrate community and toxicity testing data, despite elevated concentrations of target metals in sediments. SEL-Q_{mean} values for SQT-02 and SQT-08 were 5.2 and 7.7, respectively.

Station SQT-07 was classified as ‘unimpacted’ based on low disturbance in benthic community data, nontoxic survival endpoints in chronic toxicity testing, and, moderate exposure; these classifications resulted in an absence of biological effects and a low potential for chemically-mediated effects (Table 27C). BAP index values for SQT-07 were comparable to or greater than reference for both community sampling events; however, metric values for percent dominant taxon, diversity, and percent model affinity were significantly lower than reference due to the numerical dominance of the isopod *Caecidotea sp.* at this station, which results in a higher present dominance and lower diversity. The dominance of *Caecidotea sp.* at this station is consistent with the presence of a thick, organic *Phragmites* root mat at the surface of the sediment. No significant effects were observed in chronic endpoints evaluated in *Hyalella* or *Chironomus* exposures; significant effects in toxicity tests were limited to a slight reduction in biomass in the *Hyalella* exposure. Given that benthic invertebrate community structure was influenced significantly by the nature of the substrate and significant lethal effects were not observed in sediment toxicity testing, station SQT-07 was classified as ‘unimpacted’.

8.2 Fish Community Exposure

The following sections present the exposure evaluation for the fish community in the SWMU 1/22 Wetland Complex based on the evaluation of surface water data, the findings of the fish presence absence survey, and comparisons of mercury concentrations in fish tissue to a conservative tissue residue benchmark for mercury.

8.2.1 Surface Water Direct Contact Exposure

Direct contact surface water exposure to fish inhabiting the SWMU 1/22 Wetland Complex is not likely to result in adverse ecological effects. As presented in Section 4.3.2, concentrations of target metals in filtered surface water samples were below chronic NYSDEC SWQS, which are derived for the protection of aquatic life (Table 12). Comparisons of SWQS values for hardness-dependent metals (cadmium, copper, lead, zinc, etc.) were conservatively based on the lowest hardness value measured in the surface water dataset. Based on these sampling results, chronic exposure to metals in surface water is not likely to result in adverse effects to the fish community within the SWMU 1/22 Wetland Complex.

8.2.2 Community Evaluation

The results of the qualitative fish presence/absence survey conducted in the SWMU 1/22 Wetland Complex do not indicate degradation consistent with elevated metals concentrations in sediment. As described in Section 4.4.2, only three taxa were collected from sampling reaches upstream, within, and downstream of the SWMU 1/22 Wetland Complex. Golden shiner was numerically dominant taxon and the only taxon collected in each sampling reach. Other than one largemouth bass collected upstream of SWMU 1/22, there were no differences in the fish collected within the SWMU 1/22 Wetland Complex and the fish collected in the upstream reach. The presence of American eel in the downstream sampling reach is likely a function of upstream migration from tributaries hydrologically connected to the Hudson River, including Rondout Creek and the tributary draining the SWMU 1/22 Wetland Complex.

The composition of the fish community upstream, within, and downstream of the SWMU 1/22 is likely influenced by the availability of open water habitat and physicochemical conditions in the wetland. The dominance of golden shiner is consistent with the limited open water habitat available in the SWMU 1/22 Wetland Complex. Golden shiner, one of the largest and most abundant cyprinids in the State of New York, is a warmwater species that typically occurs in medium to large streams of low to moderate gradient, and in swamps, ditches, sloughs, ponds, lakes, and reservoirs (Smith, 1985; Jenkins and Burkhead, 1993). The occurrence of golden shiner is usually associated with abundant vegetation (Smith, 1985; Jenkins and Burkhead, 1993). Golden shiner is also tolerant of persistent high temperatures, having one of the highest lethal temperature tolerances of any indigenous North American fish, near 40°C (Jenkins and Burkhead, 1993). Based on the ability of golden shiner to tolerate and proliferate in habitats similar to the SWMU 1/22 Wetland Complex, it is likely that the dominance of this species is limited by habitat availability in the wetland.

8.2.3 Mercury Tissue Residue Evaluation

As discussed in Section 7.1.2, potential mercury-associated impacts to the fish community were evaluated based on comparisons of measured tissue concentrations to a conservative tissue residue benchmark protective of juvenile and adult fish. As depicted in Figure 24, whole body fish tissue samples (wet weight) were less than a tissue residue benchmark of 210 ng/g wet weight established by Beckvar et al. (2005). All fish tissue samples collected upstream, within, and downstream of the SWMU 1/22 Wetland Complex were less than half of the threshold concentration. Based on this comparison, it is not likely that mercury is accumulating in tissues at concentrations associated with adverse ecological effects to individual fish. Therefore, community-level impacts due to mercury are not likely in the SWMU 1/22 Wetland Complex or the downstream sampling reach.

8.3 Semi-Aquatic Wildlife Exposure

Exposure to semi-aquatic wildlife potentially foraging in the SWMU 1/22 Wetland Complex was evaluated using site-specific tissue data and simplified dose rate models (Section 7.1.3). The following sections summarize the output of the models for the two exposure scenarios evaluated for the SWMU 1/22 Wetland Complex:

- Maximum Area Use Exposure; and
- Area Use Adjusted Exposure.

A complete description of the modeling approach is presented in Appendix D; detailed model calculations are presented in Appendix E.

8.3.1 Maximum Area Use

The following sections present the exposure evaluation for semi-aquatic wildlife based on a maximum area use scenario, which conservatively assumes that individual semi-aquatic wildlife receptors forage exclusively within the defined exposure area within the SWMU 1/22 Wetland Complex their entire life span. Table 28 presents HQs calculated based on comparisons of modeled doses for the maximum area use scenario to NOAEL and LOAEL TRVs (Appendix E). A summary of maximum area use exposure is presented below by receptor (Table 28):

- **Belted kingfisher:** Estimated doses based on the ingestion of forage fish exceeded NOAEL TRVs for methylmercury (HQ_{NOAEL}=3) and selenium (HQ_{NOAEL}=2.3); the estimated dose of selenium slightly exceeded the LOAEL (HQ_{LOAEL}=1.1). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Great blue heron:** Estimated doses based on the ingestion of forage and piscivorous fish were comparable to NOAEL TRVs for methylmercury (HQ_{NOAEL}=1.1) and selenium (HQ_{NOAEL}=1.0); no doses exceeded the LOAEL TRV. Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Mallard:** Estimated doses for mallards foraging for aquatic life stage invertebrates exceeded NOAEL TRVs for copper (HQ_{NOAEL}=2.4) and selenium (HQ_{NOAEL}=2.5); estimated doses of copper (HQ_{LOAEL}=1.3) and selenium (HQ_{LOAEL}=1.3) slightly exceeded LOAEL doses. Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Tree swallow:** Estimated doses based on the ingestion of emergent life stage invertebrates exceeded NOAEL TRVs for copper (HQ_{NOAEL}=5.7), mercury (HQ_{NOAEL}=1.3), methylmercury (HQ_{NOAEL}=4.4), and selenium (HQ_{NOAEL}=10.5); estimated doses of copper (HQ_{LOAEL}=3.2), methylmercury (HQ_{LOAEL}=1.5), and selenium (HQ_{LOAEL}=5.3) exceeded LOAEL doses. Estimated doses of cadmium, lead, and zinc were less than NOAEL doses (HQ_{NOAEL}<1).

- **Indiana bat:** Estimated doses to Indiana bat foraging on emergent life stage invertebrates exceeded NOAEL TRVs for methylmercury (HQ_{NOAEL}=1.9), and selenium (HQ_{NOAEL}=7.6); estimated doses of selenium (HQ_{LOAEL}=4.6) exceeded LOAEL doses. Estimated doses of cadmium, lead, and zinc were less than NOAEL doses (HQ_{NOAEL}<1).
- **Mink:** Estimated doses based on the ingestion of forage and piscivorous fish slightly exceeded the NOAEL TRV for methylmercury (HQ_{NOAEL}=1.4), but did not exceed the LOAEL TRV. Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Raccoon:** Estimated doses for raccoons foraging on aquatic life stage invertebrates, forage fish, and piscivorous fish exceeded NOAEL TRVs for copper (HQ_{NOAEL}=1.2) and selenium (HQ_{NOAEL}=3.2); the estimated dose of selenium (HQ_{LOAEL}=2) slightly exceeded the LOAEL dose. Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).

8.3.2 Adjusted Area Use

The conservative assumptions of the maximum area use exposure evaluation presented in the preceding section were revised to enable a more realistic and site-specific evaluation of potential risk. The adjusted area use exposure scenario quantifies exposure based on the proportion of the time that a receptor is likely to forage within the exposure area as a function of its total foraging range. Area use-adjusted doses were calculated for each receptor with the exception of belted kingfisher, tree swallow, and mink. Foraging areas for these receptors are smaller than the exposure area; therefore, it is possible for individual receptors to forage within the exposure area for their entire life span. Therefore, the exposure calculations for these receptors conservatively assumed maximum area use. The results of the adjusted area use exposure evaluation are summarized in Table 28 and presented below:

- **Belted kingfisher:** Estimated doses were based on the maximum area use as described above.
- **Great blue heron:** Area use adjusted doses based on the ingestion of forage and piscivorous fish were less than NOAEL doses for target metals (HQ_{NOAEL}<1).
- **Mallard:** Area use adjusted doses for mallards foraging for aquatic life stage invertebrates were less than NOAEL doses for target metals (HQ_{NOAEL}<1).
- **Tree swallow:** Estimated doses were based on the maximum area use as described above.
- **Indiana bat:** Area use adjusted doses to Indiana bat foraging on emergent life stage invertebrates were less than NOAEL doses for target metals (HQ_{NOAEL}<1).
- **Mink:** Estimated doses were based on the maximum area use as described above.
- **Raccoon:** Area use adjusted doses for raccoons foraging on aquatic life stage invertebrates, forage fish, and piscivorous fish were less than NOAEL doses for target metals (HQ_{NOAEL}<1).

8.4 Risk Characterization

The results of the exposure evaluation indicate that the greatest potential risk in the SWMU 1/22 Wetland Complex is associated with benthic invertebrate exposure to sediments containing elevated concentration of target metals. Characterization of potential risks is provided by each receptor category in the following sections.

8.4.1 Benthic Invertebrate Community

As summarized in Section 8.1.2, the SQT weight-of-evidence evaluation identified the greatest impacts to benthic invertebrate communities at stations in closest proximity to SWMU 22. The most severe benthic community impacts were identified at station SQT-03, which contained a depauperate benthic community and acutely toxic sediments in both sediment toxicity tests. Near bottom water quality measurements at SQT-03 indicate low pH conditions (pH = 3.3 and 1.44 in June and October, respectively); low alkalinities in overlying water in sediment toxicity test chambers from SQT-03 are consistent with the low pH conditions observed in the field (Appendix B). Benthic communities at stations SQT-04, SQT-05, and SQT-06 were considered moderately impacted based on benthic community impairment and significant lethal and sublethal effects in sediment toxicity tests relative to reference stations. The greatest concentrations of target metals in sediments were generally observed at these stations, indicating that elevated concentrations of metals in sediments are a likely source of impairment to the benthic invertebrate community.

Benthic invertebrate communities were unimpacted or likely unimpacted at stations with increasing distance from SWMU 22. Benthic communities were considered likely unimpacted at station SQT-01 and unimpacted at SQT-02, SQT-07, and SQT-08. The condition of benthic invertebrate communities at stations SQT-01 and SQT-02 was equivalent to or exceeded community condition in reference samples, despite significant effects in *Hyalella* toxicity tests. Benthic community metrics at SQT-07 were influenced by the high relative abundance of a detritivorous isopod exploiting large quantities of organic root material present at the station; toxicity testing of sediments at SQT-07 indicated only minor reductions in *Hyalella* biomass that were not significantly lower than control samples. No impacts were identified in benthic community analyses or sediment toxicity testing at SQT-08, the station furthest from SWMU 22. Based on the weight-of-evidence evaluation for these stations, exposures to benthic invertebrate receptors are not likely to result in impacts that would affect community structure or function.

The lack of benthic community impacts at stations SQT-01, SQT-02, SQT-07, and SQT-08 indicates that the elevated concentrations of metals in sediments are not present in forms that are toxic to invertebrates. Benthic invertebrate community exposure to metals at these stations was considered moderate, with mean SEL-Q values ranging from 5.2 (SQT-02) to 10.2 (SQT-07). The lack of impacts identified in benthic community analyses and sediment toxicity testing resulting from the exposure to metals in sediments is likely attributed to the binding of divalent metals, particularly copper, lead, and zinc, to organic carbon, sulfides, or other ligands in sediment that mitigate bioavailability and toxicity (USEPA, 2007b; USEPA, 2005; Di Toro et al., 2005; Ankley et al., 2006; Hansen et al., 1996; Ankley et al., 1991; Di Toro et al., 1992; and Luoma, 1989).

8.4.2 Fish Community

Exposure of fish to target metals in the SWMU 1/22 Wetland Complex is not likely to result in adverse community-level effects. As demonstrated in the exposure evaluation, direct contact exposure (gill absorption) to target metals in surface water is not likely to result in adverse effects to fish or other aquatic life. Furthermore, potential exposure to methylmercury has not resulted in fish from the site accumulating mercury in exceedance of the tissue residue benchmark protective of juvenile and adult fish. Nor were levels in site fish greater than in fish collected upstream from the site.

The results of the fish tissue presence/absence survey are consistent with the evaluation of surface water and tissue exposure evaluations. The fish presence/absence survey indicated similar fish taxa in areas with elevated concentrations of target metals relative to upstream areas without elevated sediment concentrations. The findings of limited taxa and the dominance of golden shiner observed in the presence/absence survey are consistent with the lack of open water habitat. While it is acknowledged that the absence of other fish taxa may not be definitively explained by habitat limitations alone, the evaluation of direct contact surface water exposure and mercury bioaccumulation do not indicate exposure related impacts to the fish community. Based on these combined lines of evidence, adverse effects to the fish community in the SWMU 1/22 Wetland Complex are not likely.

8.4.3 Semi-Aquatic Wildlife Community

Potential risks to wildlife exposed to target metals in the SWMU 1/22 Wetland Complex are limited to receptors that forage exclusively within the exposure area. As presented in the exposure evaluation (Section 8.3.2), area use adjusted doses were lower than NOAEL TRVs for great blue heron, mallard, Indiana bat, and raccoon, which forage outside the exposure area as a portion of their total foraging range (Table 28). Of the receptors assumed to forage exclusively within the exposure area (belted kingfisher, tree swallow, mink), the greatest potential risk was identified for tree swallow. Estimated doses for tree swallow exceeded NOAEL TRVs for copper, mercury, methylmercury, and selenium and LOAEL TRVs for methylmercury, copper, and selenium (Table 28). Estimated doses to belted kingfisher exceeded NOAEL TRVs for methylmercury and selenium; the estimated dose of selenium to mink slightly exceeded the NOAEL TRV.

The potential for adverse effects to tree swallow populations is highly uncertain due to the estimation of target metal concentrations in emergent insects. As discussed in detail in Appendix D, concentrations of target metals in emergent insects were estimated based on measured concentrations in aquatic life stage invertebrates. Correction factors were applied to aquatic life stage tissue concentrations to account for the shedding or concentrating of metal body burden during the metamorphosis of larval/nymph stages to adult stages. Uncertainty associated with these correction factors greatly influences the exposure point concentration and resultant dose estimation.

Potential risks to belted kingfisher and mink foraging exclusively within the SWMU 1/22 Wetland Complex are not likely to result an adverse population-level effects based on limited the exceedance of LOAEL doses. Estimated doses to belted kingfisher exceeded NOAEL TRVs for methylmercury and selenium; however, estimated doses were comparable to or below LOAEL TRVs. The estimated dose to mink foraging exclusively within the exposure area slightly exceeded the NOAEL TRV for selenium (HQ_{NOAEL}=1.4), but did not exceed the LOAEL.

9.0 ACTIVE PLANT EXPOSURE EVALUATION

As discussed in Section 7.2, the terrestrial exposure evaluation in the Active Plant Area focused on potential risks to wildlife receptors that potentially forage on small mammals and earthworms along the margins of the facility. Terrestrial wildlife exposure was evaluated for the following scenarios based on the sampling design described in Section 5.1:

- Northern sampling grids: maximum area use exposure;
- Southern sampling grids: maximum area use exposure; and
- Northern and Southern sampling grids: maximum area use and adjusted area use exposure for long-ranging receptors (red-tailed hawk and red fox).

The following sections present the results of the terrestrial exposure evaluation conducted in the Active Plant Area of the Site.

9.1 Terrestrial Wildlife Exposure – Northern Grids

The terrestrial exposure evaluation for the Northern grids incorporated soil, earthworm, and small mammal data collected from the three (3) northern sampling grids into the dose rate model for terrestrial wildlife (Figure 10). The following sections present the exposure evaluation for terrestrial wildlife based on a maximum area use scenario in the Northern sampling grids. Table 29 presents HQs calculated based on comparisons of modeled doses for the maximum area use scenario to NOAEL and LOAEL TRVs (Appendix E). A summary of maximum area use exposure is presented below by receptor (Table 29):

- **American robin:** Estimated doses associated with foraging for earthworms exceeded NOAEL TRVs for cadmium (HQ_{NOAEL}=1.8), lead (HQ_{NOAEL}=3), and selenium (HQ_{NOAEL}=46.8); the estimated dose of selenium exceeded the LOAEL (HQ_{LOAEL}=23.4). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Red-tailed hawk:** Estimated doses based on the ingestion of small mammals exceeded the NOAEL and LOAEL TRVs for selenium (HQ_{NOAEL}=42.4 and HQ_{LOAEL}=21.2) and slightly exceeded the NOAEL for zinc (HQ_{NOAEL}=1.5). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Short-tailed shrew:** Estimated doses associated with foraging for earthworms exceeded NOAEL TRVs for cadmium (HQ_{NOAEL}=2.8) and selenium (HQ_{NOAEL}=103.6); the estimated dose of selenium exceeded the LOAEL (HQ_{LOAEL}=62.8). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).

- **Red fox:** Estimated doses based on the ingestion of small mammals exceeded the NOAEL and LOAEL TRVs for selenium (HQ_{NOAEL}=34.5 and HQ_{LOAEL}=20.9). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).

9.2 Terrestrial Wildlife Exposure – Southern Grids

The following sections present the exposure evaluation for terrestrial wildlife based on a maximum area use scenario in the Southern sampling grids. Table 30 presents HQs calculated based on comparisons of modeled doses for the maximum area use scenario to NOAEL and LOAEL TRVs (Appendix E). A summary of maximum area use exposure is presented below by receptor (Table 30):

- **American robin:** Estimated doses associated with foraging for earthworms exceeded NOAEL TRVs for lead (HQ_{NOAEL}=3.7), and selenium (HQ_{NOAEL}=14.5); the estimated dose of selenium exceeded the LOAEL (HQ_{LOAEL}=7.2). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Red-tailed hawk:** Estimated doses based on the ingestion of small mammals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Short-tailed shrew:** Estimated doses associated with foraging for earthworms exceeded NOAEL TRVs for lead (HQ_{NOAEL}=1.1) and selenium (HQ_{NOAEL}=64.6); the estimated dose of selenium exceeded the LOAEL (HQ_{LOAEL}=39.2). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Red fox:** Estimated doses based on the ingestion of small mammals were less than NOAEL doses (HQ_{NOAEL}<1).

9.3 Terrestrial Wildlife Exposure – Northern and Southern Grids

Exposure to terrestrial wildlife potentially foraging within the Active Plant Area was evaluated using the combined exposure data collected from the six (6) sampling grids at the margins of the facility. The following sections summarize the output of the models for the two exposure scenarios evaluated for the Active Plant Area:

- Maximum Area Use Exposure; and
- Area Use Adjusted Exposure.

A complete description of the modeling approach is presented in Appendix D; detailed model calculations are presented in Appendix E.

9.3.1 Maximum Area Use

The following sections present the exposure evaluation for long-ranging terrestrial wildlife based on a maximum area use scenario for the Northern and Southern sampling grids. Table 31 presents HQs calculated based on comparisons of modeled doses for the maximum area use scenario to NOAEL and LOAEL TRVs (Appendix D). A summary of maximum area use exposure is presented below by receptor (Table 31):

- **Red-tailed hawk:** Estimated doses based on the ingestion of small mammals exceeded the NOAEL and LOAEL TRVs for selenium (HQ_{NOAEL}=16 and HQ_{LOAEL}=8). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1) except for zinc which was HQ_{NOAEL}=1.1.
- **Red fox:** Estimated doses based on the ingestion of small mammals exceeded the NOAEL and LOAEL TRVs for selenium (HQ_{NOAEL}=12.7 and HQ_{LOAEL}=7.7). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).

9.3.2 Adjusted Area Use

The following sections present the exposure evaluation for long-ranging terrestrial wildlife based on an adjusted area use scenario in the Northern and Southern sampling grids. Table 31 presents HQs calculated based on comparisons of modeled doses for the maximum area use scenario to NOAEL and LOAEL TRVs (Appendix D). A summary of maximum area use exposure is presented below by receptor (Table 31):

- **Red-tailed hawk:** Estimated doses based on the ingestion of small mammals exceeded the NOAEL and LOAEL TRVs for selenium (HQ_{NOAEL}=2.9 and HQ_{LOAEL}=1.4). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).
- **Red fox:** Estimated doses based on the ingestion of small mammals exceeded the NOAEL and LOAEL TRVs for selenium (HQ_{NOAEL}=7.3 and HQ_{LOAEL}=4.5). Estimated doses of all other target metals were less than NOAEL doses (HQ_{NOAEL}<1).

9.4 Risk Characterization

The results of the terrestrial exposure evaluation at the margins of the Active Plant Area indicate that the greatest potential risk to terrestrial wildlife is associated with exposure to selenium. Estimated doses of selenium calculated based on measured concentrations in earthworm and small mammal tissue exceeded NOAEL and LOAEL TRVs for both long-ranging and short-ranging receptors. Estimated doses of other target metals including cadmium, lead, and zinc, resulted in relatively minor exceedances of NOAEL TRVs; estimated doses for these metals were below LOAEL TRVs for all receptors. Based on these findings, selenium exposure represents the greatest potential risk to wildlife at the margins of the Active Plant Area.

Potential risks associated with selenium exposure to wildlife are greatest in the northern grids. As discussed in Section 5.1.2, selenium accumulation in earthworm and small mammal tissues was greater in the northern grids relative to the southern grids. Selenium accumulation in earthworm and small mammal tissues was particularly high in samples from grids N1 and N3 in the northern plant area and resulted in elevated EPCs for earthworms and small mammals in the dose rate models. As a result of these elevated EPCs the estimated doses exceeded LOAEL TRVs for each receptor based on maximum area use exposure.

Potential risks to wildlife in the southern grids are limited to low-level, short-ranging, secondary consumers that forage on earthworms. Estimated doses to American robin and short-tailed shrew based on measured concentrations of selenium in earthworms exceeded LOAEL TRVs; HQs based on maximum use exposure to American robin and short-tailed shrew were substantially lower than HQs in the northern grids. Estimated doses to long-ranging receptors did not exceed NOAEL TRVs based maximum area use foraging within the southern grids.

Calculations based upon estimated doses of selenium to top-tier, long-ranging wildlife foraging throughout the Active Plant Area (both the northern grids and the southern grids) indicate the potential for adverse effects from selenium based on LOAEL doses. Maximum area use exposure to measured concentrations of selenium in small mammal tissues resulted in HQ_{LOAEL} values of 8 and 7.7 for red-tailed hawk and red fox, respectively; however, based on area use adjusted exposure, these HQ_{LOAEL} values are reduced to 1.4 and 4.5 for red-tailed hawk and red fox, respectively.

As stated above, elevated concentrations of selenium in small mammal tissues from grids N1 and N3 bias high the estimated doses used to represent exposure to top-tier wildlife foraging throughout the Active Plant Area. For example, the UCL_{95} used as the EPC for small mammal tissue from the combined northern and southern grids was 82.9 mg/kg dw. Removing the elevated samples from grids N1 and N3 reduced the EPC to 3.2 mg/kg dw based on the UCL_{95}. By comparison, the small mammal tissue EPC that resulted in doses below NOAEL TRVs for red-tailed hawk and red fox based on maximum area use was in the southern grids was 4.0 mg/kg dw. Based on this analysis, excluding the elevated small mammal tissue from the N1 and N3 grids would reduce exposure to red-tailed hawk and red fox foraging throughout the Site to doses below NOAEL TRVs.

Elevated selenium concentrations in biota sampled in grids N1 and N3 were coincident with the presence of several burning areas in this region of the Site (Figure 10). Grid N1 contained three open burning areas (SWMUs 6, 7, and 8) and several additional burning areas were located immediately to the south of grid N1 (SWMUs 2, 3, 4, and 5). The Burnable Waste Satellite Accumulation Area (SWMU 26G) was nearly completely contained within SWMU 26G. Although uncertain, the combustion of off-specification and waste materials in these burning areas may be associated with elevated concentrations of selenium in biota.

The overall characterization of risks to wildlife associated with exposure to selenium is uncertain due to a limited site-specific understanding of selenium speciation within the soils and tissues of dietary items. The specific mechanisms influencing selenium bioaccumulation in biota within the N1 and N3 grids are uncertain. As previously stated, bioaccumulation relationships between soil and earthworms were highly variable (Section 5.1.2). The variability in bioaccumulation relationships may be associated with the confounding and potentially variable influence of particle-sorbed selenium in the gut tract of the non-depurated earthworms, which may not accurately represent selenium incorporated into earthworm tissues. Furthermore, total selenium analyses in soil do not accurately represent the relative bioavailability of the various selenium species that may be present in soils.

Differences in selenium species within tissues of dietary items also confound the characterization of risk. TRVs for avian and mammalian receptors were based on selenium doses administered as selenomethionine and potassium selenate, respectively (Heinz et al., 1989; Rosenfeld and Beath, 1954). The relative toxicity of selenium species generally follows from most to least toxic: hydrogen selenide ~ selenomethionine (in diet) > selenite ~ selenomethionine (in water) > selenate > elemental selenium ~ metal selenides ~ methylated selenium compounds (Irwin et al., 1998). Given the relative toxicities of selenium, understanding the relative concentrations the different selenium species in dietary items is necessary to accurately characterize the receptor dose. For example, in the aquatic environment Fan et al. (2002) determined that the relatively toxic form selenomethionine was approximately 30 percent of the total selenium in biological tissues in several trophic levels. Since the avian TRV is based on a dose administered as selenomethionine, direct comparison of estimated doses to this TRV assumes that the receptor dose is 100 percent selenomethionine. This assumption likely overestimates the proportion of selenomethionine in the receptor diet. Speciation of selenium in the tissues of dietary items would reduce the uncertainty associated with risk characterization.

10.0 UNCERTAINTY ANALYSIS

An uncertainty analysis was performed to identify assumptions and procedures that may result in either an upward or a downward bias in the estimation of exposure or the characterization of risk. Assumptions and other factors that tend to overestimate, underestimate, or have an unknown effect on the findings of the FWIA are presented below with a discussion of their uncertainty. Discussions of uncertainty are organized by three relevant phases of the FWIA with inherent uncertainty: sample design/data quality, exposure evaluation, and risk characterization.

10.1 Sampling Design/Data Quality

The following uncertainties were identified relating to sample design/data quality issues.

10.1.1 Sampling Density

Sufficient sampling density is necessary to provide a representative estimate of exposure to site-related constituents. Misrepresentation of exposure results in uncertainty, which may lead to an overestimation or underestimation of risk. In this FWIA, the location and number of soil, sediment, surface water, and biological samples were determined considering historic data to provide a representative dataset to characterize exposure. Areas not previously characterized, including the sediments in the site drainage channels, sediments downstream of the SWMU 1/22 Wetland Complex, and soils at the SWMU 35 perimeter, were sampled at a sufficient density relative to the size of the each area. The number and location of sampling points were selected in consultation with DFWMR during the development of the Work Plan and subsequent discussions regarding specific areas of the Site (e.g., downstream sediment characterization). Based on sampling density, uncertainties associated with sampling design should have minimal influence on FWIA conclusions.

While sufficient sediment sampling densities were incorporated into the FWIA Step IIC study design to provide a realistic estimate of potential site risk, additional sediment sampling may be needed to characterize metals distributions with sufficient resolution to support remedial decision-making or design. Metals in sediments may be concentrated along flow paths within the SWMU 1/22 Wetland Complex. Further characterization of these migration pathways, particularly downgradient of the SWMU 22, may better define areas of sediment impacts.

10.1.2 Data Quality

Data quality assurance/quality control (QA/QC) procedures for the FWIA Step IIC investigations were conducted in accordance with the approved Work Plan (URS 2010). QA/QC samples were collected at the prescribed frequencies and sample handling and chain of custody procedures were implemented as specified in Section 6.0 of the Work Plan.

Analytical data received from the laboratory were validated according to the procedure outlined in the *Site-Wide Quality Assurance Project Plan* (URS, 2010). Laboratory data were validated to determine conformance with the analytical method at a frequency of one data package for each sample matrix. Data validation was conducted using the USEPA document: *SOP HW-2: Evaluation of Metals Data for the Contract Laboratory Program based on SOW – ILM05.3 (September 2006, Rev. 13)*. Data validation reports for each matrix are included in Appendix F.

The data validation process for FWIA Step IIC investigations identified one major deficiency affecting field data. One matrix spike/spike duplicate (MS/SD) sample associated with earthworm tissue (PE-N3-EWTIS-COMP-05) did not recover (i.e., 0%) for mercury; the associated sample results were qualified as “R”, for rejected. The matrix interference with this sample resulted in the rejection mercury results reported for six composite earthworm samples from the dataset.

One significant event occurred during the FWIA Step IIC field investigation that had the potential to influence data quality. Two sample coolers containing sediment samples that were shipped via overnight courier were delayed by approximately 24 hours. The sample coolers were received by Test America at temperatures (between 12 and 13 degrees C) exceeding guidance of 4 +/-2 degrees C. Because the sediment samples were being analyzed for parameters that would not be affected by temperature (total recoverable metals, grain size, TOC), the URS chemist qualified the results as estimated (J or UJ). The circumstances associated with the sample coolers were communicated to DFWMR via email. DFWMR concurred that the data would be usable in the FWIA as qualified data (M. Crance, email communication).

10.2 Exposure Evaluation

Elements of uncertainty associated with the exposure evaluation include:

10.2.1 Toxicity of Metals Mixtures

The lack of appropriate toxicological information to characterize effects of multiple chemicals acting jointly may overestimate or underestimate risk. Chemicals may act in an additive, antagonistic, or synergistic manner when contacted directly or ingested by wildlife. The extent to which different chemical classes interact to affect toxicity is not known, and represents an uncertainty in the evaluation.

10.2.2 Mercury-Selenium Antagonism

The bioavailability and toxicity of selenium and mercury in sediment and soil represents uncertainty because mercury and selenium commonly interact in the environment due to their affinity for each other and similar biogeochemical cycling. The interactions are generally referred to as a mercury-selenium antagonism. In the mercury-selenium antagonism, selenium is known to limit the uptake of mercury by a wide variety of organisms, and reduce mercury toxicity in birds and mammals.

Selenium has been found to confer resistance to the toxic effect of mercury in all investigated species of mammals, birds, and fish (Ralston and Raymond 2010 and references therein). The effect was first noticed in laboratory animals, where rats injected with selenite and mercuric chloride had lower mortality than rats injected with mercuric chloride alone (Parizek and Ostadalova, 1967). There are several proposed mechanisms for antagonism within biological systems, including the formation of insoluble mercury selenide (HgSe) (Yang et al., 2008), and supplying additional selenium to continue the synthesis of selenoproteins in target tissue (e.g., brain; Ralston and Raymond, 2010).

The role of selenium in mediating mercury uptake and, presumably, toxicity in ecological systems is most widely studied in aquatic systems. Several studies have observed declines in fish tissue mercury concentrations after the addition of selenite (Rudd et al., 1980; Rudd and Turner, 1983a, 1983b; Turner and Rudd, 1983; Turner and Swick, 1983; Paulsson and Lundbergh, 1991), or selenite rich loads of total selenium in surface water (Southworth et al., 2000). In each of these studies, significant declines in mercury concentrations in fish tissue or mercury assimilation rates were observed. These results have been replicated in systems with selenium gradients resulting from the distance to coal deposition of combustion (e.g., coal or metal smelters), where inverse trends between mercury and selenium have been established in organisms from a variety of trophic levels (Speyer, 1980; Chen et al., 2001; Belzile et al., 2006; Sackett et al., 2010).

There is also support that the selenium-mercury antagonism may occur in terrestrial environments, particularly in plant uptake of mercury. Amending soil with selenium decreased the uptake of mercury by the roots of radish (*Raphanus sativus*) plants (Shanker et al., 1996a) and tomato plants (Shanker et al., 1996b), due to the formation of relatively insoluble Hg-Se species in soil. Further research has indicated that mercury may form a complex with a selenoprotein in the root fraction, which prevents translocation to other parts of the plant (Afton and Caruso, 2009). The effect of selenium on plant uptake and the potential for added selenium to form strong, insoluble complexes with mercury has led to proposals to use selenium amendments to soil to reduce mercury bioavailability in soil and in receiving waters (Yang et al., 2008). It is also possible that co-occurring concentrations of selenium and mercury in soil may, in effect, lead to decreased uptake of both mercury and selenium in plant tissues.

10.2.3 Identification of Causal Relationships in Sediment Toxicity Testing

Identifying causal relationships between toxic effects observed in sediment toxicity tests and concentrations of individual target metals may be confounded by numerous factors. Test organisms may be affected by the mixture of metals present in sediment samples, which may result in antagonistic or synergistic effects on toxicity. In addition to chemical stressors, differences in sediment matrices that influence microhabitats directly related to test organism exposure (e.g., organic carbon content, acid volatile sulfide concentrations, grain size distribution) may influence the results of laboratory bioassays. Despite these limitations in identifying direct causal relationships, toxicity test endpoints were evaluated relative to target metal concentrations to identify consistencies in toxic effects and concentrations gradients. These consistencies may be considered in risk management decision-making to mitigate potential impacts to benthic invertebrate communities.

10.2.4 Metal Bioavailability

Chemical analyses of soils and sediments measured total concentrations of metals rather than the more bioavailable or toxic forms. Comparisons of total concentrations to toxicological benchmarks were based on the assumption that no physicochemical factors limited receptor exposure or the potential for toxic expression of metals. This uncertainty varies by metal depending on physicochemical characteristics. It is likely that, to some degree, metals adsorb to fine-grain particles and/or complex with chemical agents and organic ligands in the exposure media. Such actions may change the chemical speciation of the metal to a less toxic form, or reduce the concentrations of bioavailable chemicals and subsequent uptake by receptors. The use of the total concentrations to estimate exposure does not take into account these changes in speciation or reductions in toxicity and therefore, undoubtedly overestimates risk when compared to toxicological benchmarks derived from more bioavailable and toxic forms.

10.2.5 Selection of Receptors:

The FWIA cannot evaluate the potential for adverse effects on every plant and animal species that may be present and potentially exposed at the Site. As a result, representative receptors were selected based on trophic category, particular feeding behaviors, and availability of life history information, to represent several similarly exposed species at the Site. If the receptors evaluated in the assessment are more or less sensitive to exposure to site-related constituents than some receptor populations existing at the Site, the results may overestimate or underestimate overall ecological risk at the Site.

Receptors evaluated in the FWIA provide an adequate representation of potential risks to wildlife that may forage in exposure areas at the Site. Receptors were selected in consultation with DFWMR and key receptor exposure parameters, including home ranges, ingestion rates (food and substrate), were reviewed with DFWMR during the data review and analysis phase of the investigation. These consultations were designed to minimize uncertainty in the overall analysis.

10.2.6 Area Use Factors

Because it is unrealistic to expect wide-ranging receptors to live and feed exclusively in a limited area, AUFs were incorporated into the FWIA to estimate exposure more accurately based on the proportion of time a receptor would likely utilize an exposure area. Area use factors estimate the average proportion of time a receptor may spend in a specific exposure area based on the size of the exposure area relative to the size of the receptor home range. While in the short term, the incorporation of AUFs may underestimate risk if the receptor is active within the exposure area for a greater proportion of time, over longer periods of time, this is expected to average out. Conversely, if habitat quality is diminished to the point that a receptor avoids the exposure area, the area use factor may overestimate exposure. Given the disturbed nature of the Active Plant Area and the SWMU 1/22 Wetland Complex, it is not likely that receptors will preferentially forage in these areas for a greater proportion of time than anticipated based on AUFs.

Home ranges used to calculate AUFs for the FWIA were selected to minimize the underestimation of exposure. Relevant home range data were compiled for each receptor and home ranges were selected based on conservative estimates from similar habitats; selected home ranges were reviewed with DFWMR to ensure adequate conservatism in AUFs. The level of conservatism incorporated into the selection of home ranges is not likely to underestimate receptor exposure and more likely results in an overestimation of exposure.

10.2.7 Evaluation of Population- and Community-Level Effects

Because the complexity of community and population dynamics, it is not currently possible to evaluate all possible exposures or effects. The information presented, while complete and accurate, may have missed long-term influences to the environmental chemistry of metals found at the Site. It also may have failed to address adaptation of natural communities to the unique site conditions. In addition, while ecological functional redundancies contributed by unevaluated species may provide resiliency against adverse effects at the community and ecosystem levels, sensitivities may be present in other populations that have not been evaluated in the current studies. In either case, the studies presented are only estimated representations of conditions as they exist at the Site, and it is virtually certain that not all of the underlying variability and stressor effects have been quantified. Therefore, it is important to recognize that (1) potentially large uncertainties exist regarding community and population health, but (2) these uncertainties most probably do not directionally bias conclusions.

Further, it is important to recognize that substantial differences exist between observations and conclusions made at the individual, population, and community levels of biological organization. For example, effects manifested at the population or community levels resulting from the effects to only a few individuals may not be observable with the type of studies implemented. The ramifications of this also include an understanding that because the assessment level endpoints are protective of populations (not individuals), risks projected to cause loss of a few individuals may not cause impacts that are important at the levels of assessment where risk management decisions are made, (i.e., populations and communities).

The analysis performed for this assessment did not account for some Site-specific factors such as adaptive tolerance, adaptive reproductive potential, the small size of the affected area compared to the range of most species populations, and recruitment from similar adjoining areas. Such factors would tend to mitigate the degree and ecological significance of loss or impairment of a portion of ecological population(s) due to both chemical and physical stressors in the area. As a result, the approach used in this assessment likely results in overestimation of risk.

10.3 Risk Characterization

Uncertainties in characterizing risks are primarily associated with the assumption that an HQ greater than 1.0 is an adequate indicator of the potential for ecological risks of individual chemicals. Given the use of conservative exposure and effects assumptions, there is minimal uncertainty that the potential for ecological risks from exposure to individual metals were not identified in the evaluation. Conversely, there is a possibility of false positive identification of ecological risks for some individual metals. The influence of HQs on risk characterization may underestimate, but more likely overestimates risk.

10.4 Summary of Uncertainty Analysis

The FWIA Step IIC investigation used conservative assumptions and estimates to evaluate potential ecological impacts in the SWMU 1/22 Wetland Complex and the margins of the Active Plant Area. The data evaluation approach was reviewed with DFWMR during the data evaluation/reporting phase and modified as necessary to achieve a satisfactory level of conservatism. Because conservative estimates or assumptions were made for most factors considered in the assessment, there is confidence that the conclusions of the FWIA are adequately conservative to identify potential adverse effects to ecological receptor populations.

11.0 CONCLUSIONS AND RECOMMENDATIONS

The objective of this FWIA Step IIC investigation was to collect adequate and representative data to assess potential ecological impacts on the Dyno Nobel Site. The Work Plan (URS, 2010) for this investigation was approved by NYSDEC and specific study elements of this work were developed in close coordination with NYSDEC DFWMR. Additionally, the data evaluation approach was developed in consultation with NYSDEC DFWMR through multiple meetings and conference calls. The following sections present the conclusions of the FWIA Step IIC investigations and provide recommendations to support remedial-decision making to address ecological exposure at the Site.

11.1 SWMU 1/22 Wetland Complex

Comprehensive investigations were conducted in the SWMU 1/22 Wetland Complex to evaluate potential ecological risk associated with metals concentrations in surface water, sediments, and biological tissues. Based upon the results of these investigations, the following is concluded:

- The SQT weight-of-evidence evaluation indicated that impacts to benthic invertebrate communities occurred at stations adjacent to SWMU 22 (SQT-03, SQT-04, SQT-05, and SQT-06) that contained the greatest concentrations of target metals in sediments;
- Benthic invertebrate impacts decreased with distance from SWMU 22 and were not measureable at the station with the greatest distance from SWMU 22 (SQT-8);
- The incidence of significant lethal and sublethal effects on benthic test organisms in sediment toxicity tests were most consistent with concentration gradients of selenium and lead;
- Levels of target metals in surface water were generally below surface water criteria; therefore, exposure of fish and other aquatic life to target metals is not likely to result in adverse community-level effects. In addition, a fish presence/absence survey and comparisons of mercury concentrations in fish tissue to a conservative tissue residue benchmark also indicate that there is little potential for adverse effects to fish populations; and
- Potential risks to wildlife exposed to target metals were limited to receptors that forage exclusively within the exposure area; the potential for adverse effects was greatest for tree swallow, however, the estimation of the dose to tree swallow was highly uncertain.

The findings of the exposure evaluation for the select receptor communities support the following recommendations to address ecological exposure in the SWMU 1/22 Wetland Complex:

- Develop preliminary sediment remedial goals for benthic invertebrate communities at concentrations representing thresholds between ‘likely unimpacted’ and ‘likely impacted’ stations identified in the weight-of-evidence SQT evaluation;
- Develop preliminary sediment remedial goals for semi-aquatic wildlife using dose rate models based on LOAEL TRVs and site-specific sediment-to-biota bioaccumulation relationships developed in FWIA Step IIC investigations; and
- Modify the current CMS to include pathway elimination for sediments exceeding preliminary sediment remedial goals for benthic invertebrate communities and assure that UCL_{95} concentrations in residual sediments not addressed through pathway elimination do not exceed preliminary sediment remedial goals for wildlife.

11.2 Active Plant Area

The exposure evaluation in the Active Plant Area focused on risks to wildlife receptors that potentially forage on at the margins of the facility. The findings of the exposure evaluation support the following conclusions regarding exposure to terrestrial wildlife:

- The greatest potential risks to terrestrial wildlife are associated with exposure to selenium consumed in earthworms and small mammals;
- Potential risks associated with selenium exposure to wildlife are greatest in the northern grids N1 and N3, which are associated with burning areas used to combust off-specification and waste materials;
- Excluding the elevated tissue concentrations in N1 and N3, potential risks to top-tier, long-ranging receptors foraging throughout the Site are negligible; and
- Selenium bioaccumulation is highly variable and uncertain based on non-depurated earthworm tissue and total selenium analyses in soil; bioaccumulation relationships derived from site-specific data are not reliable for developing preliminary remedial goals for soil.

The findings of the terrestrial wildlife exposure evaluation support the following recommendations to address ecological exposure at the margins of the Active Plant Area:

- Preliminary remedial goals for terrestrial wildlife exposure to selenium should not be derived based on the highly variable and uncertain soil bioaccumulation relationships observed in FWIA Step IIC data; further understanding of selenium bioaccumulation and toxicity are needed prior to making informed remedial decisions.
- Further evaluation of soil bioaccumulation relationships for selenium should be based on depurated tissue samples and soil analyses that represent bioavailable forms of selenium;
- Further evaluation of selenium bioaccumulation should consider selenium uptake dynamics in similar soil types within the region that are outside of the influence of the Site;

- Selenium speciation analyses should be conducted on tissue samples to identify appropriate LOAEL TRVs for comparisons to doses estimated by dose rate modeling; and
- Given the frequent disturbance of plant activities in the Active Plant Area, risk management decision-making for terrestrial wildlife exposure to selenium should focus primarily on the protection of top-tier, long-ranging receptors, e.g., red fox and red hawk.

11.3 Additional Site Characterizations

Additional characterizations of site-related metals in soil and sediments from select areas of the Site support the following conclusions and recommendations:

- SWMU 35 Perimeter Soil: Soil results from the perimeter of SWMU 35 indicate that target metals are not migrating downgradient of the landfill and are not likely to result in adverse effect to ecological receptors. No further evaluation of soils downgradient of SWMU 35 is warranted; and
- Site Drainage Sediments: Elevated concentrations of site-related metals at various sediment depth intervals within the site drainages indicate that the two drainage ditches that traverse the Site may represent historic migration pathways of site-related metals. Further evaluation of remedial alternatives for the SWMU 1/22 Wetland Complex should consider this potential migration pathway.

12.0 REFERENCES

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TABLES

TABLE 1
SUMMARY OF NEAR-BOTTOM SURFACE WATER QUALITY PARAMETERS - SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Sediment Quality Triad Station	Substrate Characteristics	Sample Date 2010		Water Depth (in)		Temperature (°C)		Dissolved Oxygen (mg/L)		Dissolved Oxygen (% Saturation)		pH		Specific Conductivity		Oxidation-Reduction Potential (mV)	
		June	October	June	October	June	October	June	October	June	October	June	October	June	October	June	October
PE-SQT-01	Black unconsolidated sediment becoming increasingly cohesive with depth; stiff clay encountered at 12-14 inches below sediment surface; sediment reducing (degassing when disturbed)	6/14	10/27	18	36 - 48	23.37	17.18	8.5	11.7	97.8	NM	7.43	6.52	0.115	0.449	-2.9	-48.8
PE-SQT-02	Black fluidized silt with coarse particulate organic material (CPOM); becoming more cohesive with depth; stiff gray clay at ~12 inches; sediment reducing (degassing when disturbed)	6/15	10/27	12 - 18	12	22.32	17.15	6.73	2.2	77.3	NM	7.08	6.90	0.119	0.398	-6.9	57.2
PE-SQT-03	Brown/black silt with high fine particulate organic material (FPOM) and little CPOM; stiff clay encountered at ~10 inches below sediment; periphyton at surface; sediment reducing (degassing when disturbed)	6/23	10/28	18	18	28.25	16.67	4.09	6.0	52.1	62.0	3.33	1.44	0.292	3.026	186	510.4
PE-SQT-04	CPOM (leaf pack) layer ~3 inches thick at surface of sediment; underlying sediment decomposing CPOM and silt; stiffer clay/silt layer encountered at ~8 inches below sediment	6/17	10/28	8	10	18.56	12.52	6.5	4.5	70.1	42.3	7.33	7.20	0.267	1.027	92.1	97.5
PE-SQT-05	Dark brown fluidized silt becoming increasingly cohesive with depth; stiff clay encountered at ~10 inches below sediment surface; CPOM at surface transitioning to FPOM with depth; sediments reducing (degassing when disturbed)	6/15	10/27	10	12	25.35	16.96	5.7	2.4	69.3	24.5	7.08	6.75	NM	0.397	11.9	43.3
PE-SQT-06	Thick *Phragmites* root mat at surface of sediment; highly organic sediments consisting predominantly of decaying *Phragmites* to stiff gray clay layer at ~11 inches below sediment surface; sediment reducing (degassing when disturbed)	6/14	10/28	6 - 8	6	15.83	11.28	0.8	1.4	7.9	13.0	6.92	6.56	0.154	0.681	-74.1	-20.3
PE-SQT-07	*Phragmites* detritus layer ~2 inches thick at sediment surface; underlying sediment silt with CPOM and FPOM; stiff clay encountered at ~8 below sediment surface	6/17	10/27	12	12	20.42	16.16	5.59	4.9	62	49.5	7.12	6.87	0.125	0.400	-21.2	44.5
PE-SQT-08	Dark brown silt with organic root mat and detritus; stiff, light gray clay encountered at ~8 inches below sediment surface	6/17	10/27	6 - 12	12	17.51	15.38	5.99	5.8	62.7	57.8	7.09	7.06	0.12	0.504	-3.6	61.7
PE-SQT-09	*Phragmites* detritus layer at sediment surface; underlying sediment silt with decaying *Phragmites* vegetative material; sediments increasingly silts/clays with depth; stiff clay encountered at ~8 below sediment surface	6/16	10/29	12	36	17.26	10.74	2.32	2.1	24	18.5	6.65	6.65	0.051	0.192	32.3	-27.7
PE-SQT-10	*Phragmites* detritus layer at sediment surface; underlying sediment silt with decaying *Phragmites* vegetative material; sediments increasingly silts/clays with depth; stiff clay encountered at ~8 below sediment surface	6/16	10/29	36	36	18.15	11.12	3.76	3.7	39.8	33.1	6.89	6.83	0.053	0.200	17.1	-16.3
PE-SQT-11	*Phragmites* detritus layer at sediment surface; underlying sediment silt with decaying *Phragmites* vegetative material; sediments increasingly silts/clays with depth; stiff clay encountered at ~8 below sediment surface	6/16	10/29	36	42 - 48	18.58	11.11	3.18	2.3	32.9	21.3	6.98	6.73	0.059	0.210	59.7	-30.3

Notes:
NM, Measurement not recorded.

TABLE 2
SUMMARY OF ANALYTICAL RESULTS FOR TARGET METALS - SQT SEDIMENT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	NYSDEC Sediment Criteria		SWMU 1/22 SQT Stations								Reference SQT Stations		
						LEL[1]	SEL[2]	PE-SQT-01	PE-SQT-02	PE-SQT-03	PE-SQT-04	PE-SQT-05	PE-SQT-06	PE-SQT-07	PE-SQT-08	PE-SQT-09	PE-SQT-10	PE-SQT-11
Metals																		
Cadmium	mg/kg	11	11	0.22	26.6	0.6	9.0	**0.84**	**0.83**	0.22	**3.1**	**2**	**26.6**	**8.4**	**3.3**	**2.3**	**2**	**1.1**
Copper	mg/kg	11	11	37.2	18,800	16	110	**702** [J']	**524** [J']	**12600** [J']	**8070** [J']	**1790** [J']	**18800** [J']	**4390** [J']	**2300** [J']	**68** [J']	**68.4** [J']	**37.2** [J']
Lead	mg/kg	11	11	36.2	2,060	31	110	**251**	**592**	**1850** [J']	**353**	**2060**	**474**	**224**	**128**	**58.1**	**56.7**	**36.2**
Mercury	mg/kg	11	11	0.19	82.4	0.15	1.3	**57.4**	**8.3**	**61.1**	**27.8**	**3.5**	**82.4**	**12.2**	**24.8**	**0.29**	**0.32**	**0.19**
Selenium	mg/kg	11	11	5.20	198	5.00	--	**35.6**	**71**	**198**	**38.6**	**170**	**78.2**	**33.2**	**16.4**	**8.4**	**11**	**5.2**
Zinc	mg/kg	11	11	26.2	2,110	120	270	**174**	**150**	26.2	**1270**	**246**	**2110**	**623**	**404**	85.9	81.3	68.3
Other Sediment Parameters																		
Percent Solids	%	11	11	18.3	41.9	NA	NA	24.0	21.2	41.9	25.7	18.3	19.9	19.0	23.6	21.0	23.5	39.3
Total organic carbon	%	11	11	4.32	28.1	NA	NA	6.64	4.32	5.57	5.42	6.52	10.6	8.35	4.93	21.4	28.1	11.8

Notes:

[J] Result is estimated due to a minor quality control anomaly

[U] Result is a non-detect < the detection limit (DL)

[B'] Estimated result; less than the RL

[J'] Method blank contamination

[E'] Matrix interference

1, LEL, lowest effect level; sediment screening criterion for selenium is based on a value from Nagpal et al. (1995) for British Columbia

2, SEL, severe effects level

Bold results indicate a sediment concentration exceeding the LEL; shaded results indicate a concentration exceeding the SEL

TABLE 3
PEARSON CORRELATION MATRIX OF SEDIMENT TARGET METALS CONCENTRATIONS - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Pearson Correlation (*r*)						
	Cadmium	Copper	Lead	Mercury	Selenium	Zinc
Cadmium	1					
Copper	0.732	1				
Lead	-0.261	0.115	1			
Mercury	0.542	0.752	-0.074	1		
Selenium	-0.149	0.284	0.973	0.104	1	
Zinc	0.88	0.72	-0.36	0.463	-0.282	1

TABLE 4
SUMMARY OF DETECTED CONSTITUENTS - REFERENCE SQT SEDIMENT
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Sediment Criteria	Sediment Criteria Source	Maximum Concentraton Exceeds Criteria?	PE-SQT-09	PE-SQT-10	PE-SQT-11
Metals											
Aluminum	mg/kg	3	3	14,200	18,100	NS	--	--	18,100.0 J'	14,200.0 J'	15,200.0 J'
Antimony	mg/kg	3	3	0.22	0.39	2	NYSDEC LEL	No	0.36 B' J'	0.39 B' J'	0.22 B' J'
Arsenic	mg/kg	3	3	3.20	7.00	6	NYSDEC LEL	Yes	4.9	7	3.2
Barium	mg/kg	3	3	192	208	NS	--	--	208	192	192
Beryllium	mg/kg	3	3	0.97	1.50	NS	--	--	1.5	1.3	0.97
Chromium	mg/kg	3	3	16.20	18.20	26	NYSDEC LEL	No	18.2 J'	16.2 J'	17.4 J'
Cobalt	mg/kg	3	3	5.00	5.60	50	USEPA Region III	No	5.5	5	5.6
Iron	mg/kg	3	3	14,100	18,600	20,000	NYSDEC LEL	No	15,000.0	18,600.0	14,100.0
Manganese	mg/kg	3	3	134	223	460	NYSDEC LEL	No	223.0	134.0	217.0
Nickel	mg/kg	3	3	16.60	23.30	16.0	NYSDEC LEL	Yes	22.3 J'	23.3 J'	16.6 J'
Silver	mg/kg	3	3	0.20	0.33	1.0	NYSDEC LEL	No	0.32	0.33	0.20
Thallium	mg/kg	3	3	0.22	0.26	NS	--	--	0.26	0.22	0.24
Vanadium	mg/kg	3	3	25.50	35.60	NS	--	--	35.6	34.7	25.5
Organochlorine Pesticides											
4,4'-DDE	µg/kg	3	3	3.0	8.9	118.0	NYSDEC[1]	No	4.3	7.7	3.0 PG"
gamma-BHC	µg/kg	3	3	1.3	2.2	NS	--	--	2.2 J" PG"	1.9 J" PG"	1.3 J" PG"
alpha-BHC	µg/kg	3	1	0.71	0.71	NS	--	--	0.71 J" PG"	4.30 U	2.60 U
Dieldrin	µg/kg	3	1	0.42	0.42	1,062	NYSDEC[1]	No	4.0 U	4.3 U	0.42 J" PG"
Endrin	µg/kg	3	1	0.9	0.9	472.0	NYSDEC[1]	No	4.0 U	4.3 U	0.9 J" PG"
Volatile Organic Compounds											
Xylenes	µg/kg	3	3	39.0	100.0	10,856	NYSDEC[1]	No	71.0 U	96.0	39.0
Toluene	µg/kg	3	2	6.8	7.1	5,782	NYSDEC[1]	No	24.0 U	6.8 J"	13.0 U
Acetone	µg/kg	3	1	41.0	41.0	NS	--	--	95.0 U	41.0 J"	51.0 U
Semi-Volatile Organic Compounds											
Fluoranthene	µg/kg	3	2	48	49	120,360	NYSDEC[1]	No	310 U	49 J"	200 U
Pyrene	µg/kg	3	2	47	58	113,398	NYSDEC[1]	No	310 U	58 J"	200 U
Benzaldehyde	µg/kg	3	1	2,000	2,000	NS	--	--	1,500 U	2,000	1,000 U
Butyl benzyl phthalate	µg/kg	3	1	210	210	11,000	USEPA EcoTox	No	210 J"	1,700 U	1,000 U
Phenanthrene	µg/kg	3	1	57	57	14,160	NYSDEC[1]	No	310 U	57 J"	200 U
Other Sediment Parameters											
Total Organic Carbon	%	3	2	48	49	120,360	NYSDEC[1]	No	21.4	28.1	11.8

Notes:

PG" Front and rear chromatography columns display >40% difference

J" Estimated result; less than the RL

U Result is a non-detect < the detection limit (DL)

B" Method blank contamination

1, Technical Guidance for Screening Contaminated Sediments (NYSDEC 1999); based on benthic aquatic life chronic toxicity assuming the lowest total organic carbon concentration of 11.8%

NS, No standard available

TABLE 5
VOC/SVOC SEDIMENT ANALYSES - PE-SD-SQT-03
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Unit	Result
Volatile Organic Compounds (Method 8260B)		
trans-1,3-Dichloropropene	µg/kg	24 U
Acetone	µg/kg	98 U
Ethylbenzene	µg/kg	24 U
Trichlorofluoromethane	µg/kg	24 U
2-Hexanone	µg/kg	24 U
Isopropylbenzene	µg/kg	24 U
Methyl acetate	µg/kg	24 U
Methylcyclohexane	µg/kg	24 U
Methylene chloride	µg/kg	24 U
4-Methyl-2-pentanone	µg/kg	24 U
Benzene	µg/kg	24 U
Styrene	µg/kg	24 U
1,1,2,2-Tetrachloroethane	µg/kg	24 U
Tetrachloroethene	µg/kg	24 U
Toluene	**µg/kg**	**7.9 J**
1,2,4-Trichlorobenzene	**µg/kg**	**7.4 J**
1,1,1-Trichloroethane	µg/kg	24 U
1,1,2-Trichloroethane	µg/kg	24 U
Trichloroethene	µg/kg	24 U
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/kg	24 U
Vinyl chloride	µg/kg	24 U
Xylenes (total)	µg/kg	73 U
Methyl tert-butyl ether	µg/kg	24 U
Bromodichloromethane	µg/kg	24 U
Bromoform	µg/kg	24 U
Bromomethane	µg/kg	24 U
2-Butanone	µg/kg	24 U
Carbon disulfide	**µg/kg**	**4.6 J**
Carbon tetrachloride	µg/kg	24 U
Chlorobenzene	µg/kg	24 U
Dibromochloromethane	µg/kg	24 U
1,2-Dibromo-3-chloropropane	µg/kg	24 U
Chloroethane	µg/kg	24 U
Chloroform	µg/kg	24 U
Chloromethane	µg/kg	24 U
Cyclohexane	µg/kg	24 U
1,2-Dibromoethane	µg/kg	24 U
1,2-Dichlorobenzene	µg/kg	24 U
1,3-Dichlorobenzene	µg/kg	24 U
1,4-Dichlorobenzene	µg/kg	24 U
Dichlorodifluoromethane	µg/kg	24 U
1,1-Dichloroethane	µg/kg	24 U
1,2-Dichloroethane	µg/kg	24 U
1,1-Dichloroethene	µg/kg	24 U
cis-1,2-Dichloroethene	µg/kg	24 U
trans-1,2-Dichloroethene	µg/kg	24 U
1,2-Dichloropropane	µg/kg	24 U
cis-1,3-Dichloropropene	µg/kg	24 U
Semi-Volatile Organic Compounds (Method 8270C)		
Acenaphthene	µg/kg	650 U
Diethyl phthalate	µg/kg	3200 U
2,4-Dimethylphenol	µg/kg	3200 U
Dimethyl phthalate	µg/kg	3200 U
Di-n-octyl phthalate	µg/kg	3200 U
4,6-Dinitro-2-methylphenol	µg/kg	17000 U
2,4-Dinitrophenol	µg/kg	17000 U
2,4-Dinitrotoluene	µg/kg	3200 U
2,6-Dinitrotoluene	µg/kg	3200 U

Notes:
U, Result is a non-detect , the detection limit (DL)

Analyte	Unit	Result
Semi-Volatile Organic Compounds (Method 8270C)		
Anthracene	µg/kg	650 U
Fluoranthene	µg/kg	650 U
Fluorene	µg/kg	650 U
Hexachlorobenzene	µg/kg	650 U
Hexachlorobutadiene	µg/kg	650 U
Hexachlorocyclopentadiene	µg/kg	3200 U
Hexachloroethane	µg/kg	3200 U
Indeno(1,2,3-cd)pyrene	µg/kg	650 U
Isophorone	µg/kg	3200 U
Atrazine	µg/kg	3200 U
2-Methylnaphthalene	µg/kg	650 U
2-Methylphenol	µg/kg	3200 U
4-Methylphenol	µg/kg	3200 U
Naphthalene	µg/kg	650 U
2-Nitroaniline	µg/kg	17000 U
3-Nitroaniline	µg/kg	17000 U
4-Nitroaniline	µg/kg	17000 U
Nitrobenzene	µg/kg	6500 U
2-Nitrophenol	µg/kg	3200 U
4-Nitrophenol	µg/kg	17000 U
Benzo(a)anthracene	µg/kg	650 U
N-Nitrosodi-n-propylamine	µg/kg	650 U
N-Nitrosodiphenylamine	µg/kg	3200 U
Benzo(b)fluoranthene	µg/kg	650 U
Benzo(k)fluoranthene	µg/kg	650 U
Benzo(ghi)perylene	µg/kg	650 U
Benzo(a)pyrene	µg/kg	650 U
Pentachlorophenol	µg/kg	3200 U
Phenanthrene	µg/kg	650 U
Phenol	µg/kg	650 U
Pyrene	µg/kg	650 U
Acetophenone	µg/kg	3200 U
2,4,5-Trichlorophenol	µg/kg	3200 U
2,4,6-Trichlorophenol	µg/kg	3200 U
Carbazole	µg/kg	650 U
bis(2-Chloroethoxy)methane	µg/kg	3200 U
bis(2-Chloroethyl) ether	µg/kg	650 U
bis(2-Ethylhexyl) phthalate	µg/kg	6500 U
Benzaldehyde	µg/kg	3200 U
1,1'-Biphenyl	µg/kg	3200 U
4-Bromophenyl phenyl ether	µg/kg	3200 U
2,2'-oxybis(1-Chloropropane)	µg/kg	650 U
Butyl benzyl phthalate	µg/kg	3200 U
Acenaphthylene	µg/kg	650 U
Caprolactam	µg/kg	17000 U
4-Chloroaniline	µg/kg	3200 U
4-Chloro-3-methylphenol	µg/kg	3200 U
2-Chloronaphthalene	µg/kg	650 U
2-Chlorophenol	µg/kg	3200 U
4-Chlorophenyl phenyl ether	µg/kg	3200 U
Chrysene	µg/kg	650 U
Dibenz(a,h)anthracene	µg/kg	650 U
Dibenzofuran	µg/kg	3200 U
Di-n-butyl phthalate	µg/kg	3200 U
3,3'-Dichlorobenzidine	µg/kg	3200 U
2,4-Dichlorophenol	µg/kg	650 U
Total Sulfide Method 9030B/9034		
Total Sulfide	**mg/kg**	**823**
Sulfate Method 9056A		
Sulfate	**mg/kg**	**8110**
Other Sediment Parameters		
Percent Solids	%	20.5

TABLE 6

EXTRACTABLE PETROLEUM HYDROCARBON SEDIMENT ANALYSES - PE-SD-SQT-03

FWIA STEP IIC INVESTIGATION

DYNO NOBEL PORT EWEN SITE

PORT EWEN, NEW YORK

Massachusetts Extractable Petroleum Hydrocarbon (EPH) Method		
Analyte	**Unit**	**Result**
Acenaphthene	mg/Kg	10 U
Acenaphthylene	mg/Kg	10 U
Anthracene	mg/Kg	10 U
Benzo[a]anthracene	mg/Kg	10 U
Benzo[a]pyrene	mg/Kg	10 U
Benzo[b]fluoranthene	mg/Kg	10 U
Benzo[g,h,i]perylene	mg/Kg	10 U
Benzo[k]fluoranthene	mg/Kg	10 U
Chrysene	mg/Kg	10 U
Dibenz(a,h)anthracene	mg/Kg	10 U
Fluoranthene	mg/Kg	10 U
Fluorene	mg/Kg	10 U
Indeno[1,2,3-cd]pyrene	mg/Kg	10 U
2-Methylnaphthalene	mg/Kg	10 U
Naphthalene	mg/Kg	10 U
Phenanthrene	mg/Kg	10 U
Pyrene	mg/Kg	10 U
C11-C22 Aromatics (unadjusted)	mg/Kg	2600
C11-C22 Aromatics (Adjusted)	mg/Kg	2600
C19-C36 Aliphatics	mg/Kg	13000
C9-C18 Aliphatics	mg/Kg	580
Total EPH	mg/Kg	16000
Percent Moisture	%	81

Notes:

U, Result is a non-detect , the detection limit (DL)

TABLE 7
SUMMARY OF SUMMER BENTHIC INVERTEBRATE COMMUNITY ANALYSES - JUNE 2010
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

	SQT Station	SWMU 1/22 Wetland Complex SQT Stations																								Reference Wetland SQT Stations								
	SQT Station	SQT-01			SQT-02			SQT-03			SQT-04			SQT-05			SQT-06			SQT-07			SQT-08			SQT-09			SQT-10			SQT-11		
	Benthic Replicate	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
	Percent Subsampled	33.33	43.67	62.5	44.84	50	43.67	100	100	62.5	100	66.67	100	45.87	8.33	29.15	100	100	100	28.09	50	25.51	25	33.33	33.33	100	100	100	100	100	100	100	100	100
Ephemeroptera	Callibaetis sp.	4	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Odonata	Aeshnidae	0	0	0	0	0	0	0	0	0	4	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Coenagrionidae	1	3	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Corduliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
	Lestes sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	Libellulidae	1	0	1	1	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hemiptera	Belostoma sp.	0	0	*1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Belostomatidae	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Corixidae	1	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
	Naucoridae	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Neoplea sp.	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Notonecta sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Trichocorixa sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coleoptera	Dubiraphia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Dytiscidae	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
	Matus sp.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Megaloptera	Chauliodes sp.	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
	Sialis sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Diptera-Chironomidae	Ablabesmyia mallochi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	4	0	0	0	0	0	0	0	0	0
	Ablabesmyia peleensis	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0
	Chironomini	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
	Chironomus sp.	3	1	2	0	1	1	63	50	113	0	26	39	0	0	0	2	2	0	0	0	0	4	2	2	9	11	3	0	0	0	8	1	4
	Clinotanypus sp.	0	0	0	2	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	0	0	0	0	0	0	0	0	0
	Corynoneura sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cricotopus bicinctus gr.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Cricotopus sp.	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
	Cryptochironomus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Cryptotendipes sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	0	0	0	0	0	0	0	0	0
	Dicrotendipes sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	Endochironomus sp.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Kiefferulus sp.	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	0	0	0	0	0	3
	Larsia sp.	22	25	9	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
	Limnophyes sp.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Micropsectra sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Microtendipes pedellus gr.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	2	0	0	0	0	0	0	0	1	0
	Natarsia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Orthocladiinae Species C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
	Orthocladius annectens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Paramerina sp.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Parametriocnemus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Paratanytarsus sp.	4	2	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0
	Paratendipes sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	2	3	0	0	0	0	0	0	0	0	0
	Phaenopsectra sp.	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	2	1	2	0	0	0	0	0	0	0	0	0
	Polypedilum fallax gr.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Polypedilum halterale gr.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Polypedilum scalaenum gr.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Polypedilum trigonus	6	15	6	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	0
	Polypedilum tritum	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Procladius sp.	7	3	5	11	12	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0
	Pseudochironomus sp.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stenochironomus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	0	0	0	0	0	0
	Tanypus sp.	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tanytarsus sp.	1	0	0	4	10	6	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	33	42	24	0	0	0	0	0	0	0	0	0
	Thienemannimyia gr. sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0
	Zavrelimyia sp.	0	0	0	0	0	0	0	0	1	4	0	9	0	0	0	2	5	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 7
SUMMARY OF SUMMER BENTHIC INVERTEBRATE COMMUNITY ANALYSES - JUNE 2010
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

	SQT Station	SWMU 1/22 Wetland Complex SQT Stations																								Reference Wetland SQT Stations								
	SQT Station	SQT-01			SQT-02			SQT-03			SQT-04			SQT-05			SQT-06			SQT-07			SQT-08			SQT-09			SQT-10			SQT-11		
	Benthic Replicate	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
	Percent Subsampled	33.33	43.67	62.5	44.84	50	43.67	100	100	62.5	100	66.67	100	45.87	8.33	29.15	100	100	100	28.09	50	25.51	25	33.33	33.33	100	100	100	100	100	100	100	100	100
Diptera	Anopheles sp.	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bezzia/Palpomyia sp.	3	0	2	0	0	0	2	6	4	0	0	3	0	0	0	0	0	0	1	3	0	0	2	0	1	0	0	0	0	0	2	1	0
	Ceratopogoninae	0	0	1	2	0	1	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0
	Chaoborus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	5
	Chrysops sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Pilaria sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Sphaeromias sp.	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Tabanidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Tipula sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Tipulidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichoptera	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Limnephilus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Phylocentropus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	4	0	0	0	0	0	0	0	0	0
Gastropoda	Ferrissia sp.	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gyraulus sp.	2	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	1	1	1	9	2	1
	Micromenetus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Physa sp.	1	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	1	8	11	9	3	23	5	2
	Planorbella sp.	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Planorbula sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
	Pseudosuccinea columella	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Musculium sp.	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pisidium sp.	0	0	0	6	0	4	0	0	0	0	0	0	22	4	36	0	0	0	4	0	0	1	0	1	0	0	0	0	0	0	0	0	0
	Sphaeriidae	10	0	8	12	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	0	0	1	0	0
Annelida	Aulodrilus pluriseta	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dero flabelliger	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dero vaga	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Desserobdella phalera	4	1	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
	Enchytraeidae	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	1	0	0	0	0	0	5	0	5	5	2	0	0	0	0	0	0
	Erpobdella sp.	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
	Helobdella sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Helobdella stagnalis	0	1	0	4	0	1	0	0	0	0	0	0	12	12	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0
	Limnodrilus hoffmeisteri	0	0	0	0	0	0	0	0	0	31	106	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Lumbriculidae	0	0	0	0	0	0	0	0	0	0	0	3	0	1	1	16	6	16	3	3	0	0	1	0	1	1	0	0	0	0	1	0	1
	Naididae	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tubificidae w/ cap setae	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tubificidae w/o cap setae	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Acari	Acari	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Arrenurus sp.	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	9	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	Limnesia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Crustacea	Caecidotea sp.	1	0	0	40	14	44	0	1	0	1	0	0	67	80	71	27	13	2	89	67	80	16	9	24	11	7	13	1	8	8	37	11	20
	Crangonyx sp.	0	0	0	0	0	0	0	0	0	1	0	0	1	3	0	1	0	0	6	14	16	1	0	5	0	0	0	0	0	0	0	0	0
	Hyalella sp.	22	20	10	6	29	13	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	29	21	19	1	0	0	1	0	2	12	2	2
	Ostracoda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Other Organisms	Nematoda	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
	TOTAL	**100**	**98**	**90**	**96**	**95**	**100**	**69**	**66**	**127**	**43**	**134**	**80**	**106**	**100**	**111**	**51**	**43**	**32**	**107**	**101**	**105**	**116**	**105**	**101**	**40**	**38**	**37**	**29**	**19**	**22**	**106**	**29**	**41**
	Number per sample	300	224.4	144	214.1	190	229	69	66	203.2	43	201	80	231.1	1200	380.8	51	43	32	380.9	202	411.6	464	315	303	40	38	37	29	19	22	106	29	41
	Number per m2	13045	9757	6261	9308	8261	9956	3000	2870	8835	1870	8739	3478	10047	52195	16556	2217	1870	1391	16562	8783	17896	20174	13697	13175	1739	1652	1609	1261	826.1	956.5	4609	1261	1783
	Taxa Richness	23	23	17	17	20	24	5	7	6	7	4	10	8	5	5	7	12	4	9	13	9	19	21	20	12	13	9	12	4	10	18	12	10

TABLE 8
SUMMARY OF FALL BENTHIC INVERTEBRATE COMMUNITY ANALYSES - OCTOBER 2010
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

	SQT Station	SWMU 1/22 Wetland Complex SQT Stations																						Reference Wetland SQT Stations									
	SQT Station	SQT-01		SQT-02			SQT-03			SQT-04			SQT-05			SQT-06			SQT-07			SQT-08			SQT-09			SQT-10			SQT-11		
	Benthic Replicate	A	B,C[1]	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
	Percent Subsampled	100	100	100	100	87.72	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Ephemeroptera	Baetidae	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Caenis sp.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Odonata	Aeshna sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Aeshnidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Anisoptera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
	Ischnura sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0
	Libellulidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	1	0	0
	Libellulidae/Corduliidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Hemiptera	Neoplea sp.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pelocoris sp.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coleoptera	Agabus sp.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	Colymbetinae	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Elmidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Megaloptera	Sialis sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Diptera-Chironomidae	Clinotanypus sp.	0	0	7	0	1	0	0	0	3	8	8	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Diplocladius sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Larsia sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Limnophyes sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Natarsia sp.	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Paraphaenocladius sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Paratendipes sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pentaneurini	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Polypedilum scalaenum gr.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Polypedilum tritum	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0
	Procladius sp.	0	0	3	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tanypus sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tanytarsus sp.	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Thienemannimyia gr. sp.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Zavrelimyia sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diptera	Bezzia/Palpomyia sp.	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bittacomorpha sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ceratopogoninae	0	0	6	0	8	0	0	0	0	7	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	1	0
	Chaoborus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
	Chrysops sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Diptera	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	Myxosargus sp.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Odontomyia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Pseudolimnophila sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Sphaeromias sp.	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Stratiomyidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 8
SUMMARY OF FALL BENTHIC INVERTEBRATE COMMUNITY ANALYSES - OCTOBER 2010
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

	SQT Station	SWMU 1/22 Wetland Complex SQT Stations																						Reference Wetland SQT Stations								
	SQT Station	SQT-01		SQT-02			SQT-03			SQT-04			SQT-05			SQT-06			SQT-07			SQT-08			SQT-09			SQT-10			SQT-11		
	Benthic Replicate	A	B,C[1]	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
	Percent Subsampled	100	100	100	100	87.72	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Trichoptera	Agrypnia sp.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Limnephilidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Limnephilus sp.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
	Oligostomis sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Phylocentropus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
	Polycentropodidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ptilostomis sp.	0	0	2	2	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lepidoptera	Crambidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Lepidoptera	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Gastropoda	Gyraulus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
	Planorbella sp.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0
	Planorbidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	Planorbula sp.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0
Bivalvia	Musculium sp.	0	0	14	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
	Pisidium sp.	0	0	3	0	1	0	0	0	0	0	0	21	1	15	0	0	0	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0
	Sphaeriidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	1	0	0
Annelida	Enchytraeidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
	Erpobdella sp.	1	9	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Helobdella sp.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Helobdella stagnalis	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Limnodrilus hoffmeisteri	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
	Lumbriculidae	0	0	3	0	1	0	0	0	0	0	0	5	0	2	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Tubificidae w/o cap setae	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Acari	Arrenurus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	Limnesia sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Amphipoda	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
	Caecidotea sp.	0	0	24	7	59	0	0	0	0	0	0	21	0	62	0	0	0	29	12	26	2	0	0	3	1	1	3	2	0	9	0	0
	Crangonyx sp.	0	0	4	0	0	0	0	0	0	0	0	4	0	0	0	0	0	9	0	6	0	0	0	0	0	0	0	0	0	0	0	0
	Hyalella sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0
	Ostracoda	0	0	6	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Other Organisms	Nematoda	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Turbellaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	**7**	**12**	**81**	**9**	**105**	**0**	**0**	**0**	**5**	**23**	**22**	**55**	**2**	**85**	**0**	**1**	**4**	**47**	**19**	**41**	**16**	**3**	**5**	**15**	**2**	**7**	**7**	**16**	**1**	**25**	**1**	**0**
	Number per sample	7	12	81	9	119.7	0	0	0	5	23	22	55	2	85	0	1	4	47	19	41	16	3	5	15	2	7	7	16	1	25	1	0
	Number per m2	304.3	260.9	3522	391.3	5204	0	0	0	217.4	1000	956.5	2391	86.96	3696	0	43.48	173.9	2043	826.1	1783	695.7	130.4	217.4	652.2	86.96	304.3	304.3	695.7	43.48	1087	43.48	0
	Taxa Richness	6	3	17	2	17	0	0	0	3	8	8	8	2	8	0	1	2	9	8	10	7	3	4	6	2	7	5	10	1	7	1	0

Notes:
1, Replicates B and C at SQT-01 were inadvertently composited by the taxonomic laboratory; the taxa counts represent the organisms sorted from the composited sample.

TABLE 9
SUMMARY OF TOXICITY TESTING ENDPOINTS - 42 DAY HYALELLA AZTECA SURVIVAL, GROWTH, AND REPRODUCTION SEDIMENT TOXICITY TEST
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Endpoint		SWMU 1/22 SQT Stations								Reference SQT Stations			Laboratory Control
		PE-SQT-01	PE-SQT-02	PE-SQT-03	PE-SQT-04	PE-SQT-05	PE-SQT-06	PE-SQT-07	PE-SQT-08	PE-SQT-09	PE-SQT-10	PE-SQT-11	
Day 28													
Survival	Mean Percent Survival	61.7%	64.2%	0.0%	25.8%	9.2%	35.0%	70.8%	70.8%	83.3%	80.0%	80.8%	87.5%
	Standard Error	6.1%	6.2%	0.0%	5.1%	3.6%	7.9%	5.8%	6.0%	4.8%	4.3%	3.6%	4.8%
	Statistical Difference	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	Not Applicable			
Biomass	Mean Biomass (mg dw)	0.313	0.234	0	0.054	0.035	0.038	0.205	0.308	0.418	0.469	0.409	0.369
	Standard Error	0.077	0.067	0.000	0.026	0.021	0.015	0.017	0.101	0.034	0.058	0.020	0.061
	Statistical Difference	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	Not Applicable			
Day 35													
Survival	Mean Percent Survival	43.8%	63.8%	0.0%	25.0%	8.8%	30.0%	71.3%	71.3%	76.3%	73.8%	80.0%	75.0%
	Standard Error	6.2%	4.6%	0.0%	6.0%	3.9%	6.7%	7.3%	6.1%	6.4%	6.4%	4.4%	8.5%
	Statistical Difference	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	Not Applicable			
Day 42													
Survival	Mean Percent Survival	38.8%	63.8%	0.0%	22.5%	8.8%	28.8%	66.3%	68.8%	76.3%	72.5%	76.3%	68.9%
	Standard Error	5.9%	4.6%	0.0%	5.7%	3.9%	6.8%	8.0%	7.5%	6.4%	6.5%	4.6%	8.4%
	Statistical Difference	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	No	No	Not Applicable			
Biomass	Mean Biomass (mg dw)	0.2071	0.3627	0	0.1449	0.0761	0.1827	0.4165	0.4784	0.6148	0.5374	0.5782	0.3849
	Standard Error	0.0848	0.0527	0.0000	0.0602	0.0508	0.0558	0.0991	0.0944	0.0748	0.0755	0.0425	0.1041
	Statistical Difference	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	Not Applicable			
Juvenile Production	Mean Number per Female	2.31	2.646	0	2.517	0.5	0.583	3.364	6.944	6.667	5.682	5.862	6.479
	Standard Error	1.448	0.709	0.000	1.488	0.000	0.600	0.997	2.109	2.332	1.509	1.619	2.166
	Statistical Difference	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No	Not Applicable			

TABLE 10
SUMMARY OF TOXICITY TESTING ENDPOINTS - *CHIRONOMUS RIPARIUS* CHRONIC EXPOSURE SEDIMENT EVALUATION
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Endpoint		SWMU 1/22 SQT Stations								Reference SQT Stations			Laboratory Control
		PE-SQT-01	PE-SQT-02	PE-SQT-03	PE-SQT-04	PE-SQT-05	PE-SQT-06	PE-SQT-07	PE-SQT-08	PE-SQT-09	PE-SQT-10	PE-SQT-11	
Day 10													
Survival	Mean Percent Survival	75.0%	72.5%	0.0%	97.5%	60.0%	97.5%	95.0%	82.5%	87.5%	97.5%	87.5%	92.5%
	Standard Error	8.7%	18.0%	0.0%	2.5%	19.6%	2.5%	5.0%	4.8%	4.8%	24.4%	4.8%	2.5%
	Statistical Difference	No	No	**Yes**	No	No	No	No	No	Not Applicable			
Biomass	Mean Biomass (mg dw)	0.45	0.516	0	0.3825	0.1743	0.4933	0.5425	0.5202	0.5502	0.5241	0.5292	0.7353
	Standard Error	0.071	0.125	0.000	0.045	0.071	0.049	0.042	0.045	0.096	0.025	0.086	0.073
	Statistical Difference	No	No	**Yes**	No	**Yes**	No	No	No	Not Applicable			
Emergence													
Time to Emergence	Mean Days	14.93	15.44	16.33	15.82	16.61	14.32	15.9	15.36	14.31	14.46	16.81	13.56
	Standard Error	0.89	1.03	0.03	1.14	1.44	0.25	1.28	0.73	0.49	0.20	0.82	0.45
	Statistical Difference	No	No	No	**Yes**	**Yes**	No	No	No	Not Applicable			
Percent Emergence	Mean Percent Emergence	83.8%	87.5%	10.0%	94.4%	88.8%	87.5%	96.3%	95.0%	88.8%	83.8%	60.0%	86.9%
	Standard Error	9.6%	10.9%	157.2%	3.6%	4.8%	9.5%	5.3%	3.0%	6.8%	8.4%	17.7%	6.9%
	Statistical Difference	No	No	**Yes**	No	No	No	No	No	Not Applicable			

TABLE 11
SUMMARY OF ANALYTICAL RESULTS FOR TARGET METALS - DOWNSTREAM SEDIMENT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	UnitS	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	NYSDEC Sediment Criteria		PE-DNS-SD-01 (0-1.0)	PE-DNS-SD-01 (1-1.5)	PE-DNS-SD-02 (0-1.0)	PE-DNS-SD-03 (0-1.0)	PE-DNS-SD-04 (0-1.0)
						LEL[1]	SEL[2]					
Metals												
Cadmium	mg/kg	5	5	0.45	1.9	0.6	9.0	**1.9**	**1**	**1.7** E'	0.45	**0.78**
Copper	mg/kg	5	5	179	2,440	16	110	**2020**	**2440**	**1410**	**246**	**179**
Lead	mg/kg	5	5	25.9	77.3	31	110	**77.3**	**51.4**	**52.3**	25.9	**40.6**
Mercury	mg/kg	5	5	1.1	45.3	0.15	1.3	**25.5**	**45.3**	**25.4**	**3.4**	**1.1**
Selenium	mg/kg	5	5	1.3	7.7	5.00	--	**7.7**	4.3	**5.1** E'	1.3	2
Zinc	mg/kg	5	5	89.3	270	120	270	**270**	**249**	**226**	89.3	**185**
Other Sediment Parameters												
Percent Solids	%	5	5	17.2	61	NA	NA	17.2	40.6	32.4	61	44.2
Total Organic Carbon	%	5	5	2	8	NA	NA	7.14	4.25	7.75	2.08	4.82

Notes:

If the result is > the reporting limit (RL), then [x] is non-detect at the sample concentration; if the result is < the RL, then [x] is non-detect at the RL.

U Result is a non-detect < the detection limit (DL)

E' Matrix interference

1, LEL, lowest effect level; sediment screening criterion for selenium is based on a value from Nagpal et al. (1995) for British Columbia

2, SEL, severe effects level

Bold results indicate a sediment concentration exceeding the LEL; shaded results indicate a concentration exceeding the SEL

TABLE 12
SWMU 1/22 SURFACE WATER STATIONS - SUMMARY OF ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Sample Type[1]	Units	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	NYSDEC SWQS	SWMU 1/22 Wetland Complex Stations						Reference Stations		
								PE-SW-01	PE-SW-02	PE-SW-03	PE-SW-04	PE-SW-05	PE-SW-06	PE-SW-07	PE-SW-08	PE-SW-09
Metals																
Cadmium	U	µg/L	9	0	ND	ND	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
	F	µg/L	9	0	ND	ND	2.52	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Copper	U	µg/L	9	9	0.33	19	NA	3.30	2.40	18.60	3.00	3.70	5.90	0.81 B'	1.30 B'	0.33 B'
	F	µg/L	9	6	1.90	12	14.1	2.00	1.90 B'	12.00	2.00	2.60	4.40	0.93 U (2.0)	1.50 U (2.0)	0.68 U (2.0)
Lead	U	µg/L	9	9	0.072	0.96	NA	0.16 B'	0.15 B'	0.07 B'	0.96 B'	0.58 B'	0.40 B'	0.10 B'	0.46 B'	0.11 B'
	F	µg/L	9	9	0.04	0.26	4.9	0.06 B'	0.19 B'	0.04 B'	0.26 B'	0.25 B'	0.20 B'	0.11 B'	0.18 B'	0.14 B'
Mercury	U	µg/L	9	0	ND	ND	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	F	µg/L	9	0	ND	ND	0.77	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Selenium	U	µg/L	9	1	0.49	0.49	NA	5.00 U	5.00 U	0.49 B'	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
	F	µg/L	9	3	0.5	1.4	4.6	5.00 U	0.86 B'	1.40 B'	0.50 B'	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Zinc	U	µg/L	9	9	1.3	7.2	NA	3.90 B'	2.70 B'	4.90 B'	7.20	1.70 B'	2.80 B'	2.20 B'	3.70 B'	1.30 B'
	F	µg/L	9	6	1.3	4.5	101.2	4.50 B'	1.90 B'	3.70 B'	2.60 B'	2.30 B'	4.50 B'	3.40 U (5.0)	3.00 U (5.0)	1.30 U (5.0)
Other Water Quality Parameters																
Total Suspended Solids	U	mg/L	9	3	2	4	4	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	2.00 B'	3.60 B'	2.00 B'
Hardness	U	mg/L	9	9	54.7	156	156	133.00	128.00	156.00	132.00	127.00	133.00	54.70	71.60	80.00

Notes:

If the result is > the reporting limit (RL), then [x] is non-detect at the sample concentration; if the result is < the RL, then [x] is non-detect at the RL.

[U] Result is a non-detect < the detection limit (DL)

[B'] Estimated result; less than the RL

[J'] Method blank contamination

1, U, Unfiltered sample; F, Filtered (0.45µm) sample

ND, Analyted was not detected in any sample

NA, Not applicable; NYSDEC SWQS are based on filtered surface water results.

TABLE 13
FISH COMMUNITY PRESENCE/ABSENCE SURVEY RESULTS - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Species	Upstream			Site			Downstream		
	Number	Mean Length (mm) (+/- SE)	Mean Weight (g) (+/- SE)	Number	Mean Length (mm) (+/- SE)	Mean Weight (g) (+/- SE)	Number	Mean Length (mm) (+/- SE)	Mean Weight (g) (+/- SE)
Golden Shiner (*Notemigonus crysoleucas)*	96	80 (4)	6.2 (1.2)	79	79 (4)	5.8 (1)	81	91 (3)	8.3 (1.1)
Largemouth Bass (*Micropterus salmoides)*	1	135	34.6	0	NC	NC	0	NC	NC
American Eel (*Anguilla rostrata)*	0	NC	NC	0	NC	NC	6	364 (42)	112.2 (36.5)

Notes:
NC, Not calculated; taxon was not present in sampling reach.

TABLE 14
SUMMARY OF BENTHIC INVERTEBRATE TISSUE ANALYSES - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units[1]	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	SWMU 1/22 Wetland Complex SQT Stations							Reference
						PE-SQT-BITIS-01	PE-SQT-BITIS-02	PE-SQT-BITIS-04	PE-SQT-BITIS-05	PE-SQT-BITIS-06	PE-SQT-BITIS-07	PE-SQT-BITIS-08	PE-SQT-BITIS-11
Cadmium	mg/kg, ww	8	8	0.03	0.94	0.078	0.043	0.061	0.154	0.944	0.044	0.171	0.031
Copper	mg/kg, ww	8	8	10.30	171	15.2	16.9	78.3	64.9	171	14.5	53.1	10.3
Mercury	ng/g,ww	8	8	18.60	270	69.9	30.9	70.9	18.6	26.8	64.7	270	30.2
Methylmercury	ng/g,ww	8	8	0.68	45.70	22.1	17.7	17	5.37	0.68	45.7	17.5	22.8
Lead	mg/kg, ww	8	8	0.29	6.65	0.285 [J-M]	1.85 [J-M]	0.446 [J-M]	6.65 [J-M]	3 [J-M]	1.11 [M]	0.782 [J-M]	0.304 [J-M]
Selenium	mg/kg, ww	8	8	0.42	8.51	0.65	2.4	1.04	4.63	8.51	1.76	2.84	0.42
Zinc	mg/kg, ww	8	8	20.30	42	20.6	42	25.9	31.8	37.8	22.6	33	20.3

Notes:

If the result is > the reporting limit (RL), then [x] is non-detect at the sample concentration; if the result is < the RL, then [x] is non-detect at the RL.

[J-M] Result is estimated; duplicate precision percent difference associated with QC sample was not within acceptance criteria.

[M] Result is estimated; duplicate precision percent difference was not within acceptance criteria.

1, ww, Results expressed on a wet weight basis

TABLE 15
SUMMARY OF FISH TISSUE RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units[1]	Upstream				Site				Downstream			
		Concentration (+/- SE)				Concentration (+/- SE)				Concentration (+/- SE)			
		Mean	+/- SE	Min	Max	Mean	SE	Min	Max	Mean	SE	Min	Max
Golden Shiner													
Cadmium	mg/kg ww	0.0063	0.0014	0.0033	0.0114	0.0065	0.0026	0.0030	0.0166	0.0098	0.0005	0.0081	0.0108
Copper	mg/kg ww	1.620	0.140	1.248	2.105	1.722	0.381	0.710	2.944	2.135	0.324	1.272	3.146
Mercury	ng/g ww	56.1	5.5	40.8	73.0	77.8	5.4	63.7	96.0	97.7	9.5	72.5	119.1
Methylmercury	ng/g ww	57.5	8.9	32.9	82.0	77.1	5.0	59.7	89.6	94.4	12.9	61.6	124.9
Lead	mg/kg ww	0.038	0.016	0.017	0.100	0.131	0.028	0.043	0.196	0.040	0.011	0.021	0.076
Selenium	mg/kg ww	0.395	0.016	0.336	0.426	0.911	0.120	0.667	1.288	1.145	0.095	0.916	1.396
Zinc	mg/kg ww	38.364	5.040	19.387	48.395	43.229	3.616	37.094	53.591	39.034	1.987	33.566	42.955
Largemouth Bass													
Cadmium	mg/kg ww				0.0031								
Copper	mg/kg ww				1.418								
Mercury	ng/g ww				49.7								
Methylmercury	ng/g ww	Not Calculated			49.1	Taxon Not Present				Taxon Not Present			
Lead	mg/kg ww				0.056								
Selenium	mg/kg ww				0.322								
Zinc	mg/kg ww				42.187								
American Eel													
Cadmium	mg/kg ww									0.0257	0.0059	0.0465	0.0132
Copper	mg/kg ww									1.548	0.551	3.659	0.572
Mercury	ng/g ww									98.7	22.8	187.6	66.7
Methylmercury	ng/g ww	Taxon Not Present				Taxon Not Present				86.9	18.1	156.1	56.2
Lead	mg/kg ww									0.039	0.011	0.067	0.019
Selenium	mg/kg ww									1.984	0.115	2.212	1.663
Zinc	mg/kg ww									16.087	1.231	19.797	13.129

Notes:
1, ww, Results are presented on a wet weight basis
NC, Not calculated; taxon was not present in sampling reach.

TABLE 16
SUMMARY OF SMALL MAMMAL TISSUE ANALYSES - ACTIVE PLANT AREA
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units[1]	Northern Grids					Southern Grids				
		Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	UCL_{95} Concentration[2]	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	UCL_{95} Concentration[2]
Metals											
Antimony	mg/kg dw	15	2	0.171	0.201	NC	7	1	0.060	0.06	NC
Arsenic	mg/kg dw	15	11	0.12	5.94	1.741	7	4	0.10	0.28	0.184
Barium	mg/kg dw	15	15	2.77	85.2	31.56	7	7	5.08	23.85	18.41
Cadmium	mg/kg dw	15	6	0.13	1.62	0.497	7	1	0.02	0.02	NC
Chromium	mg/kg dw	15	15	8.38	40.76	26.53	7	7	7.14	83.33	51.31
Cobalt	mg/kg dw	15	15	0.14	3.42	1.413	7	7	0.13	0.63	0.421
Copper	mg/kg dw	15	15	8.70	30.63	18.52	7	7	8.44	22.46	18.3
Lead	mg/kg dw	15	15	0.21	47.2	14.49	7	7	0.53	4.2	2.699
Mercury	mg/kg dw	15	3	0.05	0.12	0.12	7	5	0.06	0.43	0.245
Selenium	mg/kg dw	15	15	1.65	259.4	219.2	7	7	1.49	5.9	4.02
Silver	mg/kg dw	15	1	0.033	0.03	NC	7	0	ND	ND	NC
Zinc	mg/kg dw	15	15	79.0	2185.0	1083	7	7	84.7	184.8	165.6
Other Parameters											
Percent Moisture	%	15	15	72.2	89.2	--	7	7	69.2	88.1	--

Notes:
1, dw, Results are presented on a dry weight basis
2, UCL_{95}, 95 percent upper cor 1, UCL_{95}, 95 percent upper confidence limit of the mean concentration; calculated in USEPA ProUCL 4.00.02
NC, Not calculated; insufficient detected results to calcuate UCL_{95}

TABLE 17
SUMMARY OF EARTHWORM TISSUE ANALYSES - ACTIVE PLANT AREA
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units[1]	Northern Grids					Southern Grids				
		Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	UCL_{95} Concentration[2]	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	UCL_{95} Concentration[2]
Metals											
Antimony	mg/kg dw	13	4	0.051	0.478	0.293	14	3	0.060	0.57	0.358
Arsenic	mg/kg dw	13	13	1.29	12.59	8.525	14	14	3.55	9.87	7.413
Barium	mg/kg dw	13	13	2.31	98.7	39.18	14	14	2.55	40.69	26.58
Cadmium	mg/kg dw	13	13	2.24	64.71	33.19	14	14	3.94	23.81	12.41
Chromium	mg/kg dw	13	11	0.98	13.91	5.554	14	10	0.97	10.29	6.243
Cobalt	mg/kg dw	13	13	1.39	10.49	6.407	14	14	1.63	9.80	6.034
Copper	mg/kg dw	13	13	5.20	51.23	25.08	14	14	6.21	95.88	62.93
Lead	mg/kg dw	13	13	1.44	219.1	198.8	14	14	3.79	556.5	249.6
Mercury	mg/kg dw	9	9	0.46	5.68	3.082	11	11	0.69	9.80	5.998
Selenium	mg/kg dw	13	13	4.48	209.1	150.6	14	14	9.65	196.8	96.36
Silver	mg/kg dw	13	12	0.019	1.68	0.839	14	9	0.014	1.16	0.956
Zinc	mg/kg dw	13	13	122.9	654.3	455.4	14	14	170.5	768.7	455.9
Other Parameters											
Percent Moisture	%	13	13	50.0	87.0	NC	14	14	79.0	87.0	NC

Notes:
1, dw, Results are presented on a dry weight basis
2, UCL_{95}, 95 percent ι 1, UCL_{95}, 95 percent upper confidence limit of the mean concentration; calculated in USEPA ProUCL 4.00.02

TABLE 18
SUMMARY OF SOIL ANALYSES - ACTIVE PLANT AREA
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units[1]	Northern Grids					Southern Grids				
		Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	UCL_{95} Concentration[2]	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	UCL_{95} Concentration[2]
Metals											
Antimony	mg/kg dw	15	15	0.220	0.750	0.423	15	15	0.170	0.51	0.324
Arsenic	mg/kg dw	15	15	5.30	13.30	8.926	15	15	4.30	9.80	7.027
Barium	mg/kg dw	15	15	55.20	558.0	257.7	15	15	47.30	115.00	82.34
Cadmium	mg/kg dw	15	15	0.14	0.80	0.462	15	15	0.13	0.36	0.229
Chromium	mg/kg dw	15	15	16.20	25.70	21.29	15	15	12.30	25.80	17.32
Cobalt	mg/kg dw	15	15	8.20	16.90	12.81	15	15	6.80	22.80	12.98
Copper	mg/kg dw	15	15	19.10	172.00	81.79	15	15	13.00	282.00	147.7
Lead	mg/kg dw	15	15	22.20	676.0	272.7	15	15	21.10	563.0	230.5
Mercury	mg/kg dw	15	15	0.06	1.40	0.453	15	15	0.08	4.40	1.542
Selenium	mg/kg dw	15	15	0.78	179.0	133.6	15	15	0.87	6.2	2.036
Silver	mg/kg dw	15	15	0.034	0.16	0.1	15	15	0.036	0.08	0.0603
Zinc	mg/kg dw	15	15	64.1	92.1	81.51	15	15	42.8	227.0	87.93

Notes:
1, dw, Results are presented on a dry weight basis
2, UCL_{95}, 95 percent upper con 1, UCL_{95}, 95 percent upper confidence limit of the mean concentration; calculated in USEPA ProUCL 4.00.02

TABLE 19
SUMMARY OF SOIL ANALYSES - SWMU 35 PERIMETER
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concentration	Soil Screening Criteria		PE-35-SO-01	PE-35-SO-02	PE-35-SO-03	PE-35-SO-04	PE-35-SO-05
						Criteria	Source					
Metals												
Antimony	mg/kg	5	5	0.16	0.31	0.27	Min USEPA Eco-SSL	0.31 [J]	0.23 [J]	0.16 [J]	0.22 [J]	0.16 [J]
Arsenic	mg/kg	5	5	4.50	7.10	13	NYSDEC 375-6	5.60 [J]	7.10 [J]	5.20 [J]	6.40 [J]	4.50 [J]
Barium	mg/kg	5	5	49.30	286.00	433	NYSDEC 375-7	73.90	89.40	49.30	286.00	87.20
Cadmium	mg/kg	5	5	0.10	11.80	4	NYSDEC 375-8	11.80	0.26	0.10	0.46	0.14
Chromium	mg/kg	5	5	16.60	21.70	41	NYSDEC 375-9	16.60 [J']	16.70 [J']	18.30 [J']	21.70 [J']	17.00 [J']
Cobalt	mg/kg	5	5	8.90	17.10	13	Min USEPA Eco-SSL	10.10	10.30	10.60	17.10	8.90
Copper	mg/kg	5	5	11.80	40.70	50	NYSDEC 375-9	40.70 [J]	22.90 [J]	14.60 [J]	17.80 [J]	11.80 [J]
Lead	mg/kg	5	5	17.80	41.20	63.00	NYSDEC 375-10	41.20	21.80	17.80 [J]	31.50	22.80 [J']
Mercury	mg/kg	5	5	0.03	0.14	0.18	NYSDEC 375-11	0.09	0.09	0.03	0.14	0.13
Selenium	mg/kg	5	5	0.34	0.96	3.9	NYSDEC 375-12	0.76	0.53	0.34	0.96	0.55
Silver	mg/kg	5	5	0.02	0.15	2	NYSDEC 375-13	0.07 [J']	0.07	0.02 [B']	0.15	0.06 [B']
Zinc	mg/kg	5	5	52.10	72.70	109	NYSDEC 375-14	62.90	61.70	52.60	72.70	52.10
Other Soil Parameters												
Percent Solids	%	5	5	73.50	80.70	--	--	75.10	80.70	75.90	78.30	73.50

Notes:

If the result is > the reporting limit (RL), then [x] is non-detect at the sample concentration; if the result is < the RL, then [x] is non-detect at the RL

[J] Result is estimated due to a minor quality control anomaly

[U] Result is a non-detect < the detection limit (DL)

[B'] Estimated result; less than the RL

[J'] Method blank contamination

TABLE 20
RELATIVE WEIGHT OF SEDIMENT QUALITY LINES OF EVIDENCE
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

SQT Line of Evidence	Relevance to Site-Specific Toxicity	Relative Weight
Benthic Invertebrate Community Analysis	High: Community assessment provides an *in situ* evaluation of sediment toxicity based on benthic invertebrates that have integrated the effects of stressors and the population compensatory mechanisms evolved over time to survive in a highly variable and stressful environment	+++
Sediment Toxicity Testing: 28-day *Chironomus riparius* Test 42-day *Hyalella azteca* Test	Moderate: Sediment toxicity testing represents an *ex situ* evaluation of sediment toxicity.	++
Bulk Sediment Chemistry Comparisons to Screening Criteria	Low: Sediment screening values are based on the co-occurrence of benthic invertebrates and sediment contaminant concentrations.	+

TABLE 21
WEIGHT-OF-EVIDENCE FRAMEWORK TO CLASSIFY BENTHIC INVERTEBRATE COMMUNITY IMPACTS - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Table 20 A: Severity of Effect Classifications

		Sediment Toxicity LOE Category			
		Non Toxic	Low Toxicity	Moderate Toxicity	High Toxicity
Benthic Community Analysis	Reference	Unaffected	Unaffected	Unaffected	Low Effect
	Low Disturbance	Unaffected	Low Effect	Low Effect	Low Effect
	Moderate Disturbance	Moderate Effect	Moderate Effect	Moderate Effect	Moderate Effect
	High Disturbance	Moderate Effect	High Effect	High Effect	High Effect

Table 20 B: Potential That Effects Are Chemically-Mediated

		Sediment Toxicity LOE Category			
		Non Toxic	Low Toxicity	Moderate Toxicity	High Toxicity
Sediment Chemistry	Minimal Exposure	Minimal Potential	Minimal Potential	Low Potential	Moderate Potential
	Low Exposure	Minimal Potential	Low Potential	Moderate Potential	Moderate Potential
	Moderate Exposure	Low Potential	Moderate Potential	Moderate Potential	Moderate Potential
	High Exposure	Moderate Potential	Moderate Potential	High Potential	High Potential

Table 20 C: Multiple Lines of Evidence Station Classifications

		Severity of Effect Classification			
		Unaffected	Low Effect	Moderate Effect	High Effect
Potential for Chemically-Mediated Effects	Minimal Potential	Unimpacted	Likely Unimpacted	Likely Unimpacted	Inconclusive
	Low Potential	Unimpacted	Likely Unimpacted	Possibly Impacted	Possibly Impacted
	Moderate Potential	Likely Unimpacted	Possibly Impacted or Inconclusive	Likely Impacted	Likely Impacted
	High Potential	Inconclusive	Likely Impacted	Clearly Impacted	Clearly Impacted

TABLE 22
SUMMARY OF SEVERE EFFECT LEVEL QUOTIENTS FOR TARGET METALS - SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	NYSDEC Sediment Criteria		Severe Effect Level Quotients (SEL-Q)										
			SWMU 1/22 SQT Stations								Reference SQT Stations		
	LEL[1]	SEL[2]	PE-SQT-01	PE-SQT-02	PE-SQT-03	PE-SQT-04	PE-SQT-05	PE-SQT-06	PE-SQT-07	PE-SQT-08	PE-SQT-09	PE-SQT-10	PE-SQT-11
Metals													
Cadmium	0.6	9.0	0.1	0.1	0.0	0.3	0.2	3.0	0.9	0.4	0.3	0.2	0.1
Copper	16	110	6.4	4.8	114.5	73.4	16.3	170.9	39.9	20.9	0.6	0.6	0.3
Lead	31	110	2.3	5.4	16.8	3.2	18.7	4.3	2.0	1.2	0.5	0.5	0.3
Mercury	0.15	1.3	44.2	6.4	47.0	21.4	2.7	63.4	9.4	19.1	0.2	0.2	0.1
Selenium[3]	5.00	--	7.1	14.2	39.6	7.7	34.0	15.6	6.6	3.3	1.7	2.2	1.0
Zinc	120	270	0.6	0.6	0.1	4.7	0.9	7.8	2.3	1.5	0.3	0.3	0.3
Mean SEL-Quotient (SEL-Q_{mean})			**10.1**	**5.2**	**36.3**	**18.5**	**12.1**	**44.2**	**10.2**	**7.7**	**0.7**	**0.8**	**0.4**

Notes:
1, LEL, lowest effect level; sediment screening criterion for selenium is based on a value from Nagpal et al. (1995) for British Columb
2, SEL, severe effects level
3, For selenium, the magnitude of exceedances (SEL-Q) was represented as the quotient of the measured concentration to the SQG developed for British Columbia by Nagpal (199
Shaded cells indicate SEL-Q values greater than 1.(

TABLE 23
BENTHIC COMMUNITY METRIC CALCULATIONS - SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

June 2010 Benthic Commuinty Metrics	SWMU 1/22 Wetland Complex																								Reference Wetland								
	SQT-01			SQT-02			SQT-03			SQT-04			SQT-05			SQT-06			SQT-07			SQT-08			SQT-09			SQT-10			SQT-11		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Taxa Richness	23	22	16	15	20	23	5	6	5	7	4	10	8	5	5	7	12	4	9	13	9	19	21	20	12	12	9	12	4	10	18	12	10
Non-Chironomidae and Oligochaeta (NCO) Richness	13	11	9	9	9	11	4	5	3	3	0	4	6	4	4	3	4	2	6	6	4	8	9	7	7	6	5	11	3	9	11	7	6
Percent Dominance	22.0	25.5	34.8	41.7	30.5	44.0	91.3	75.8	89.0	72.1	79.1	48.8	63.2	80.0	64.0	52.9	30.2	50.0	83.2	66.3	76.2	28.4	40.0	23.8	27.5	28.9	35.1	37.9	47.4	36.4	34.9	37.9	48.8
Shannon-Weiner Diversity Index (H)	3.62	3.49	3.27	2.97	3.34	3.16	0.59	1.35	0.70	1.48	0.83	2.47	1.56	1.03	1.17	1.78	2.86	1.68	1.09	1.89	1.24	2.97	3.05	3.26	2.88	3.12	2.60	2.87	1.48	2.88	2.94	2.94	2.51
Hilsenhoff Biotic Index	7.44	6.95	7.36	7.12	7.45	7.01	9.78	9.09	9.56	8.72	9.80	8.54	6.51	6.12	6.68	6.76	7.73	7.34	6.01	5.76	5.75	7.01	6.77	6.61	7.96	8.08	7.76	7.29	6.98	7.00	7.30	6.89	7.20
Percent Model Affinity	66.0	63.6	67.1	60.4	49.7	50.0	28.7	41.5	30.2	45.6	40.0	57.5	42.8	30.0	33.6	42.8	59.7	51.9	25.3	34.8	23.6	40.2	53.1	40.9	72.5	63.9	58.1	45.3	35.3	66.4	52.6	60.3	61.3
Ephemeroptera, Plecoptera, and Trichoptera (EPT) Taxa Richnes	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	2	1	0	0	0	0	0	0	0	0	0

Fall 2010 Benthic Commuinty Metrics	SWMU 1/22 Wetland Complex																							Reference Wetland								
	SQT-01		SQT-02			SQT-03			SQT-04			SQT-05			SQT-06			SQT-07			SQT-08			SQT-09			SQT-10			SQT-11		
	A	B,C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Taxa Richness	6	3	17	2	17	0	0	0	3	8	8	7	2	8	0	1	2	9	8	10	7	3	4	6	2	7	5	8	1	7	1	0
Non-Chironomidae and Oligochaeta (NCO) Richness	6	3	9	2	11	0	0	0	2	2	5	5	2	6	0	1	0	6	6	6	7	3	3	3	2	5	5	7	1	7	1	0
Percent Dominance	28.6	75.0	29.6	77.8	56.2	NA	NA	NA	60.0	34.8	36.4	38.2	50.0	72.9	NA	100.0	75.0	61.7	63.2	63.4	31.3	33.3	40.0	33.3	50.0	14.3	42.9	25.0	100.0	44.0	100.0	NA
Shannon-Weiner Diversity Index (H)	2.52	1.04	3.34	0.76	2.43	NA	NA	NA	1.37	2.42	2.28	2.07	1.00	1.33	NA	0.00	0.81	1.85	1.98	1.95	2.52	1.58	1.92	2.42	1.00	2.81	2.13	3.12	0.00	1.98	0.00	NA
Hilsenhoff Biotic Index	7.00	7.90	6.40	5.78	6.28	NA	NA	NA	7.40	7.48	6.76	6.82	7.35	6.47	NA	8.00	9.33	5.50	6.06	5.79	6.69	5.67	8.93	6.02	6.50	7.20	6.17	7.56	6.00	6.17	6.00	NA
Percent Model Affinity	45.0	30.0	66.0	35.0	53.1	NA	NA	NA	40.0	53.0	44.5	46.4	25.0	39.4	NA	20.0	20.0	34.1	46.1	37.0	35.0	35.0	55.0	63.3	30.0	77.9	49.3	55.0	20.0	47.0	20.0	NA
Ephemeroptera, Plecoptera, and Trichoptera (EPT) Taxa Richnes	1	0	1	1	2	0	0	0	0	0	2	0	0	1	0	0	0	2	1	2	1	0	0	0	0	1	1	0	0	0	0	0

TABLE 24
SUMMARY OF BENTHIC COMMUNITY METRIC STATISTICAL COMPARISONS - SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

SQT Station	Probability (p) Values for Pairwise Comparisons with Pooled[1] Reference Samples											
	Taxa Richness		NCO Richness		Percent Dominant Taxon		Shannon-Weiner Diversity Index (H)		Hilsenhoff Biotic Index		Percent Model Affinity	
	June	October	June	October	June	October	June	October	1-Jun	October	June	October
PE_SQT_01	0.132	1	0.124	1	0.421	1	0.282	1	1	0.647	0.873	0.997
PE_SQT_02	0.204	0.119	0.612	0.119	1	1	0.842	0.992	1	0.998	0.999	0.998
PE_SQT_03	0.131	NA	0.271	NA	***0***	NA	***0***	NA	***0***	NA	***0.009***	NA
PE_SQT_04	0.55	0.997	***0.019***	0.997	***0.008***	1	***0.036***	0.999	***0***	0.733	0.754	1
PE_SQT_05	0.278	1	0.558	1	***0.003***	1	***0.003***	1	0.206	0.977	***0.02***	0.989
PE_SQT_06	0.715	0.956	0.061	0.956	0.952	0.555	0.625	0.679	1	***0.034***	0.98	0.43
PE_SQT_07	1	0.661	0.855	0.661	***0.001***	0.995	***0.009***	1	***0***	0.795	***0.001***	0.998
PE_SQT_08	0.138	1	0.999	1	0.87	0.968	0.922	0.999	0.969	0.938	0.44	1
ANOVA p-value	***0***	--	***0***	0.181	***0***	0.47	--	0.599	***0***	***0.012***	***0***	0.491
Kruskal- Wallis p-value	--	0.14	--	--	--	--	***0.001***	--	--	--	--	--
Transformation Type	Log	NON	NON	NON	Log	NON	NON	NON	Log	Log	NON	NON

Notes:
Shaded cells indicate signficant differences in SWMU 1/22 SQT stations relative to pooled reference SQT stations that are indicative of benthic invertebrate community impairment.
Statistical analyses were not conducted on Ephemeroptera, Plecoptera, and Trichoptera (EPT) richness due to the low occurrence of these taxa at SQT stations (See Table 23).
1, Significant differences were observed in HBI values for summer reference locations; statistical comparisons to SWMU 1/22 were based on comparisons to data from SQT-10, which had the lowest (most conservative) values of HBI.
NA, Metrics were not calculated for SQT-03 because no organisms were present in the samples.
--, Statistical procedure not performed.

TABLE 25
BIOLOGICAL ASSESSMENT PROFILE - SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

June 2010 Biological Assessment Profile	SWMU 1/22 Wetland Complex																Reference Wetland					
	SQT-01		SQT-02		SQT-03		SQT-04		SQT-05		SQT-06		SQT-07		SQT-08		SQT-09		SQT-10		SQT-11	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Taxa Richness	7.09	1.17	6.55	1.21	0	0	0.48	0.48	0	0	0.98	0.98	1.61	0.90	6.82	0.26	2.21	0.75	1.46	0.85	3.43	1.32
Non-Chironomidae and Oligochaeta (NCO) Richness	7.94	0.63	7.21	0.39	4.17	0.32	2.59	1.31	4.60	0.43	3.61	0.32	5.03	0.43	6.36	0.26	5.36	0.35	6.14	1.31	6.45	0.78
Hilsenhoff Biotic Index	4.58	0.25	4.68	0.22	0.87	0.34	1.64	0.66	5.94	0.28	4.54	0.47	6.93	0.14	5.34	0.19	3.45	0.16	4.85	0.17	4.78	0.21
EPT Taxa Richness	1.00	0.50	0.50	0.50	0	0	0	0	0	0	0	0	1.0	0.5	2.83	0.67	0	0	0	0	0	0
Index	5.15	0.42	4.73	0.53	1.26	0.15	1.18	0.57	2.63	0.11	2.28	0.25	3.64	0.40	5.34	0.22	2.75	0.24	3.11	0.50	3.67	0.50

Fall 2010 Biological Assessment Profile	SWMU 1/22 Wetland Complex																Reference Wetland					
	SQT-01		SQT-02		SQT-03		SQT-04		SQT-05		SQT-06		SQT-07		SQT-08		SQT-09		SQT-10		SQT-11	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Taxa Richness	0	0	3.64	1.82	0	0	0	0	0	0	0	0	0.71	0.41	0	0	0	0	0	0	0	0
Non-Chironomidae and Oligochaeta (NCO) Richness	4.53	0.75	5.96	1.49	0	0	3.61	0.56	4.41	0.71	0.33	0.33	5.45	0.00	4.38	0.77	3.80	0.49	3.88	1.48	2.30	1.83
Hilsenhoff Biotic Index	4.25	0.61	6.41	0.32	--	--	4.64	0.38	5.20	0.43	2.23	0.90	7.03	0.27	4.84	1.61	5.71	0.57	5.71	0.82	6.53	0.11
EPT Taxa Richness	0.75	0.61	2.17	0.67	0	0	1.17	1.17	0.50	0.50	0	0	2.83	0.67	0.50	0.50	0.50	0.50	0.50	0.50	0	0
Index	2.38	0.49	4.54	0.86	0	0	2.35	0.53	2.53	0.39	0.45	0.32	4.01	0.31	2.43	0.56	2.50	0.15	2.52	0.36	1.66	0.90

Notes:
--, Value not calculated for SQT-03 because no organisms were present in the samples.

TABLE 26
DESIGNATION OF RESPONSE CATEGORIES - SQT WEIGHT-OF-EVIDENCE EVALUATION OF SEDIMENT IMPACTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Station ID	Sediment Chemistry SEL Quotients (SEL-Q)							Sediment Chemistry Exposure Category	Benthic Community Analyses								Benthic Community Disturbance Category	Toxicity Testing Percent Survival Relative to Mean Reference Survival		Toxicity Category
									Statistical Significance from Reference						BAP - Index Quotients			*Chironomus riparius*	*Hyalella azteca*	
	Cd	Cu	Pb	Hg	Se	Zn	Mean SEL-Q		TR	NCO	PD	HBI	SWD	PMA	June	October		Day 10 Relative Survival	Day 42 Relative Survival	
PE-SQT-01	0.1	6.4	2.3	44.2	7.1	0.6	10.1	Moderate Exposure	–	–	–	–	–	–	1.6	1.1	Reference	82.6%	51.7%	Moderate Toxicity
PE-SQT-02	0.1	4.8	5.4	6.4	14.2	0.6	5.2	Moderate Exposure	–	–	–	–	–	–	1.5	2.0	Reference	79.8%	85.0%	Non Toxic
PE-SQT-03	0.0	114.5	16.8	47.0	39.6	0.1	36.3	High Exposure	+	+	+	+	+	+	0.4	0.0	High Disturbance	0.0%	0.0%	High Toxicity
PE-SQT-04	0.3	73.4	3.2	21.4	7.7	4.7	18.5	High Exposure	–	+	+	+	+	–	0.4	1.1	Moderate Disturbance	107.3%	30.0%	Moderate Toxicity
PE-SQT-05	0.2	16.3	18.7	2.7	34.0	0.9	12.1	Moderate Exposure	–	–	+	+	–	+	0.8	1.1	Moderate Disturbance	66.1%	11.7%	High Toxicity
PE-SQT-06	3.0	170.9	4.3	63.4	15.6	7.8	44.2	High Exposure	–	–	–	–	+	–	0.7	0.2	Moderate Disturbance	107.3%	38.3%	Moderate Toxicity
PE-SQT-07	0.9	39.9	2.0	9.4	6.6	2.3	10.2	Moderate Exposure	–	–	+	+	–	+	1.1	1.8	Low Disturbance	104.6%	88.3%	Non Toxic
PE-SQT-08	0.4	20.9	1.2	19.1	3.3	1.5	7.7	Moderate Exposure	–	–	–	–	–	–	1.7	1.1	Reference	90.8%	91.7%	Non Toxic

TABLE 27
BENTHIC COMMUNITY IMPACT CLASSIFICATIONS BASED ON SQT WEIGHT-OF-EVIDENCE EVALUATION - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Table 26 A: Severity of Effect Classifications

		Sediment Toxicity LOE Category			
		Non Toxic	Low Toxicity	Moderate Toxicity	High Toxicity
Benthic Community Analysis	Reference	Unaffected SQT-08, SQT-02		Unaffected SQT-01	
	Low Disturbance	Unaffected SQT-07			
	Moderate Disturbance			Moderate Effect SQT-04, SQT-06	Moderate Effect SQT-05
	High Disturbance				High Effect SQT-03

Table 26 B: Potential That Effects Are Chemically-Mediated

		Sediment Toxicity LOE Category			
		Non Toxic	Low Toxicity	Moderate Toxicity	High Toxicity
Sediment Chemistry	Minimal Exposure				
	Low Exposure				
	Moderate Exposure	Low Potential SQT-02, SQT-07 SQT-08		Moderate Potential SQT-01	Moderate Potential SQT-05
	High Exposure			High Potential SQT-04, SQT-06	High Potential SQT-03

Table 26 C: Multiple Lines of Evidence Station Classifications

		Severity of Effect Classification			
		Unaffected	Low Effect	Moderate Effect	High Effect
Potential for Chemically-Mediated Effects	Minimal Potential				
	Low Potential	Unimpacted SQT-02, SQT-07 SQT-08			
	Moderate Potential	Likely Unimpacted SQT-01		Likely Impacted SQT-05	
	High Potential			Clearly Impacted SQT-04, SQT-06	Clearly Impacted SQT-03

TABLE 28
SUMMARY OF SEMI-AQUATIC WILDLIFE EXPOSURE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Common Name	HQ_{NOAEL} / HQ_{LOAEL}						
	Cadmium	Copper	Lead	Mercury	Methylmercury	Selenium	Zinc
Maximum Area Use Exposure Scenario							
Great blue heron	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**1.1 / <1**	**1 / <1**	<1 / <1
Belted kingfisher	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**3 / <1**	**2.3 / 1.1**	<1 / <1
Mallard	<1 / <1	**2.4 / 1.3**	<1 / <1	<1 / <1	<1 / <1	**2.5 / 1.3**	<1 / <1
Tree swallow	<1 / <1	**5.7 / 3.2**	<1 / <1	**1.3 / <1**	**4.4 / 1.5**	**10.5 / 5.3**	<1 / <1
Indiana bat	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**1.9 / <1**	**7.6 / 4.6**	<1 / <1
Mink	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**1.4 / <1**	<1 / <1
Raccoon	<1 / <1	**1.2 / <1**	<1 / <1	<1 / <1	<1 / <1	**3.2 / 2**	<1 / <1
Area Use Adjusted Exposure Scenario							
Great blue heron	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1
Belted kingfisher	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**3 / <1**	**2.3 / 1.1**	<1 / <1
Mallard	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1
Tree swallow	<1 / <1	**5.7 / 3.2**	<1 / <1	**1.3 / <1**	**4.4 / 1.5**	**10.5 / 5.3**	<1 / <1
Indiana bat	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1
Mink	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**1.4 / <1**	<1 / <1
Raccoon	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1

TABLE 29
SUMMARY OF TERRESTRIAL WILDLIFE EXPOSURE - NORTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Common Name	HQ_{NOAEL} / HQ_{LOAEL}											
	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Selenium	Silver	Zinc
Maximum Area Use Exposure Scenario												
American robin	NA / NA	<1 / <1	<1 / <1	**1.8 / <1**	<1 / <1	<1 / <1	<1 / <1	**3 / <1**	<1 / <1	**46.8 / 23.4**	<1 / <1	<1 / <1
Red-tailed hawk	NA / NA	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**42.4 / 21.2**	<1 / <1	**1.5 / <1**
Short-tailed shrew	<1 / NA	<1 / <1	<1 / <1	**2.8 / <1**	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**103.6 / 62.8**	<1 / <1	<1 / <1
Red fox	<1 / NA	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**34.5 / 20.9**	<1 / <1	<1 / <1

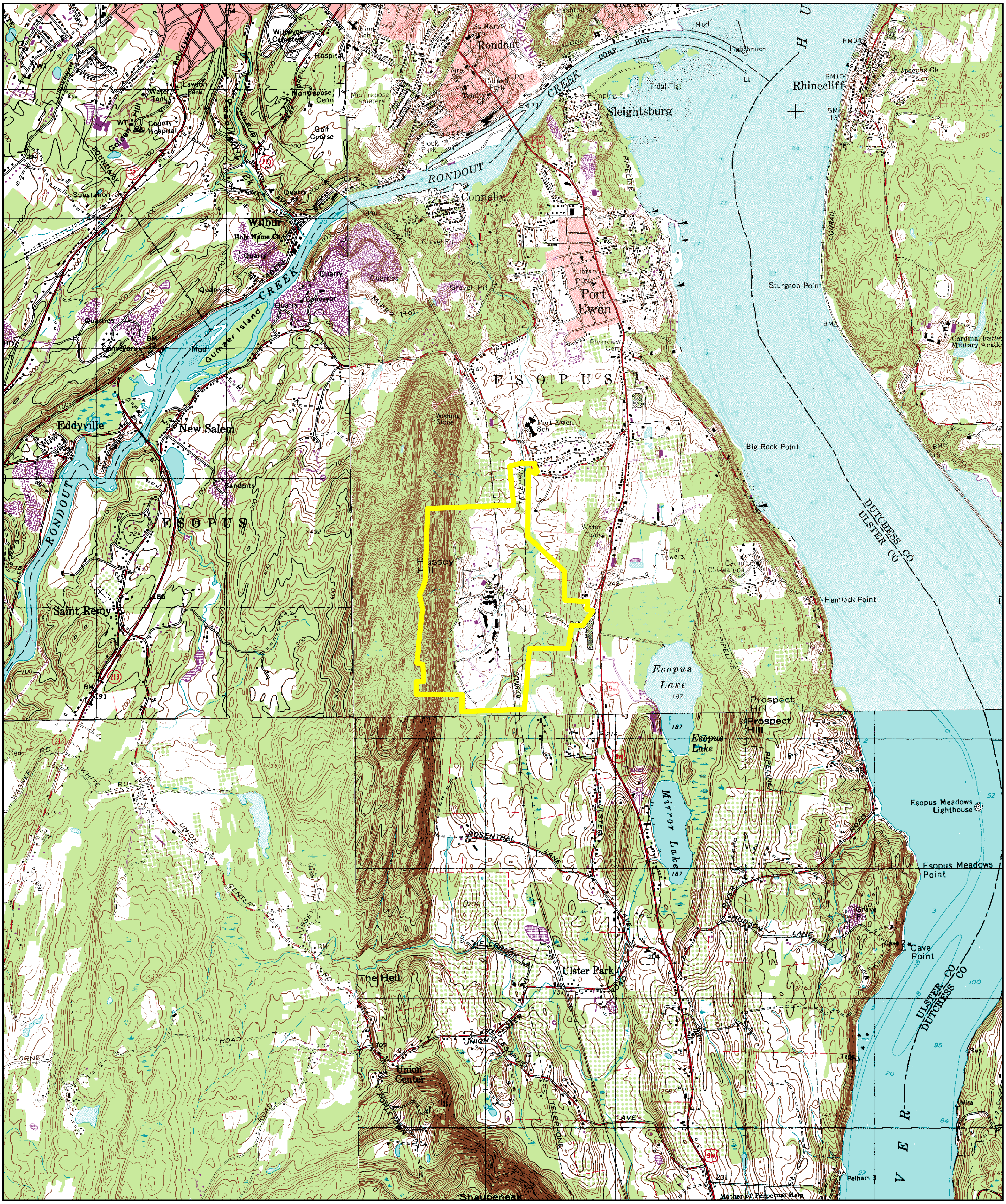
TABLE 30
SUMMARY OF TERRESTRIAL WILDLIFE EXPOSURE - SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Common Name	HQ_{NOAEL} / HQ_{LOAEL}											
	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Selenium	Silver	Zinc
Maximum Area Use Exposure Scenario												
American robin	NA / NA	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**3.7 / <1**	<1 / <1	**14.5 / 7.2**	<1 / <1	<1 / <1
Red-tailed hawk	NA / NA	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1
Short-tailed shrew	<1 / NA	<1 / <1	<1 / <1	**1 / <1**	<1 / <1	<1 / <1	<1 / <1	**1.1 / <1**	<1 / <1	**64.6 / 39.2**	<1 / <1	<1 / <1
Red fox	<1 / NA	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1

TABLE 31
SUMMARY OF TERRESTRIAL WILDLIFE EXPOSURE - NORTHERN AND SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Common Name	Maximum Area Use Exposure Scenario HQ_{NOAEL} / HQ_{LOAEL}											
	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Selenium	Silver	Zinc
Maximum Area Use Exposure Scenario												
Red-tailed hawk	NA / NA	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**16 / 8**	<1 / <1	**1.1 / <1**
Red fox	<1 / NA	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**12.7 / 7.7**	<1 / <1	<1 / <1
Area Use Adjusted Exposure Scenario												
Red-tailed hawk	NA / NA	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**2.9 / 1.4**	<1 / <1	<1 / <1
Red fox	<1 / NA	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	<1 / <1	**7.3 / 4.5**	<1 / <1	<1 / <1

FIGURES



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Legend

APPROXIMATE PROPERTY BOUNDARY

0 1,000 2,000 4,000 Feet

N

FIGURE 1
SITE LOCATION MAP
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Map Source:
USGS topographic maps: Kingston West (2000), Kingston East (1980), Rosendale (1980), Hyde Park (2000)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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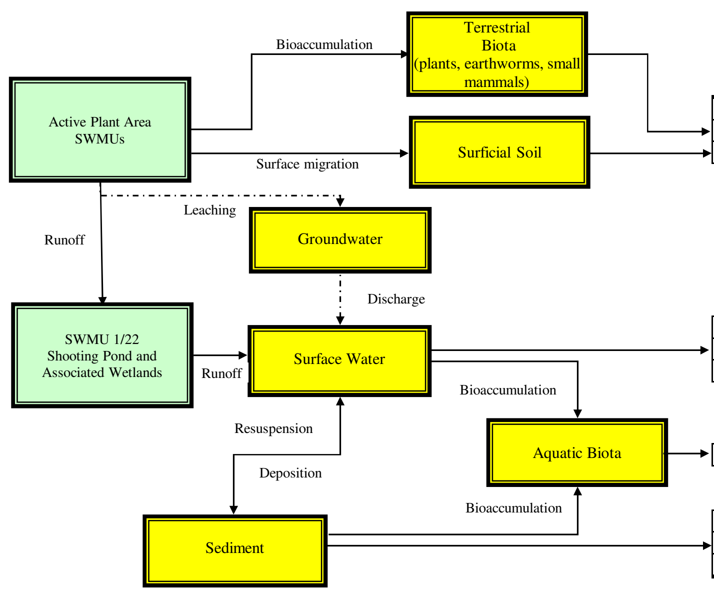
FIGURE 2
ECOLOGICAL CONCEPTUAL SITE MODEL
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Areas of Concern | **Migration Pathways and Exposure Media** | **Potential Exposure Routes** | **Potential Ecological Receptors**



Exposure Media	Potential Exposure Routes	Terrestrial – Active Plant Area: Invertivorous Mammal (e.g., Short-tailed shrew)	Invertivorous Bird (e.g., American robin)	Carnivorous Mammal (e.g., red fox)	Carnivorous Bird (e.g., red-tailed hawk)	Wetland – SWMU 1/22 Wetland Complex: Emergent Vegetation	Benthic Macroinvertebrates	Fish/Amphibians	Omnivorous Mammal (e.g., raccoon)	Aerial Insectivorous Mammal (e.g., Indiana bat)	Piscivorous Mammal (e.g., mink)	Invertivorous Bird (e.g., mallard)	Aerial Insectivorous Bird (e.g., tree swallow)	Semi-Aquatic Insectivorous Bird (e.g., Kentucky Warbler)	Piscivorous Bird (e.g., great blue heron)
Terrestrial Biota / Surficial Soil	Direct Contact/Absorption														
	Direct Ingestion	●	●	●	●										
	Incidental Ingestion	●	●	●	❍										
Surface Water	Direct Contact/Absorption					❍	❍	●							
	Direct Ingestion						❍	❍	●	●	●	●	●	●	●
	Incidental Ingestion														
Aquatic Biota	Direct Ingestion						❍	❍	●	●	●	●	●	●	●
Sediment	Direct Contact/Absorption					❍	●	❍	--	--	--	--	--	--	--
	Direct Ingestion														
	Incidental Ingestion								●	--	--	●	--	●	●

Notes:
→ CONTAINMINANT MIGRATION PATHWAY
··→ LIMITED OR INSIGNIFICANT CONTAMINANT MIGRATION PATHWAY
● PRIMARY EXPOSURE PATHWAY: EVALUATED QUANTITATIVELY
❍ SECONDARY EXPOSURE PATHWAY: EVALUATED QUALITATIVELY
-- EXPOSURE PATHWAY IS INSIGNIFICANT
BLANK = INCOMPLETE EXPOSURE PATHWAY

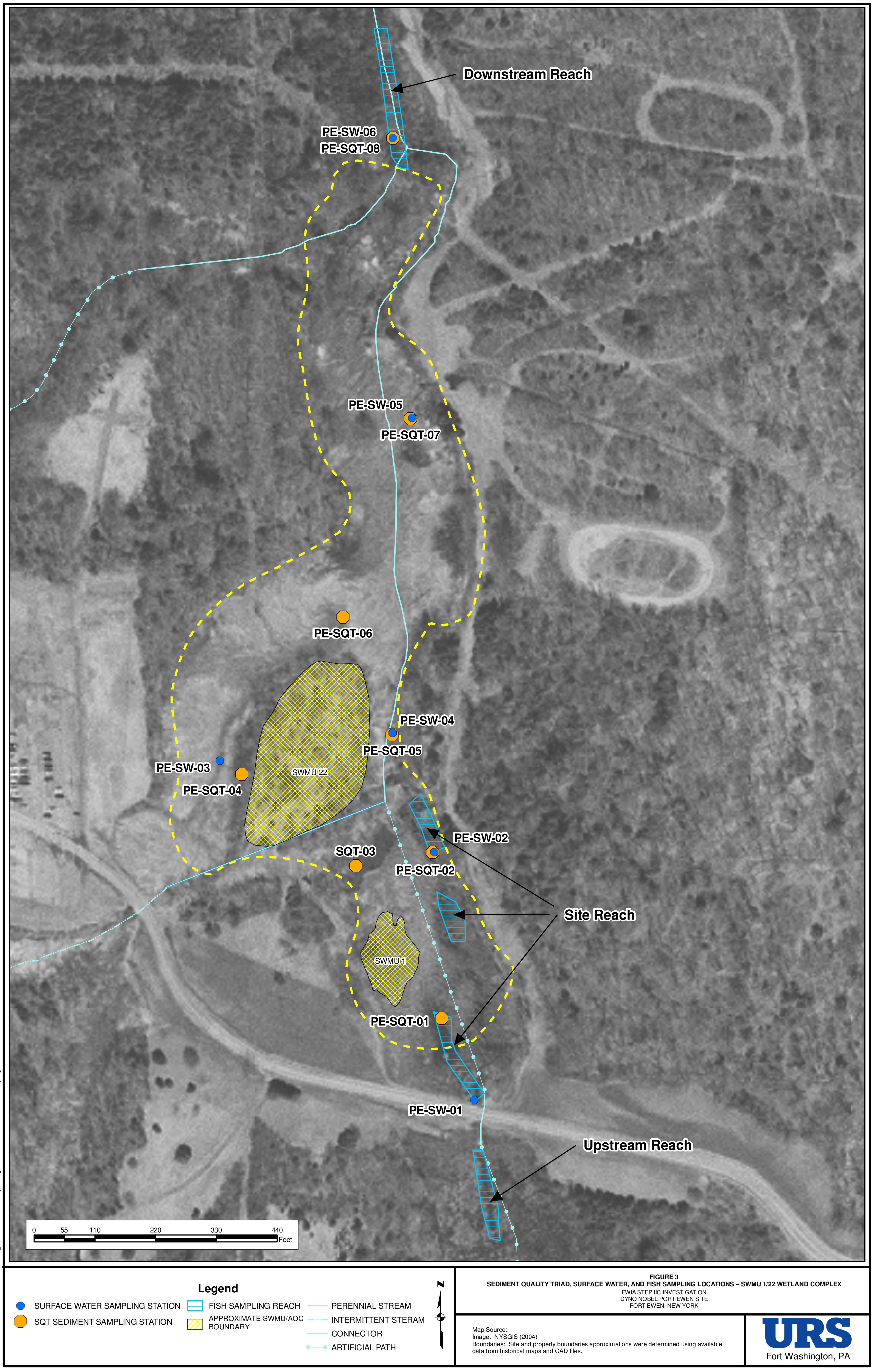


FIGURE 3
SEDIMENT QUALITY TRIAD, SURFACE WATER, AND FISH SAMPLING LOCATIONS – SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2004)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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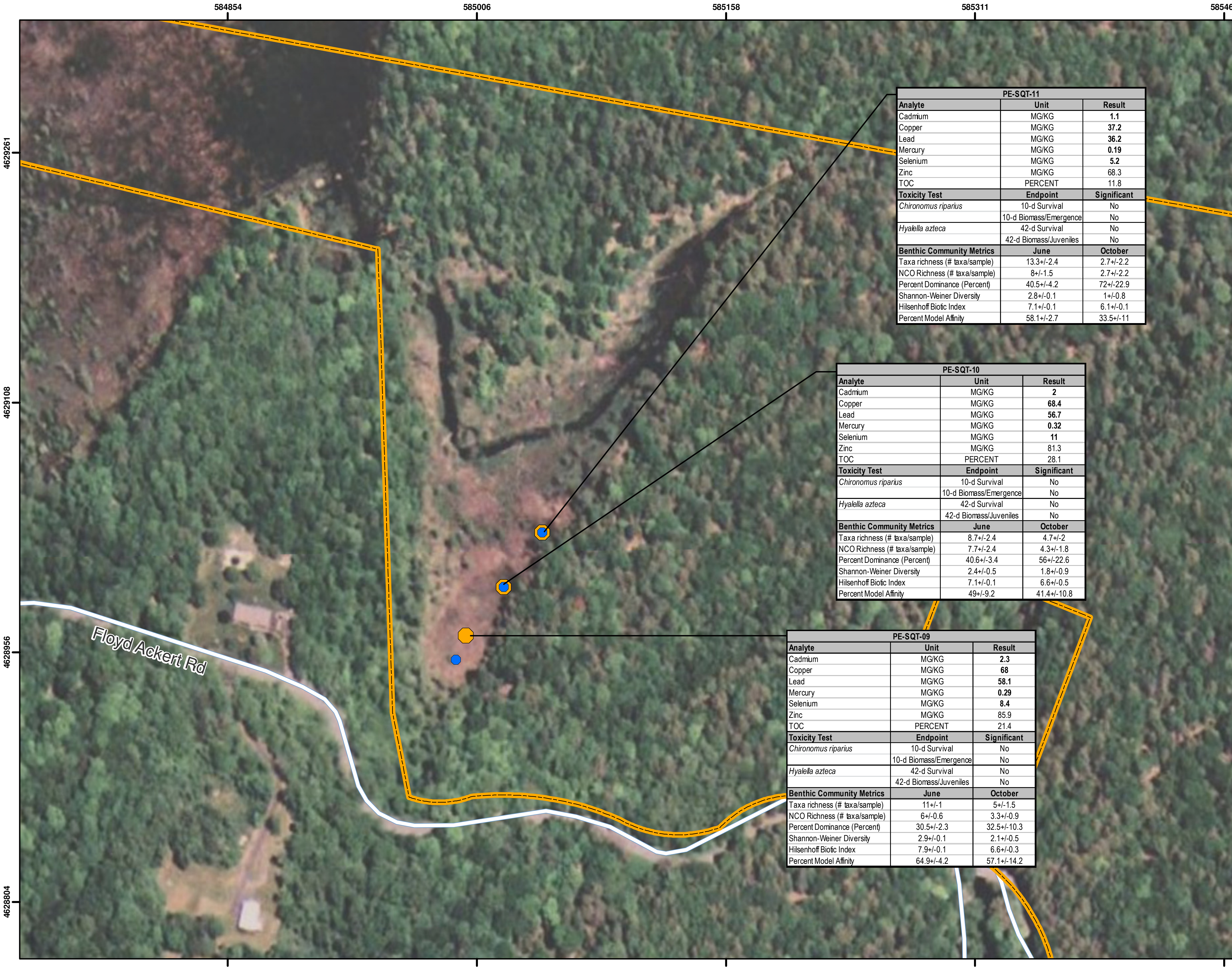


PE-SQT-11		
Analyte	**Unit**	**Result**
Cadmium	MG/KG	**1.1**
Copper	MG/KG	**37.2**
Lead	MG/KG	**36.2**
Mercury	MG/KG	**0.19**
Selenium	MG/KG	**5.2**
Zinc	MG/KG	68.3
TOC	PERCENT	11.8
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	No
	42-d Biomass/Juveniles	No
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	13.3+/-2.4	2.7+/-2.2
NCO Richness (# taxa/sample)	8+/-1.5	2.7+/-2.2
Percent Dominance (Percent)	40.5+/-4.2	72+/-22.9
Shannon-Weiner Diversity	2.8+/-0.1	1+/-0.8
Hilsenhoff Biotic Index	7.1+/-0.1	6.1+/-0.1
Percent Model Affinity	58.1+/-2.7	33.5+/-11

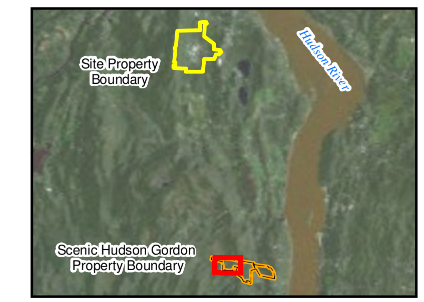
PE-SQT-10		
Analyte	**Unit**	**Result**
Cadmium	MG/KG	**2**
Copper	MG/KG	**68.4**
Lead	MG/KG	**56.7**
Mercury	MG/KG	**0.32**
Selenium	MG/KG	**11**
Zinc	MG/KG	81.3
TOC	PERCENT	28.1
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	No
	42-d Biomass/Juveniles	No
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	8.7+/-2.4	4.7+/-2
NCO Richness (# taxa/sample)	7.7+/-2.4	4.3+/-1.8
Percent Dominance (Percent)	40.6+/-3.4	56+/-22.6
Shannon-Weiner Diversity	2.4+/-0.5	1.8+/-0.9
Hilsenhoff Biotic Index	7.1+/-0.1	6.6+/-0.5
Percent Model Affinity	49+/-9.2	41.4+/-10.8

PE-SQT-09		
Analyte	**Unit**	**Result**
Cadmium	MG/KG	**2.3**
Copper	MG/KG	**68**
Lead	MG/KG	**58.1**
Mercury	MG/KG	**0.29**
Selenium	MG/KG	**8.4**
Zinc	MG/KG	85.9
TOC	PERCENT	21.4
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	No
	42-d Biomass/Juveniles	No
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	11+/-1	5+/-1.5
NCO Richness (# taxa/sample)	6+/-0.6	3.3+/-0.9
Percent Dominance (Percent)	30.5+/-2.3	32.5+/-10.3
Shannon-Weiner Diversity	2.9+/-0.1	2.1+/-0.5
Hilsenhoff Biotic Index	7.9+/-0.1	6.6+/-0.3
Percent Model Affinity	64.9+/-4.2	57.1+/-14.2

Legend

- SURFACE WATER SAMPLING STATION
- SQT SEDIMENT SAMPLING STATION
- SCENIC HUDSON GORDON PROPERTY BOUNDARY

Note: All concentrations are represented as mg/kg
Bold sediment concentrations indicate an exceedance of the LEL;
shaded concentrations indicate an exceedance of the SEL.



Key Map

0 3 6 Miles

Key Map Scale

N

NAD 1983 UTM Zone 18N
Projection: Transverse Mercator
False Easting: 500000.000000
False Northing: 0.000000
Central Meridian: -75.000000
Scale Factor: 0.999600
Latitude Of Origin: 0.000000
Linear Unit: Meter

0 100 200 400 Feet

Main Map Scale
1 inch = 200 feet

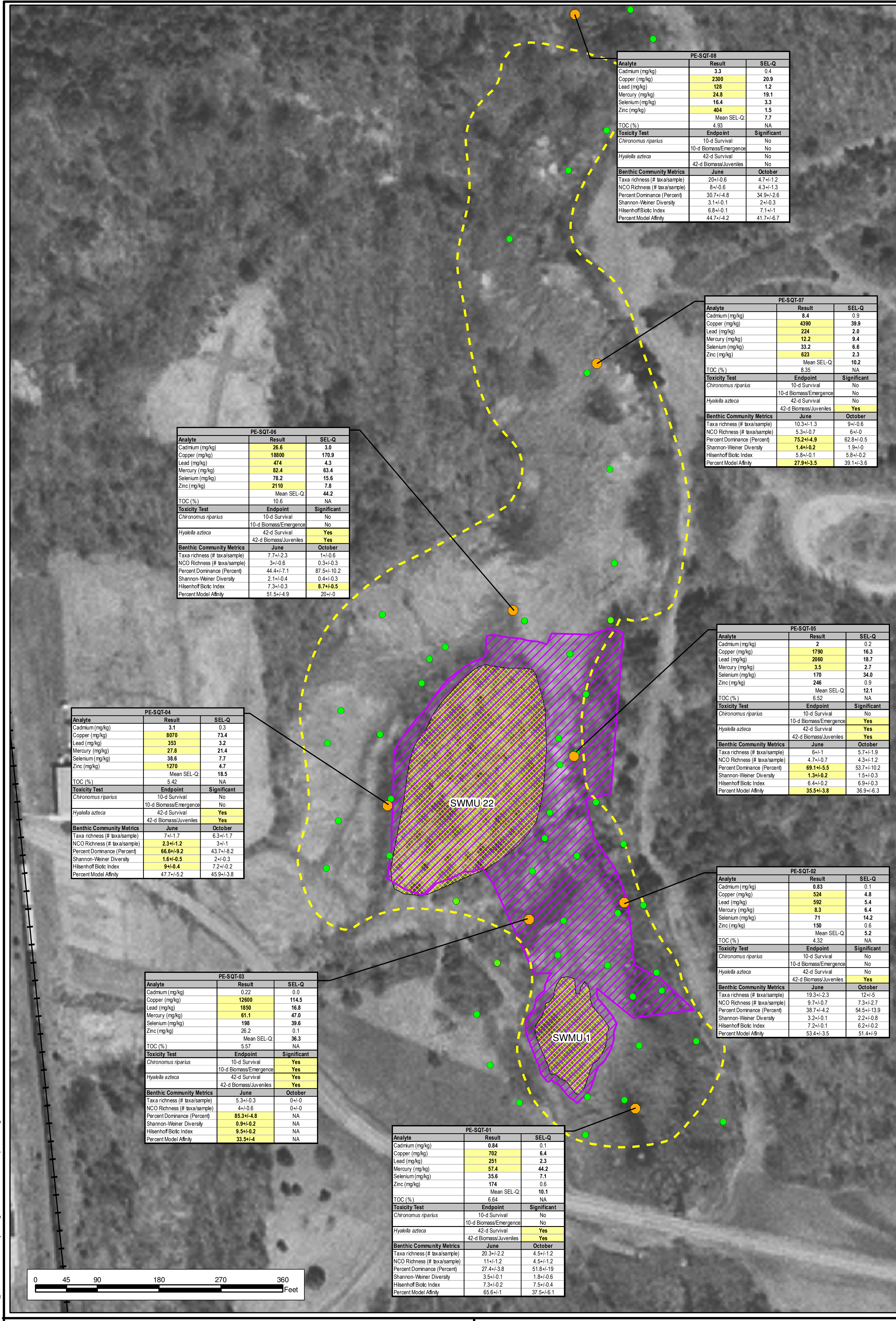
URS

FIGURE 4
SEDIMENT QUALITY TRIAD AND SURFACE WATER SAMPLING STATIONS-REFERENCE WETLANDS

FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Prepared By: RRM III	Checked By: GL
Job:19998508/9.00002	Date: 03/21/2011

Q:\GIS_Data\HERCULES\Projects\PortEwen\March_2011\Figure 4 Gordon Reference Sampling Area.mxd



PE-SQT-08		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**3.3**	0.4
Copper (mg/kg)	**2300**	**20.9**
Lead (mg/kg)	**128**	**1.2**
Mercury (mg/kg)	**24.8**	**19.1**
Selenium (mg/kg)	**16.4**	**3.3**
Zinc (mg/kg)	**404**	**1.5**
	Mean SEL-Q:	**7.7**
TOC (%)	4.93	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	No
	42-d Biomass/Juveniles	No
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	20+/-0.6	4.7+/-1.2
NCO Richness (# taxa/sample)	8+/-0.6	4.3+/-1.3
Percent Dominance (Percent)	30.7+/-4.8	34.9+/-2.6
Shannon-Weiner Diversity	3.1+/-0.1	2+/-0.3
Hilsenhoff Biotic Index	6.8+/-0.1	7.1+/-1
Percent Model Affinity	44.7+/-4.2	41.7+/-6.7

PE-SQT-07		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**8.4**	0.9
Copper (mg/kg)	**4390**	**39.9**
Lead (mg/kg)	**224**	**2.0**
Mercury (mg/kg)	**12.2**	**9.4**
Selenium (mg/kg)	**33.2**	**6.6**
Zinc (mg/kg)	**623**	**2.3**
	Mean SEL-Q:	**10.2**
TOC (%)	8.35	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	No
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	10.3+/-1.3	9+/-0.6
NCO Richness (# taxa/sample)	5.3+/-0.7	6+/-0
Percent Dominance (Percent)	**75.2+/-4.9**	62.8+/-0.5
Shannon-Weiner Diversity	**1.4+/-0.2**	1.9+/-0
Hilsenhoff Biotic Index	5.8+/-0.1	5.8+/-0.2
Percent Model Affinity	**27.9+/-3.5**	39.1+/-3.6

PE-SQT-06		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**26.6**	**3.0**
Copper (mg/kg)	**18800**	**170.9**
Lead (mg/kg)	**474**	**4.3**
Mercury (mg/kg)	**82.4**	**63.4**
Selenium (mg/kg)	**78.2**	**15.6**
Zinc (mg/kg)	**2110**	**7.8**
	Mean SEL-Q:	**44.2**
TOC (%)	10.6	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	7.7+/-2.3	1+/-0.6
NCO Richness (# taxa/sample)	3+/-0.6	0.3+/-0.3
Percent Dominance (Percent)	44.4+/-7.1	87.5+/-10.2
Shannon-Weiner Diversity	2.1+/-0.4	0.4+/-0.3
Hilsenhoff Biotic Index	7.3+/-0.3	**8.7+/-0.5**
Percent Model Affinity	51.5+/-4.9	20+/-0

PE-SQT-05		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**2**	0.2
Copper (mg/kg)	**1790**	**16.3**
Lead (mg/kg)	**2060**	**18.7**
Mercury (mg/kg)	**3.5**	**2.7**
Selenium (mg/kg)	**170**	**34.0**
Zinc (mg/kg)	**246**	0.9
	Mean SEL-Q:	**12.1**
TOC (%)	6.52	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	**Yes**
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	6+/-1	5.7+/-1.9
NCO Richness (# taxa/sample)	4.7+/-0.7	4.3+/-1.2
Percent Dominance (Percent)	**69.1+/-5.5**	53.7+/-10.2
Shannon-Weiner Diversity	**1.3+/-0.2**	1.5+/-0.3
Hilsenhoff Biotic Index	6.4+/-0.2	6.9+/-0.3
Percent Model Affinity	**35.5+/-3.8**	36.9+/-6.3

PE-SQT-04		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**3.1**	0.3
Copper (mg/kg)	**8070**	**73.4**
Lead (mg/kg)	**353**	**3.2**
Mercury (mg/kg)	**27.8**	**21.4**
Selenium (mg/kg)	**38.6**	**7.7**
Zinc (mg/kg)	**1270**	**4.7**
	Mean SEL-Q:	**18.5**
TOC (%)	5.42	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	7+/-1.7	6.3+/-1.7
NCO Richness (# taxa/sample)	**2.3+/-1.2**	3+/-1
Percent Dominance (Percent)	**66.6+/-9.2**	43.7+/-8.2
Shannon-Weiner Diversity	**1.6+/-0.5**	2+/-0.3
Hilsenhoff Biotic Index	**9+/-0.4**	7.2+/-0.2
Percent Model Affinity	47.7+/-5.2	45.9+/-3.8

PE-SQT-02		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**0.83**	0.1
Copper (mg/kg)	**524**	**4.8**
Lead (mg/kg)	**592**	**5.4**
Mercury (mg/kg)	**8.3**	**6.4**
Selenium (mg/kg)	**71**	**14.2**
Zinc (mg/kg)	**150**	0.6
	Mean SEL-Q:	**5.2**
TOC (%)	4.32	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	No
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	19.3+/-2.3	12+/-5
NCO Richness (# taxa/sample)	9.7+/-0.7	7.3+/-2.7
Percent Dominance (Percent)	38.7+/-4.2	54.5+/-13.9
Shannon-Weiner Diversity	3.2+/-0.1	2.2+/-0.8
Hilsenhoff Biotic Index	7.2+/-0.1	6.2+/-0.2
Percent Model Affinity	53.4+/-3.5	51.4+/-9

PE-SQT-03		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	0.22	0.0
Copper (mg/kg)	**12600**	**114.5**
Lead (mg/kg)	**1850**	**16.8**
Mercury (mg/kg)	**61.1**	**47.0**
Selenium (mg/kg)	**198**	**39.6**
Zinc (mg/kg)	26.2	0.1
	Mean SEL-Q:	**36.3**
TOC (%)	5.57	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	**Yes**
	10-d Biomass/Emergence	**Yes**
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	5.3+/-0.3	0+/-0
NCO Richness (# taxa/sample)	4+/-0.6	0+/-0
Percent Dominance (Percent)	**85.3+/-4.8**	NA
Shannon-Weiner Diversity	**0.9+/-0.2**	NA
Hilsenhoff Biotic Index	**9.5+/-0.2**	NA
Percent Model Affinity	**33.5+/-4**	NA

PE-SQT-01		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**0.84**	0.1
Copper (mg/kg)	**702**	**6.4**
Lead (mg/kg)	**251**	**2.3**
Mercury (mg/kg)	**57.4**	**44.2**
Selenium (mg/kg)	**35.6**	**7.1**
Zinc (mg/kg)	**174**	0.6
	Mean SEL-Q:	**10.1**
TOC (%)	6.64	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	20.3+/-2.2	4.5+/-1.2
NCO Richness (# taxa/sample)	11+/-1.2	4.5+/-1.2
Percent Dominance (Percent)	27.4+/-3.8	51.8+/-19
Shannon-Weiner Diversity	3.5+/-0.1	1.8+/-0.6
Hilsenhoff Biotic Index	7.3+/-0.2	7.5+/-0.4
Percent Model Affinity	65.6+/-1	37.5+/-6.1

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Legend

SQT SEDIMENT SAMPLING STATION

HISTORIC SEDIMENT SAMPLE LOCATION

APPROXIMATE SWMU/AOC BOUNDARY

SWMU 1/22 BOUNDARY

APPROXIMATE EXTENT OF REMEDIAL BOUNDARY PROPOSED IN 2006 CMS

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Note: All concentrations are represented as mg/kg. Bold sediment concentrations indicate an exceedance of the LEL; shaded concentrations indicate an exceedance of the SEL; Shaded sediment toxicity testing and benthic community results indicate statistical significance relevant to reference stations.

FIGURE 5
SEDIMENT QUALITY TRIAD SAMPLING LOCATIONS – SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2004)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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PE-DNS-SD-04

Analyte	Units	0.0'-1.0'
Cadmium	MG/KG	**0.78**
Copper	MG/KG	**179**
Lead	MG/KG	**40.6**
Mercury	MG/KG	**1.1**
Selenium	MG/KG	2
Zinc	MG/KG	**185**
TOC	Percent	4.82

PE-DNS-SD-03

Analyte	Units	0.0'-1.0'
Cadmium	MG/KG	0.45
Copper	MG/KG	**246**
Lead	MG/KG	25.9
Mercury	MG/KG	**3.4**
Selenium	MG/KG	1.3
Zinc	MG/KG	89.3
TOC	Percent	2.08

PE-DNS-SD-02

Analyte	Units	0.0'-1.0'
Cadmium	MG/KG	**1.7**
Copper	MG/KG	**1,410**
Lead	MG/KG	**52.3**
Mercury	MG/KG	**25.4**
Selenium	MG/KG	**5.1**
Zinc	MG/KG	**226**
TOC	Percent	7.75

PE-DNS-SD-01

Analyte	Units	0.0'-1.0'	1.0'-1.5'
Cadmium	MG/KG	**1.9**	**1**
Copper	MG/KG	**2,020**	**2,440**
Lead	MG/KG	**77.3**	**51.4**
Mercury	MG/KG	**25.5**	**45.3**
Selenium	MG/KG	**7.7**	4.3
Zinc	MG/KG	**270**	**249**
TOC	Percent	7.14	4.25

PE-SQT-08

Analyte	Units	Result
Cadmium	MG/KG	**3.3**
Copper	MG/KG	**2,300**
Lead	MG/KG	**128**
Mercury	MG/KG	**24.8**
Selenium	MG/KG	16.4
Zinc	MG/KG	**404**
TOC	Percent	4.93

Legend

- DOWNSTREAM SEDIMENT SAMPLING STATION
- SQT SEDIMENT SAMPLING STATION
- RAILROAD
- PERENNIAL STREAM
- INTERMITTENT STREAM
- SWAMP/MARSH
- NYSDEC MAPPED CLASS 2 WETLANDS
- NYSDEC MAPPED CLASS 3 WETLANDS
- APPROXIMATE PROPERTY BOUNDARY

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FIGURE 6
DOWNSTREAM SEDIMENT SAMPLING STATIONS - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service - National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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Q:\GIS_Data\HERCULES\Projects\Figure 6 Active Plant Area Sample Postings.mxd

FIGURE 7
PERCENT ABUNDANCE OF BENTHIC TAXA IN MARKET BASKET TISSUE COMPOSITE SAMPLES
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

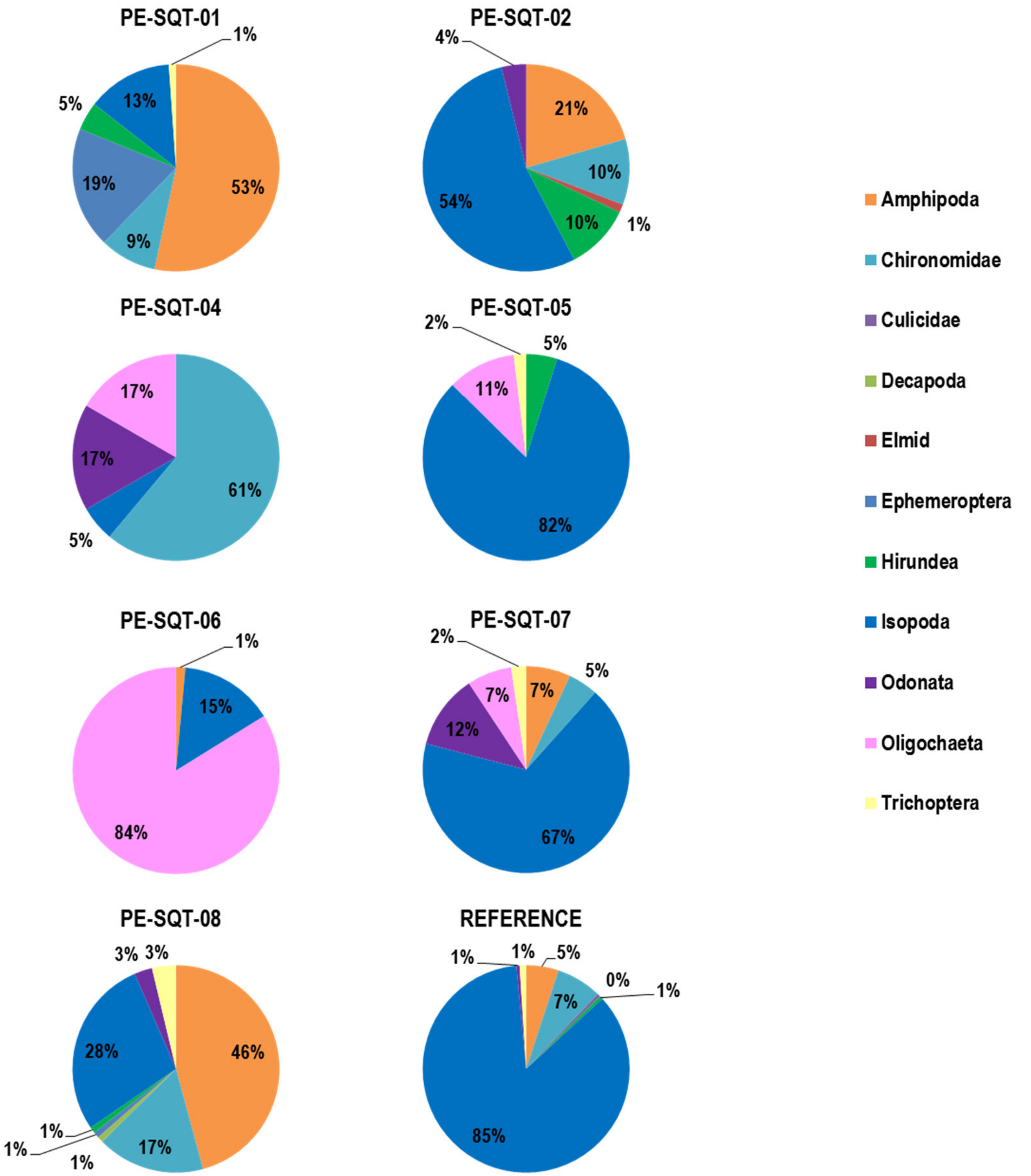


FIGURE 8
NON-DEPURATED BENTHIC INVERTEBRATE CONCENTRATIONS ALONG A GRADIENT OF SEDIMENT CONCENTRATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

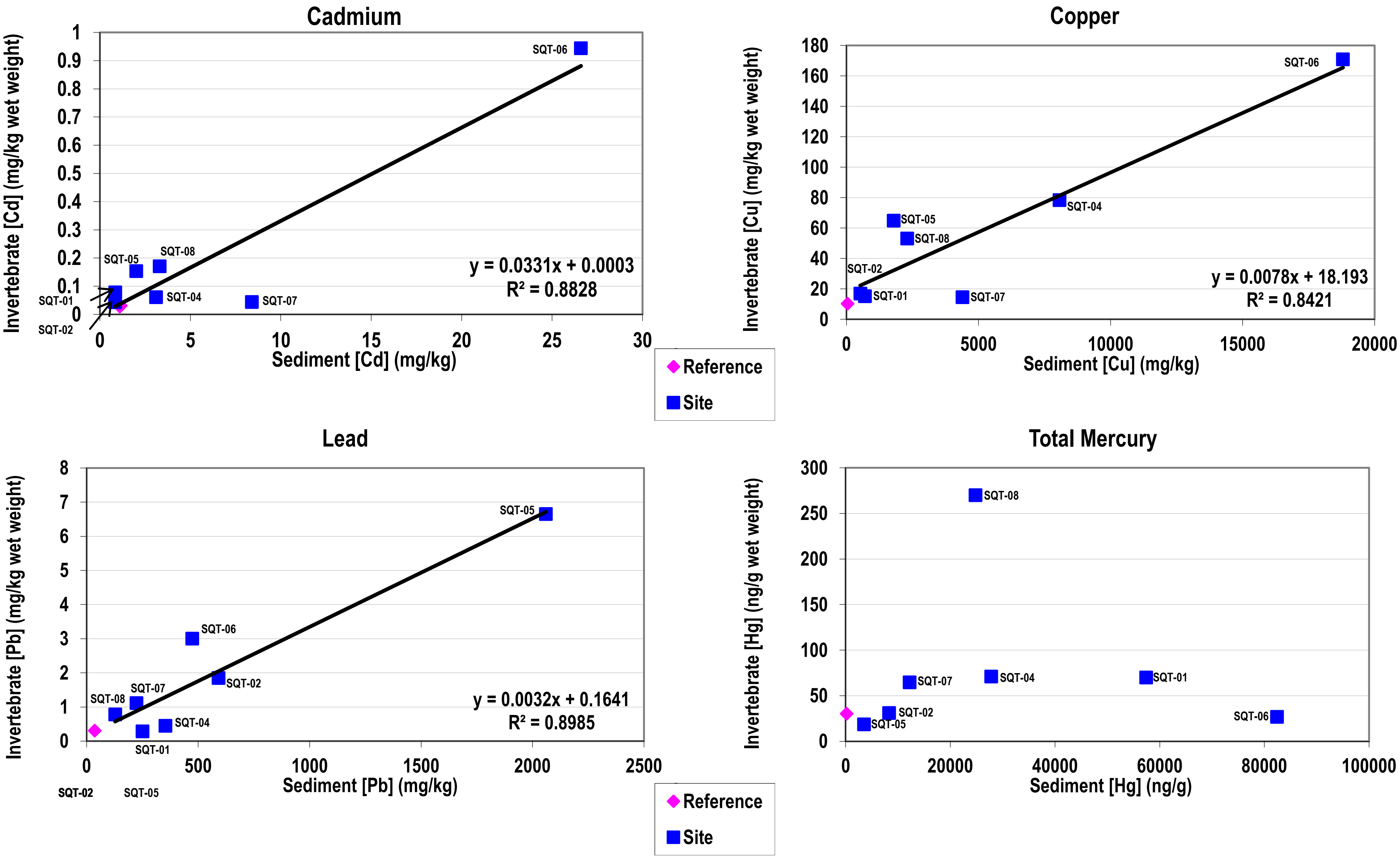


FIGURE 8 (continued)
NON-DEPURATED BENTHIC INVERTEBRATE CONCENTRATIONS ALONG A GRADIENT OF SEDIMENT CONCENTRATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

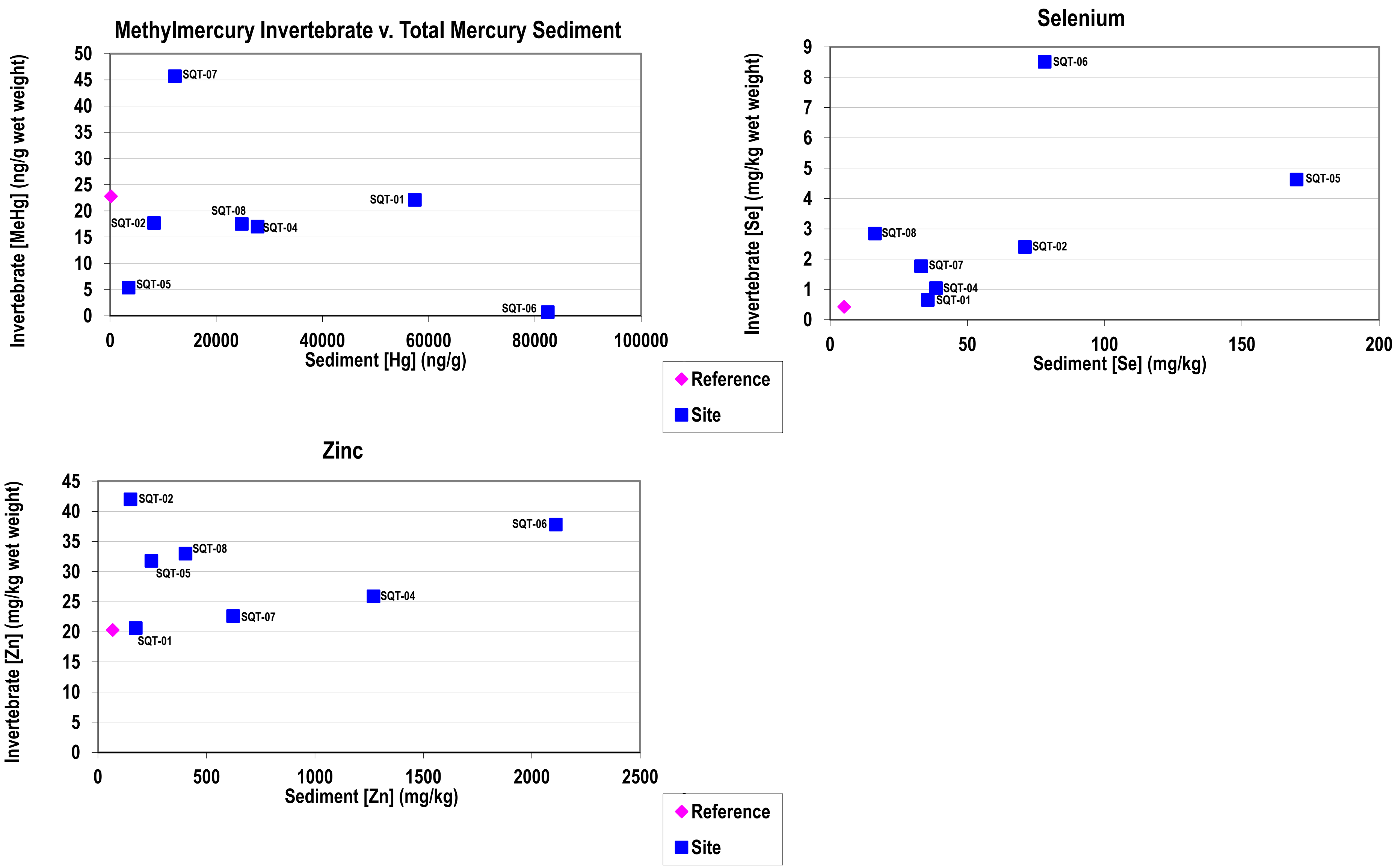


FIGURE 9
FISH TISSUE CONCENTRATIONS BY REACH
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

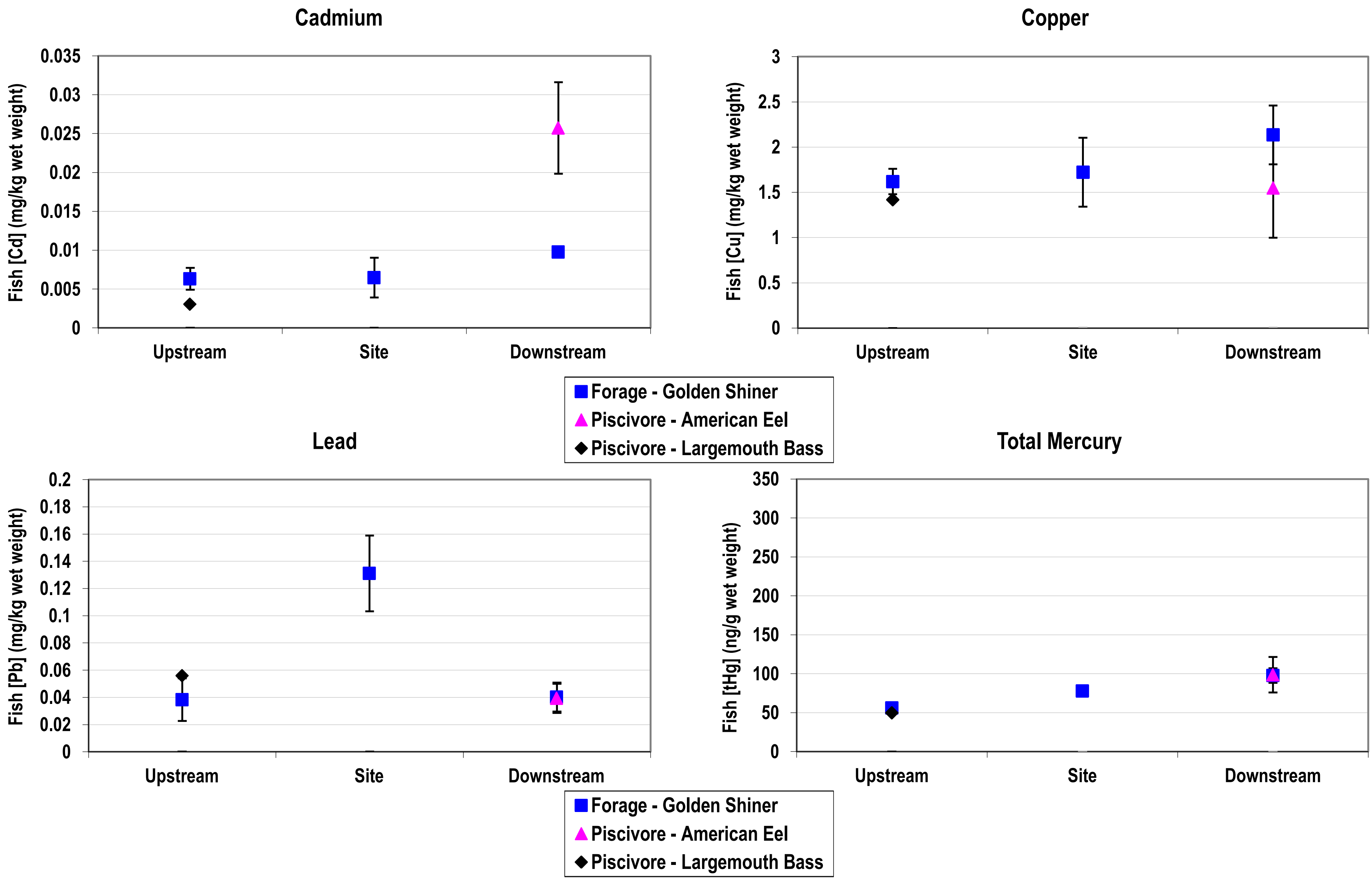
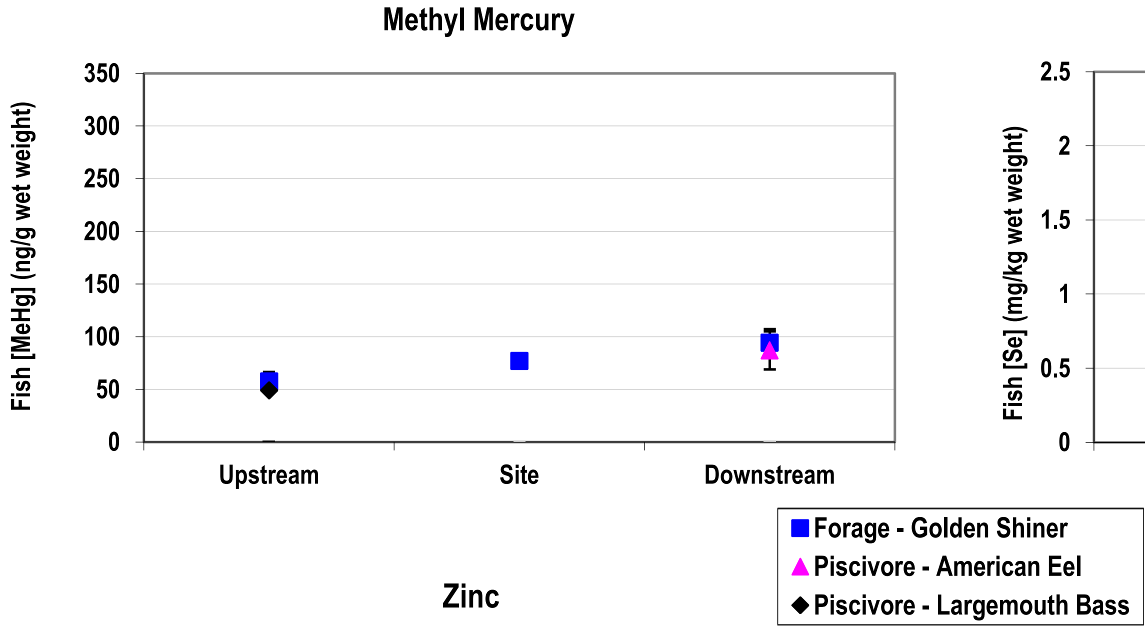
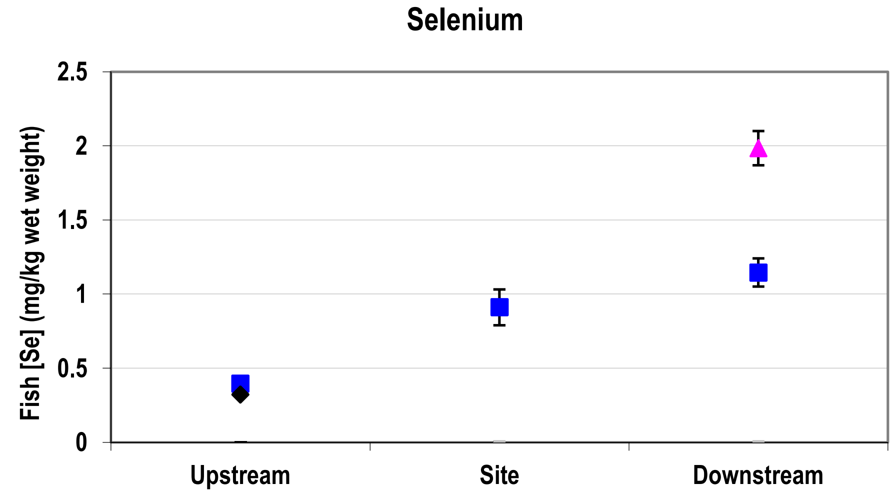
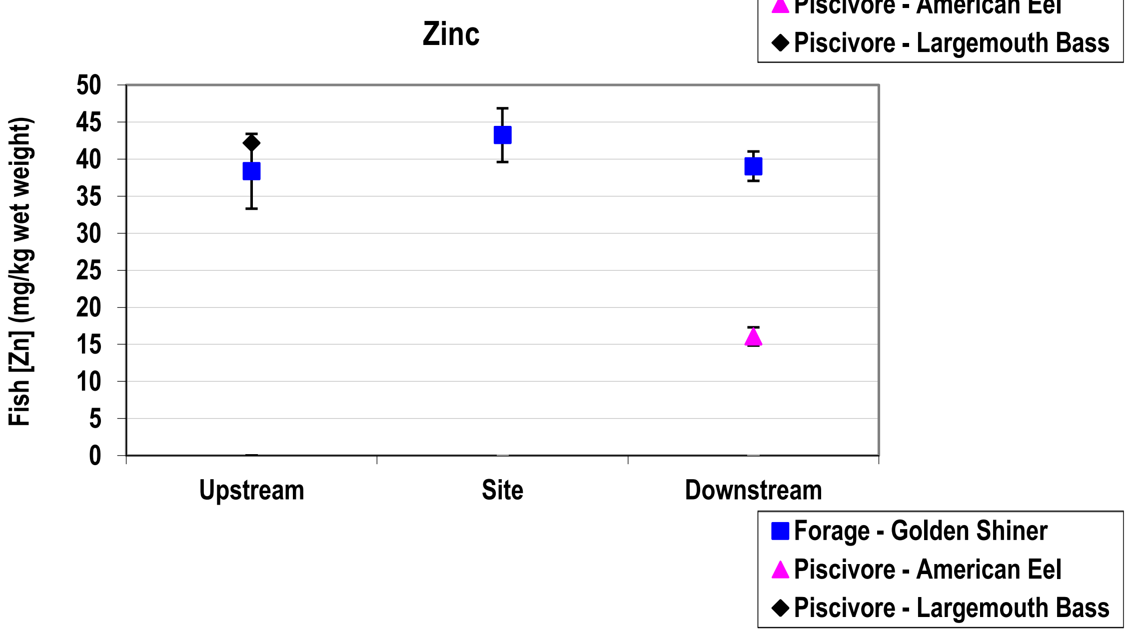


FIGURE 9 (continued)
FISH TISSUE CONCENTRATIONS BY REACH
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK







Legend

- *Microtus pennsylvanicus*
- *Peromyscus leucopus*
- *Zapus hudsonius*
- ACTIVE PLANT SOIL
- EARTHWORM
- SMALL MAMMAL TRANSECT END POINTS
- SMALL MAMMAL TRANSECTS
- BIOLOGICAL TISSUE AND SOIL SAMPLING GRID
- RAILROAD
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE SWMU/AOC BOUNDARY
- SWMU 1/22 BOUNDARY

FIGURE 10
ACTIVE PLANT AREA SAMPLING LOCATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service
- National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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FIGURE 11
MEAN (+/- SE) SMALL MAMMAL TISSUE CONCENTRATIONS BY SAMPLING GRID
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

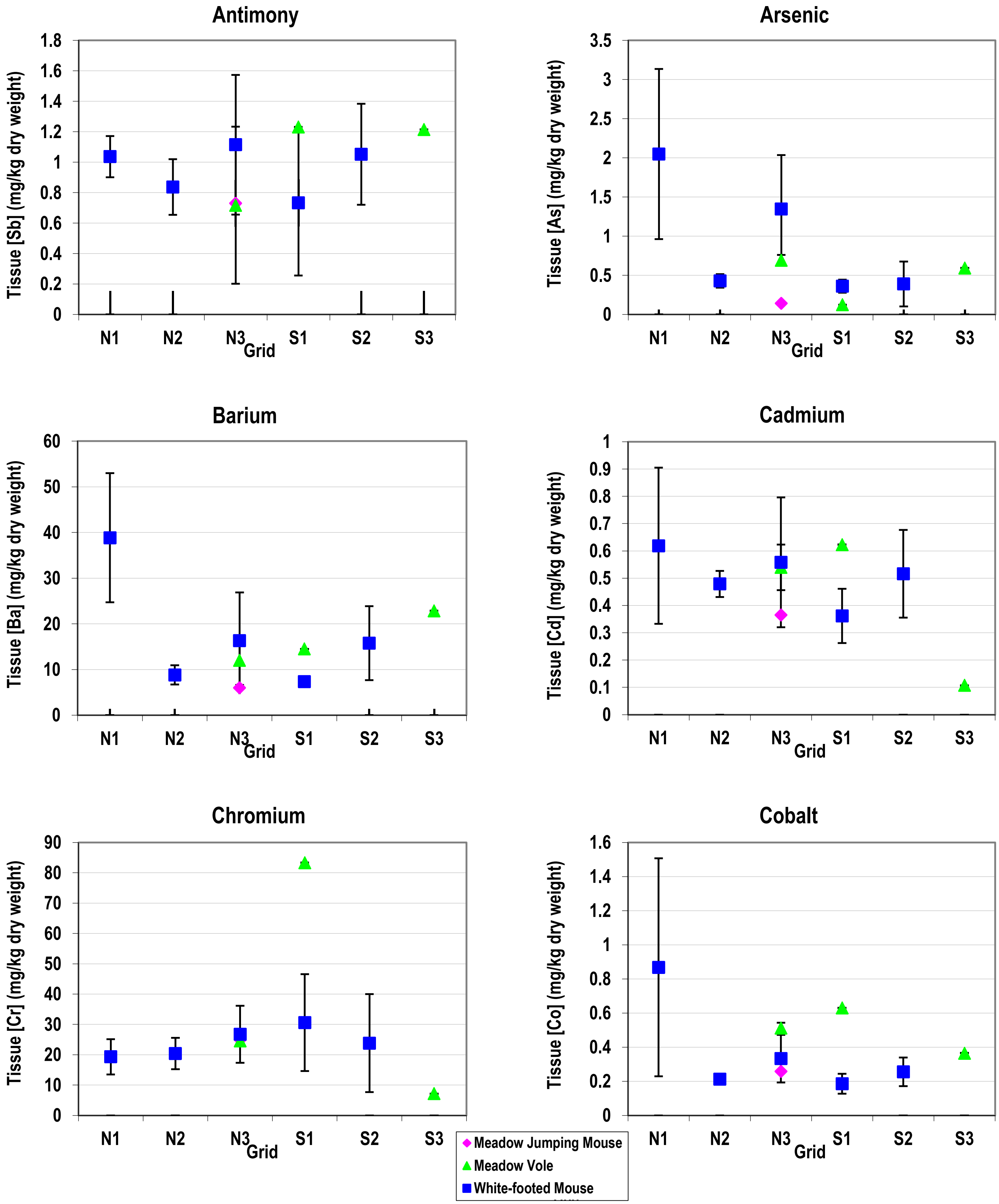


FIGURE 11 (continued)
MEAN (+/- SE) SMALL MAMMAL TISSUE CONCENTRATIONS BY SAMPLING GRID
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

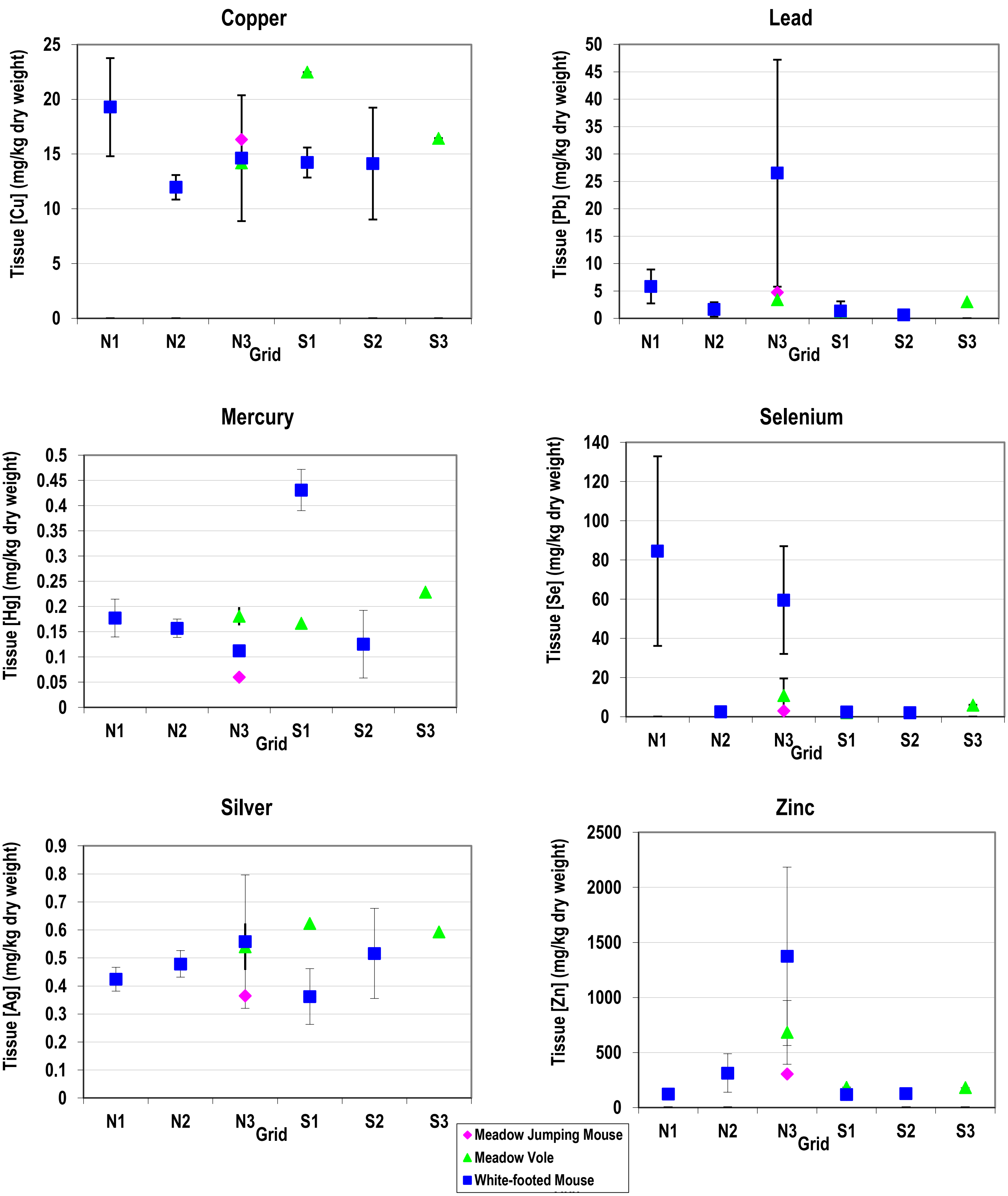


FIGURE 12
NON-DEPURATED EARTHWORM TISSUE CONCENTRATIONS ALONG A GRADIENT OF SOIL CONCENTRATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

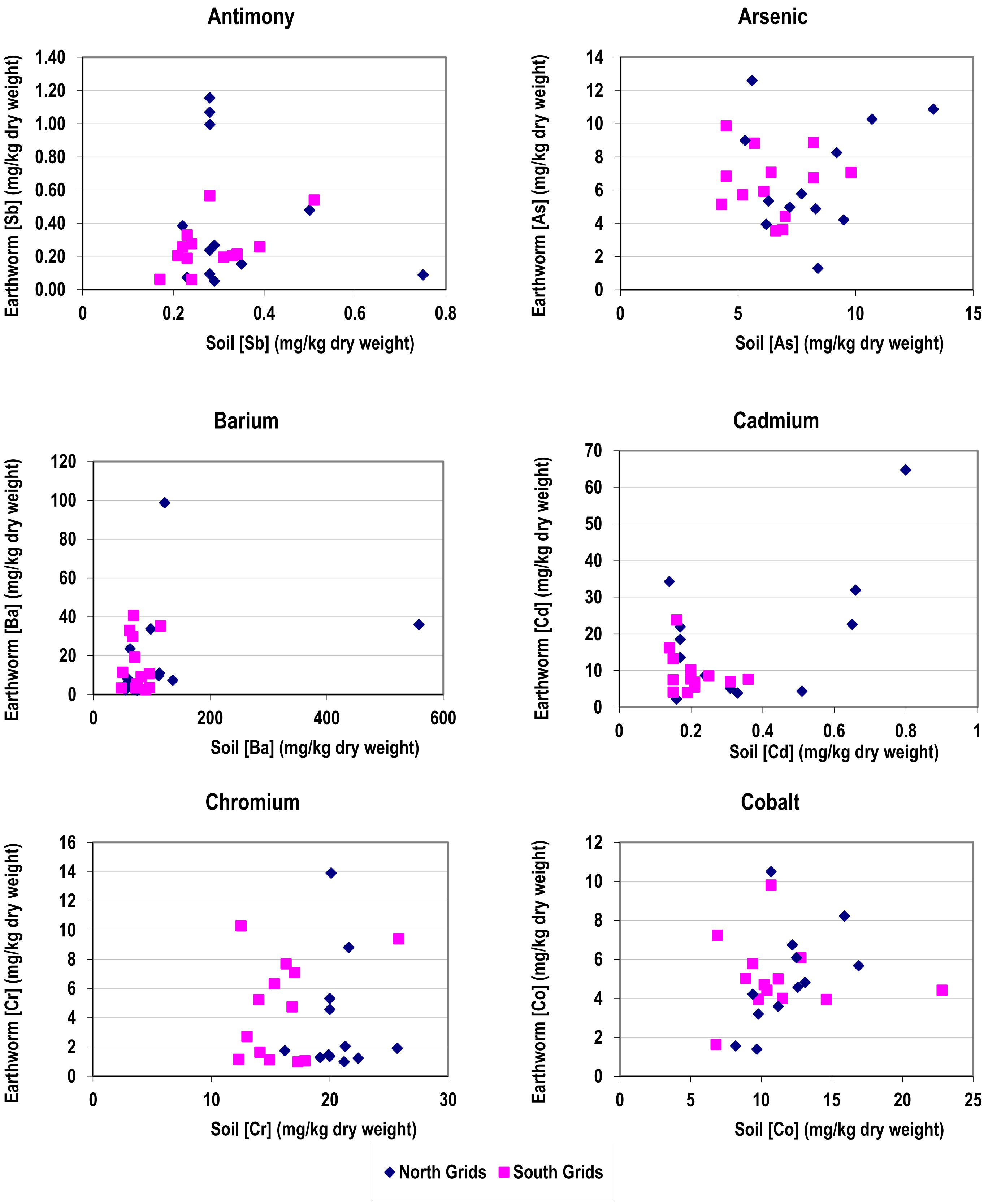
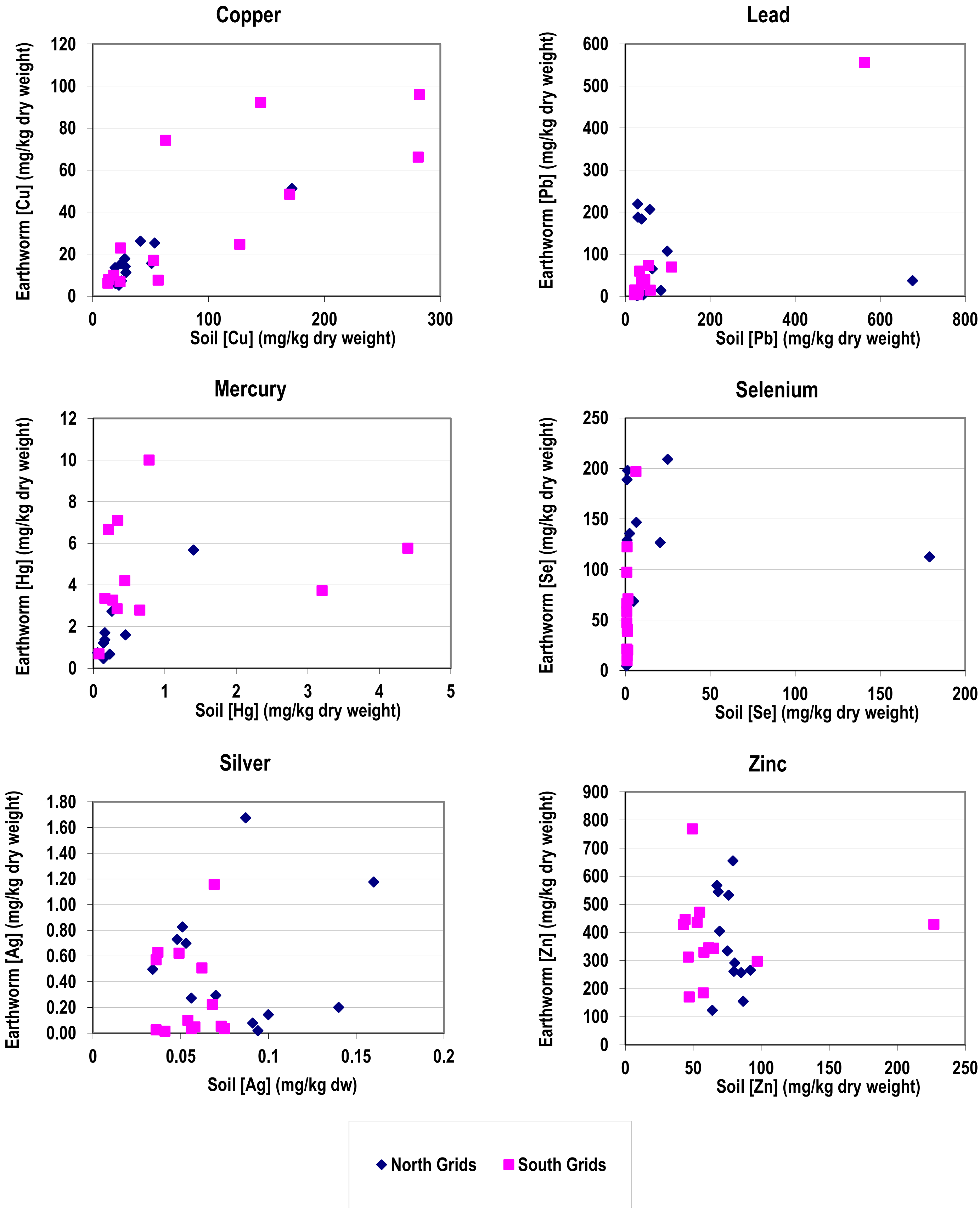
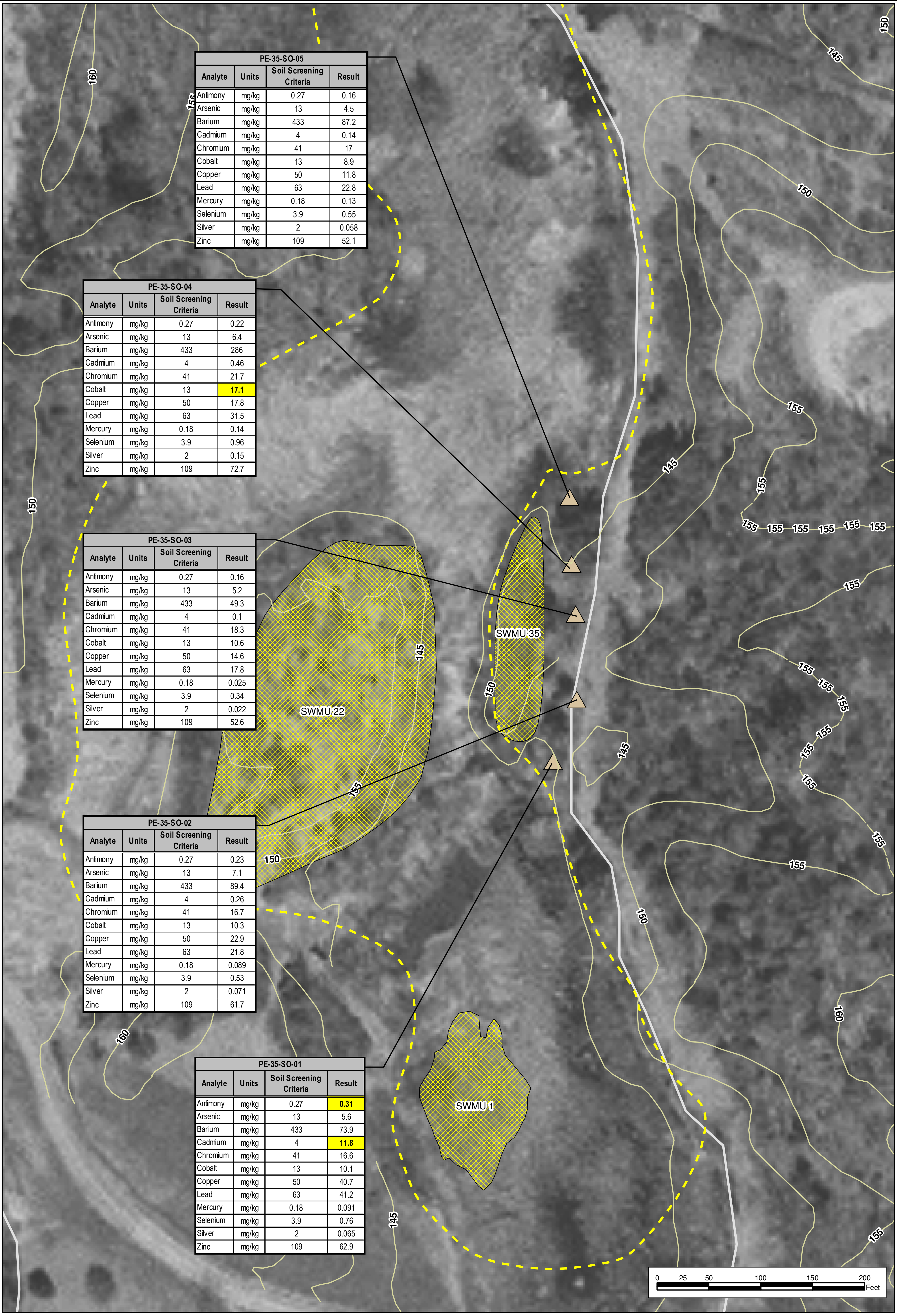


FIGURE 12 (continued)
NON-DEPURATED EARTHWORM TISSUE CONCENTRATIONS ALONG A GRADIENT OF SOIL CONCENTRATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK





PE-35-SO-05			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.16
Arsenic	mg/kg	13	4.5
Barium	mg/kg	433	87.2
Cadmium	mg/kg	4	0.14
Chromium	mg/kg	41	17
Cobalt	mg/kg	13	8.9
Copper	mg/kg	50	11.8
Lead	mg/kg	63	22.8
Mercury	mg/kg	0.18	0.13
Selenium	mg/kg	3.9	0.55
Silver	mg/kg	2	0.058
Zinc	mg/kg	109	52.1

PE-35-SO-04			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.22
Arsenic	mg/kg	13	6.4
Barium	mg/kg	433	286
Cadmium	mg/kg	4	0.46
Chromium	mg/kg	41	21.7
Cobalt	mg/kg	13	17.1
Copper	mg/kg	50	17.8
Lead	mg/kg	63	31.5
Mercury	mg/kg	0.18	0.14
Selenium	mg/kg	3.9	0.96
Silver	mg/kg	2	0.15
Zinc	mg/kg	109	72.7

PE-35-SO-03			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.16
Arsenic	mg/kg	13	5.2
Barium	mg/kg	433	49.3
Cadmium	mg/kg	4	0.1
Chromium	mg/kg	41	18.3
Cobalt	mg/kg	13	10.6
Copper	mg/kg	50	14.6
Lead	mg/kg	63	17.8
Mercury	mg/kg	0.18	0.025
Selenium	mg/kg	3.9	0.34
Silver	mg/kg	2	0.022
Zinc	mg/kg	109	52.6

PE-35-SO-02			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.23
Arsenic	mg/kg	13	7.1
Barium	mg/kg	433	89.4
Cadmium	mg/kg	4	0.26
Chromium	mg/kg	41	16.7
Cobalt	mg/kg	13	10.3
Copper	mg/kg	50	22.9
Lead	mg/kg	63	21.8
Mercury	mg/kg	0.18	0.089
Selenium	mg/kg	3.9	0.53
Silver	mg/kg	2	0.071
Zinc	mg/kg	109	61.7

PE-35-SO-01			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.31
Arsenic	mg/kg	13	5.6
Barium	mg/kg	433	73.9
Cadmium	mg/kg	4	11.8
Chromium	mg/kg	41	16.6
Cobalt	mg/kg	13	10.1
Copper	mg/kg	50	40.7
Lead	mg/kg	63	41.2
Mercury	mg/kg	0.18	0.091
Selenium	mg/kg	3.9	0.76
Silver	mg/kg	2	0.065
Zinc	mg/kg	109	62.9

Legend

- SWMU 35 SOIL SAMPLES
- APPROXIMATE SWMU/AOC BOUNDARY
- SWMU 1/22 BOUNDARY
- APPROXIMATE SITE BOUNDARY
- CONTOUR INTERVAL (5 Feet)

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FIGURE 13
SWMU 35 SURFICIAL SOIL SAMPLING LOCATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2004)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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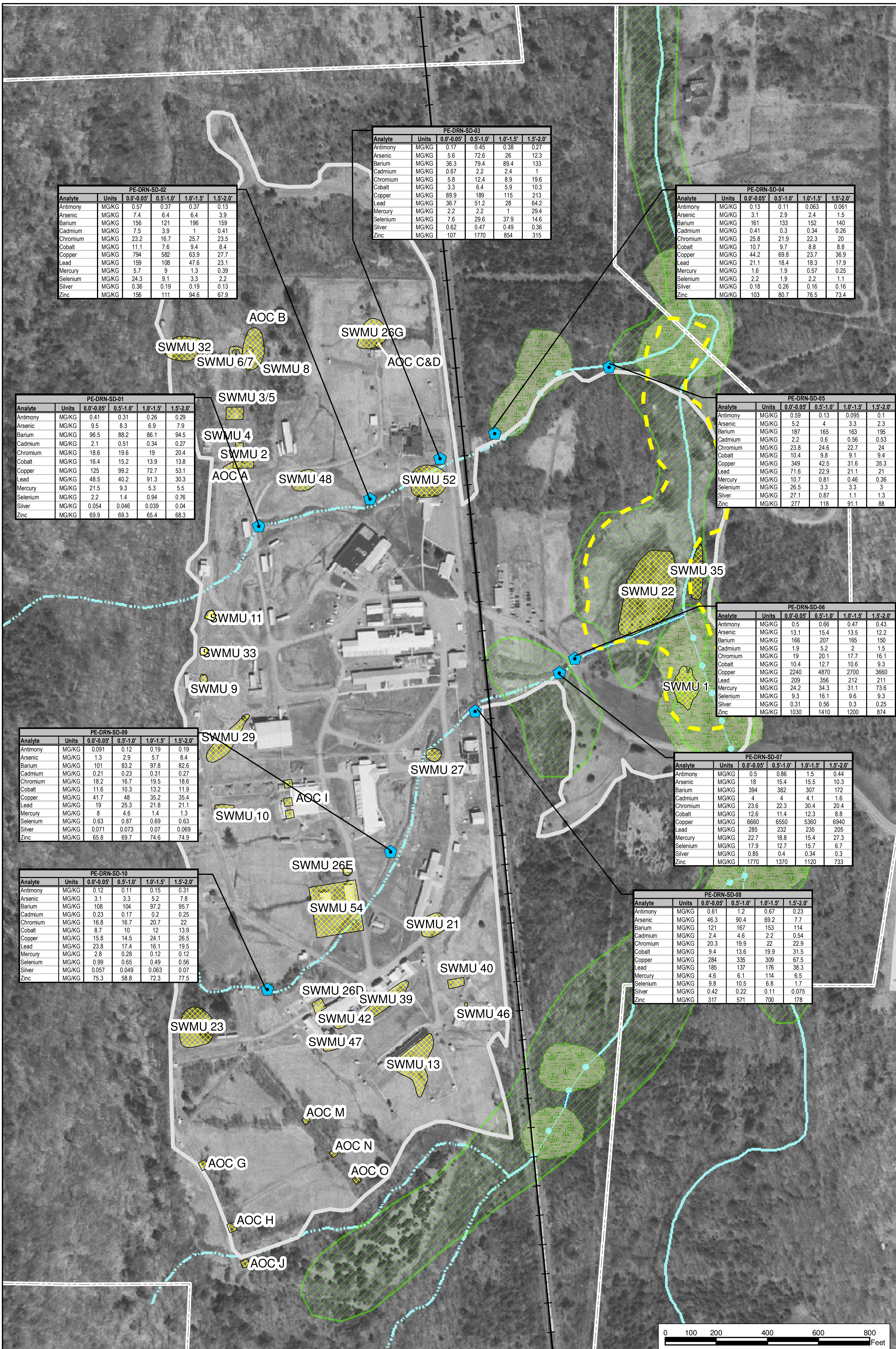


PE-DRN-SD-01					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.41	0.31	0.26	0.29
Arsenic	MG/KG	9.5	8.3	6.9	7.9
Barium	MG/KG	96.5	88.2	86.1	94.5
Cadmium	MG/KG	2.1	0.51	0.34	0.27
Chromium	MG/KG	18.6	19.6	19	20.4
Cobalt	MG/KG	16.4	15.2	13.9	13.8
Copper	MG/KG	125	99.2	72.7	53.1
Lead	MG/KG	48.5	40.2	91.3	30.3
Mercury	MG/KG	21.5	9.3	5.3	5.5
Selenium	MG/KG	2.2	1.4	0.94	0.76
Silver	MG/KG	0.054	0.046	0.039	0.04
Zinc	MG/KG	69.9	69.3	65.4	68.3

PE-DRN-SD-02					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.57	0.37	0.37	0.13
Arsenic	MG/KG	7.4	6.4	6.4	3.9
Barium	MG/KG	156	121	196	159
Cadmium	MG/KG	7.5	3.9	1	0.41
Chromium	MG/KG	23.2	16.7	25.7	23.5
Cobalt	MG/KG	11.1	7.6	9.4	8.4
Copper	MG/KG	794	582	63.9	27.7
Lead	MG/KG	159	108	47.6	23.1
Mercury	MG/KG	5.7	9	1.3	0.39
Selenium	MG/KG	24.3	9.1	3.3	2.2
Silver	MG/KG	0.36	0.19	0.19	0.13
Zinc	MG/KG	156	111	94.6	67.9

PE-DRN-SD-03					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.17	0.45	0.38	0.27
Arsenic	MG/KG	5.6	72.6	26	12.3
Barium	MG/KG	36.3	79.4	89.4	133
Cadmium	MG/KG	0.67	2.2	2.4	1
Chromium	MG/KG	5.8	12.4	8.9	19.6
Cobalt	MG/KG	3.3	6.4	5.9	10.3
Copper	MG/KG	89.9	189	115	213
Lead	MG/KG	36.7	51.2	28	64.2
Mercury	MG/KG	2.2	2.2	1	29.4
Selenium	MG/KG	7.6	29.6	37.9	14.6
Silver	MG/KG	0.62	0.47	0.49	0.36
Zinc	MG/KG	107	1770	854	315

PE-DRN-SD-04					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.13	0.11	0.063	0.061
Arsenic	MG/KG	3.1	2.9	2.4	1.5
Barium	MG/KG	161	133	152	140
Cadmium	MG/KG	0.41	0.3	0.34	0.26
Chromium	MG/KG	25.8	21.9	22.3	20
Cobalt	MG/KG	10.7	9.7	8.8	8.8
Copper	MG/KG	44.2	69.8	23.7	36.9
Lead	MG/KG	21.1	18.4	18.3	17.9
Mercury	MG/KG	1.6	1.9	0.57	0.25
Selenium	MG/KG	2.2	1.9	2.2	1.1
Silver	MG/KG	0.18	0.26	0.16	0.16
Zinc	MG/KG	103	80.7	76.5	73.4

PE-DRN-SD-05					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.59	0.13	0.095	0.1
Arsenic	MG/KG	5.2	4	3.3	2.3
Barium	MG/KG	187	165	163	195
Cadmium	MG/KG	2.2	0.6	0.56	0.53
Chromium	MG/KG	23.8	24.6	22.7	24
Cobalt	MG/KG	10.4	9.8	9.1	9.4
Copper	MG/KG	349	42.5	31.6	35.3
Lead	MG/KG	71.6	22.9	21.1	21
Mercury	MG/KG	10.7	0.81	0.46	0.36
Selenium	MG/KG	26.5	3.3	3.3	3
Silver	MG/KG	27.1	0.87	1.1	1.3
Zinc	MG/KG	277	118	91.1	88

PE-DRN-SD-06					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.5	0.66	0.47	0.43
Arsenic	MG/KG	13.1	15.4	13.5	12.2
Barium	MG/KG	166	207	165	150
Cadmium	MG/KG	1.9	5.2	2	1.5
Chromium	MG/KG	19	20.1	17.7	16.1
Cobalt	MG/KG	10.4	12.7	10.6	9.3
Copper	MG/KG	2240	4870	2700	3660
Lead	MG/KG	209	356	212	211
Mercury	MG/KG	24.2	34.3	31.1	73.6
Selenium	MG/KG	9.3	16.1	9.6	9.3
Silver	MG/KG	0.31	0.56	0.3	0.25
Zinc	MG/KG	1030	1410	1200	874

PE-DRN-SD-07					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.5	0.86	1.5	0.44
Arsenic	MG/KG	18	15.4	15.5	10.3
Barium	MG/KG	394	382	307	172
Cadmium	MG/KG	4	4	4.1	1.6
Chromium	MG/KG	23.6	22.3	30.4	20.4
Cobalt	MG/KG	12.6	11.4	12.3	8.8
Copper	MG/KG	6660	6550	5360	6940
Lead	MG/KG	285	232	235	205
Mercury	MG/KG	22.7	18.8	15.4	27.3
Selenium	MG/KG	17.9	12.7	15.7	6.7
Silver	MG/KG	0.85	0.4	0.34	0.3
Zinc	MG/KG	1770	1370	1120	733

PE-DRN-SD-08					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.61	1.2	0.67	0.23
Arsenic	MG/KG	46.3	90.4	69.2	7.7
Barium	MG/KG	121	167	153	114
Cadmium	MG/KG	2.4	4.6	2.2	0.54
Chromium	MG/KG	20.3	19.9	22	22.9
Cobalt	MG/KG	9.4	13.6	19.9	31.5
Copper	MG/KG	284	335	309	67.5
Lead	MG/KG	185	137	176	38.3
Mercury	MG/KG	4.6	6.1	114	6.5
Selenium	MG/KG	9.8	10.5	6.8	1.7
Silver	MG/KG	0.42	0.22	0.11	0.075
Zinc	MG/KG	317	571	700	178

PE-DRN-SD-09					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.091	0.12	0.19	0.19
Arsenic	MG/KG	1.3	2.9	5.7	8.4
Barium	MG/KG	101	83.2	97.8	82.6
Cadmium	MG/KG	0.21	0.23	0.31	0.27
Chromium	MG/KG	18.2	16.7	19.5	18.6
Cobalt	MG/KG	11.6	10.3	13.2	11.9
Copper	MG/KG	41.7	48	35.2	35.4
Lead	MG/KG	19	25.3	21.8	21.1
Mercury	MG/KG	8	4.6	1.4	1.3
Selenium	MG/KG	0.63	0.87	0.69	0.63
Silver	MG/KG	0.071	0.073	0.07	0.069
Zinc	MG/KG	65.8	69.7	74.6	74.9

PE-DRN-SD-10					
Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.12	0.11	0.15	0.31
Arsenic	MG/KG	3.1	3.3	5.2	7.8
Barium	MG/KG	108	104	97.2	95.7
Cadmium	MG/KG	0.23	0.17	0.2	0.25
Chromium	MG/KG	16.8	16.7	20.7	22
Cobalt	MG/KG	8.7	10	12	13.9
Copper	MG/KG	15.8	14.5	24.1	26.5
Lead	MG/KG	23.8	17.4	16.1	19.5
Mercury	MG/KG	2.8	0.28	0.12	0.12
Selenium	MG/KG	0.99	0.65	0.49	0.56
Silver	MG/KG	0.057	0.049	0.063	0.07
Zinc	MG/KG	75.3	58.8	72.3	77.5

Q:\GIS_Data\HERCULES\Projects\Figure 10 Site Drainage Sed Smp Res.mxd

Legend

- SITE DRAINAGE SEDIMENT SAMPLES
- RAILROAD
- NYSDEC MAPPED CLASS 2 WETLANDS
- NYSDEC MAPPED CLASS 3 WETLANDS
- SWAMP/MARSH
- PERENNIAL STREAM
- INTERMITTENT STREAM
- ARTIFICIAL PATH
- CONNECTOR
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE SWMU/AOC BOUNDARY
- SWMU 1/22 BOUNDARY
- APPROXIMATE SITE BOUNDARY

N

FIGURE 14
SITE DRAINAGE FEATURES - SEDIMENT SAMPLING RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service - National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

URS
Fort Washington, PA

Legend

- SEDIMENT SAMPLE LOCATION
- SQT STATION
- RAILROAD
- SWMU 1/22 BOUNDARY
- EXPOSURE AREA

0 100 200 400 600 Feet

N

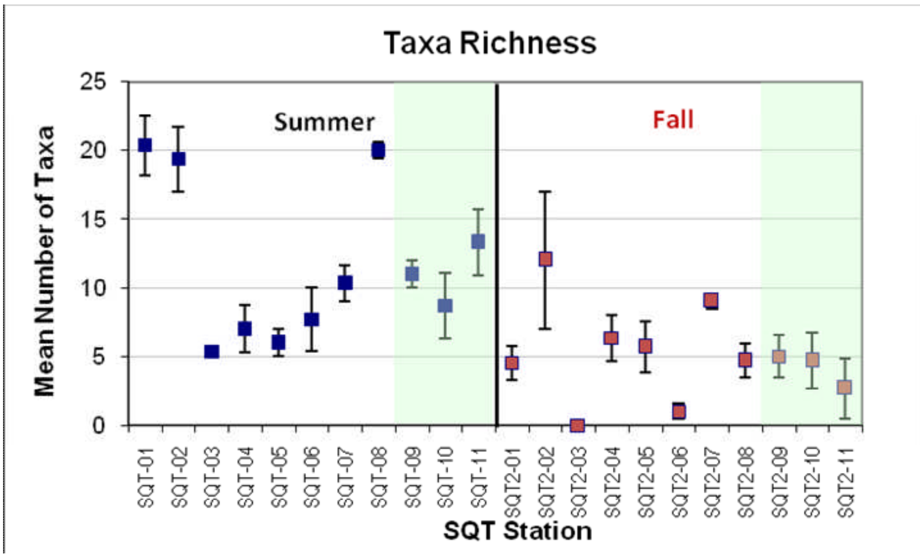
FIGURE 15
SWMU 1/22 WILDLIFE EXPOSURE AREA
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

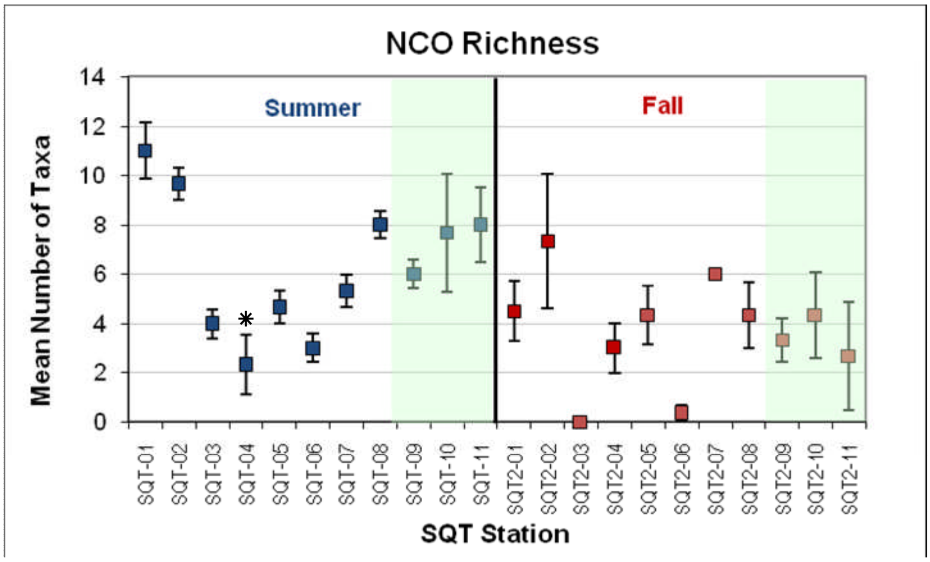
Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service
- National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

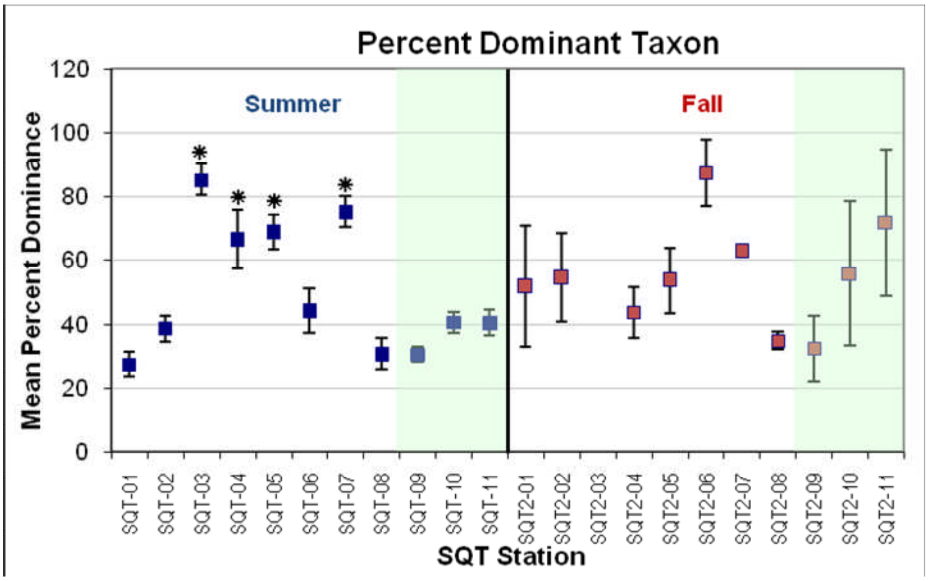
URS
Fort Washington, PA

O:\GIS_Data\HERCULES\Projects\Figure 15 SWMU 1 & 22 Complex Wildlife Exposure.mxd

FIGURE 16
BENTHIC COMMUNITY METRICS – SUMMER AND FALL 2010 – SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK





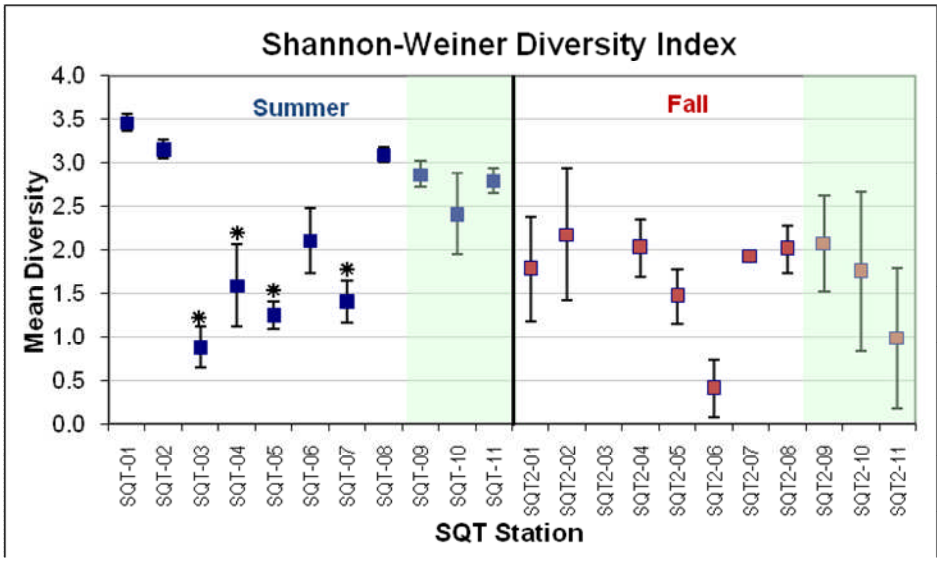


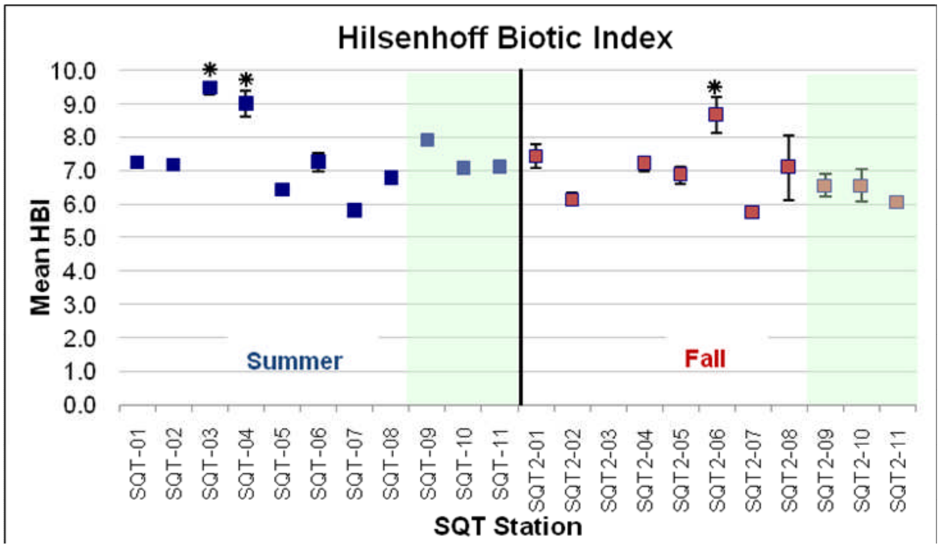
Notes:

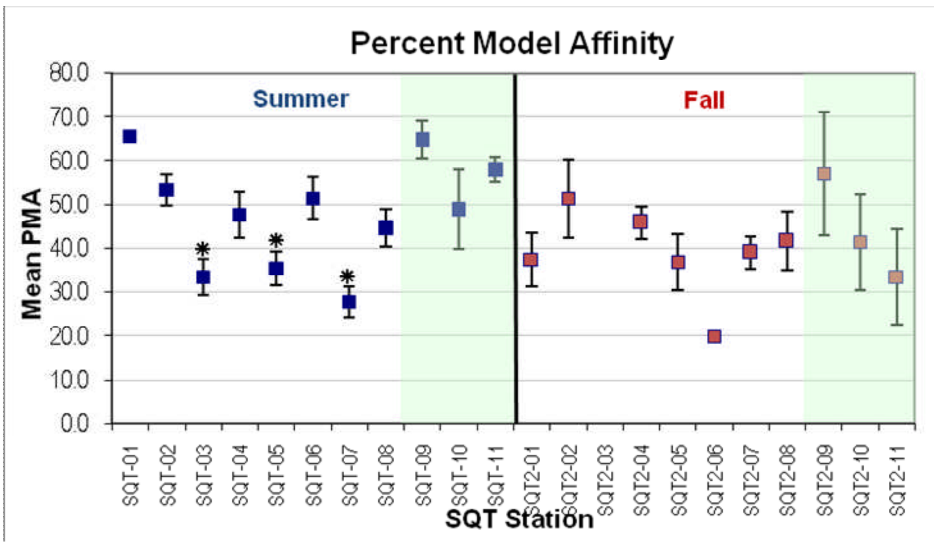
✳ Indicates a statistically significant difference relative to pooled reference values.

EPT richness metrics were not plotted

FIGURE 16 (continued)
BENTHIC COMMUNITY METRICS – SUMMER AND FALL 2010 – SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK







Notes:

✱ Indicates a statistically significant difference relative to pooled reference values.

EPT richness metrics were not plotted

FIGURE 17
BIOLOGICAL ASSESSMENT PROFILE – SUMMER AND FALL 2010 – SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

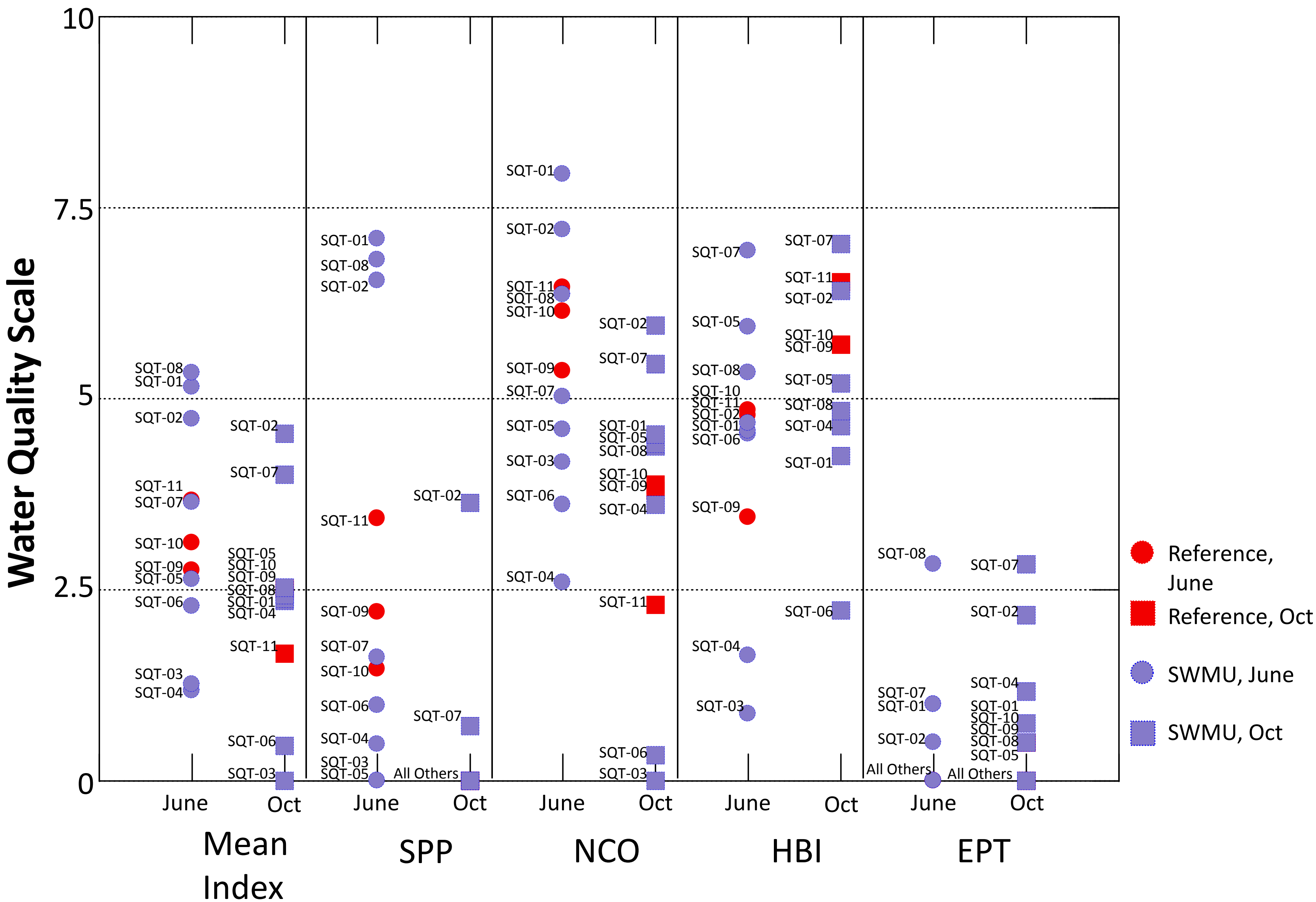


FIGURE 18
HYALELLA AZTECA SEDIMENT TOXICITY TEST – DAY 42 SURVIVAL
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

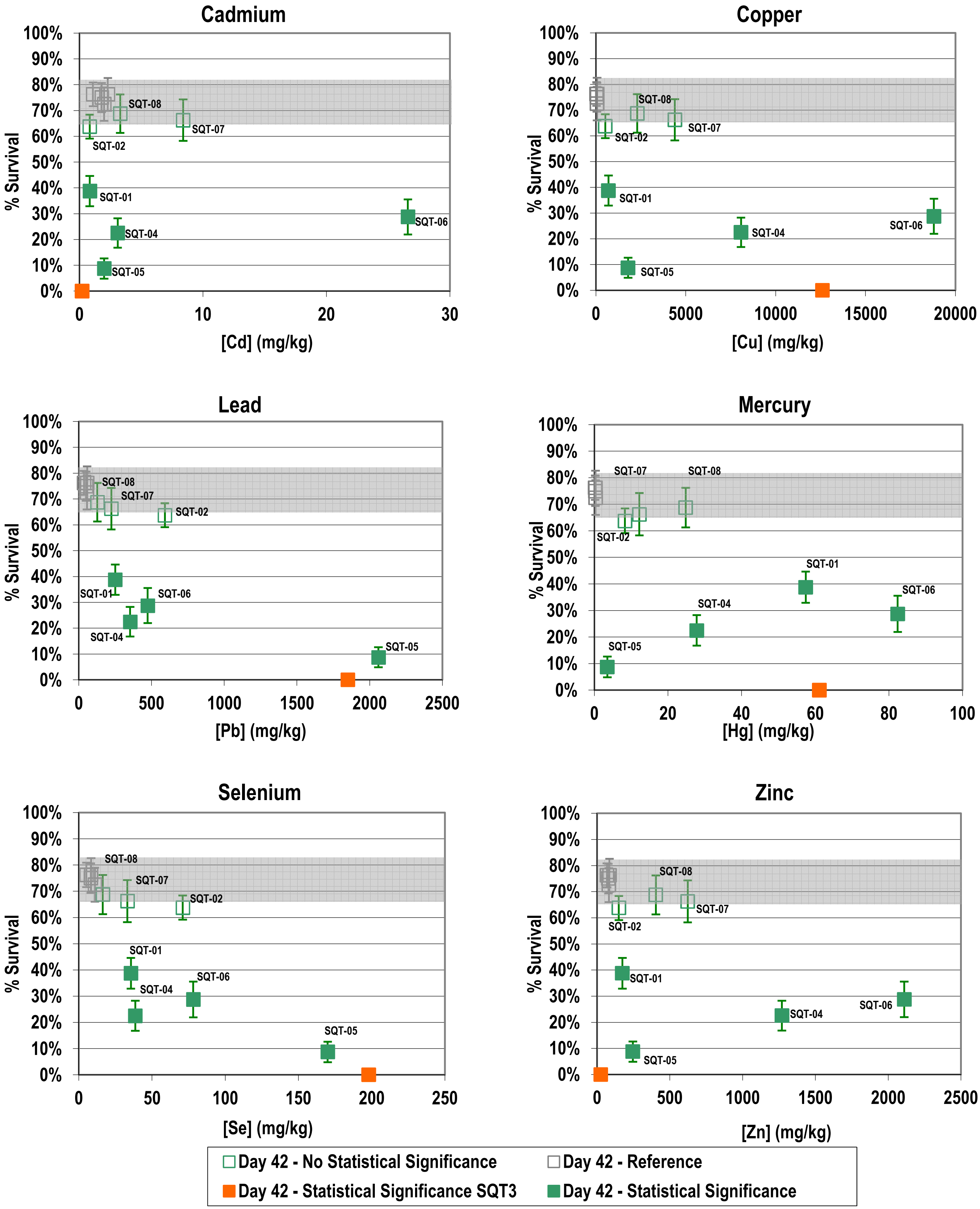


FIGURE 19
HYALELLA AZTECA SEDIMENT TOXICITY TEST – DAY 42 BIOMASS
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

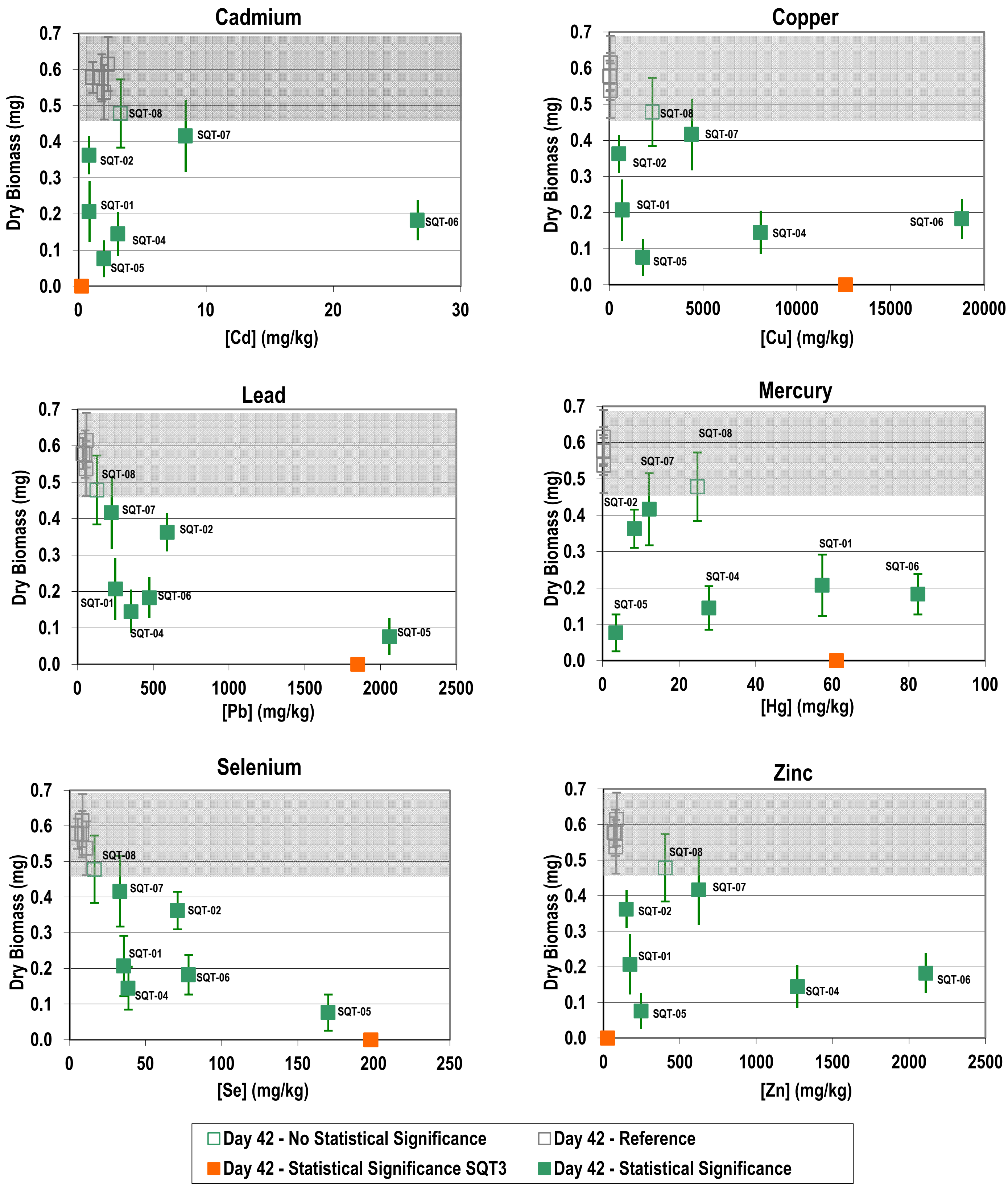


FIGURE 20
HYALELLA AZTECA SEDIMENT TOXICITY TEST – DAY 42 JUVENILES PER FEMALE
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

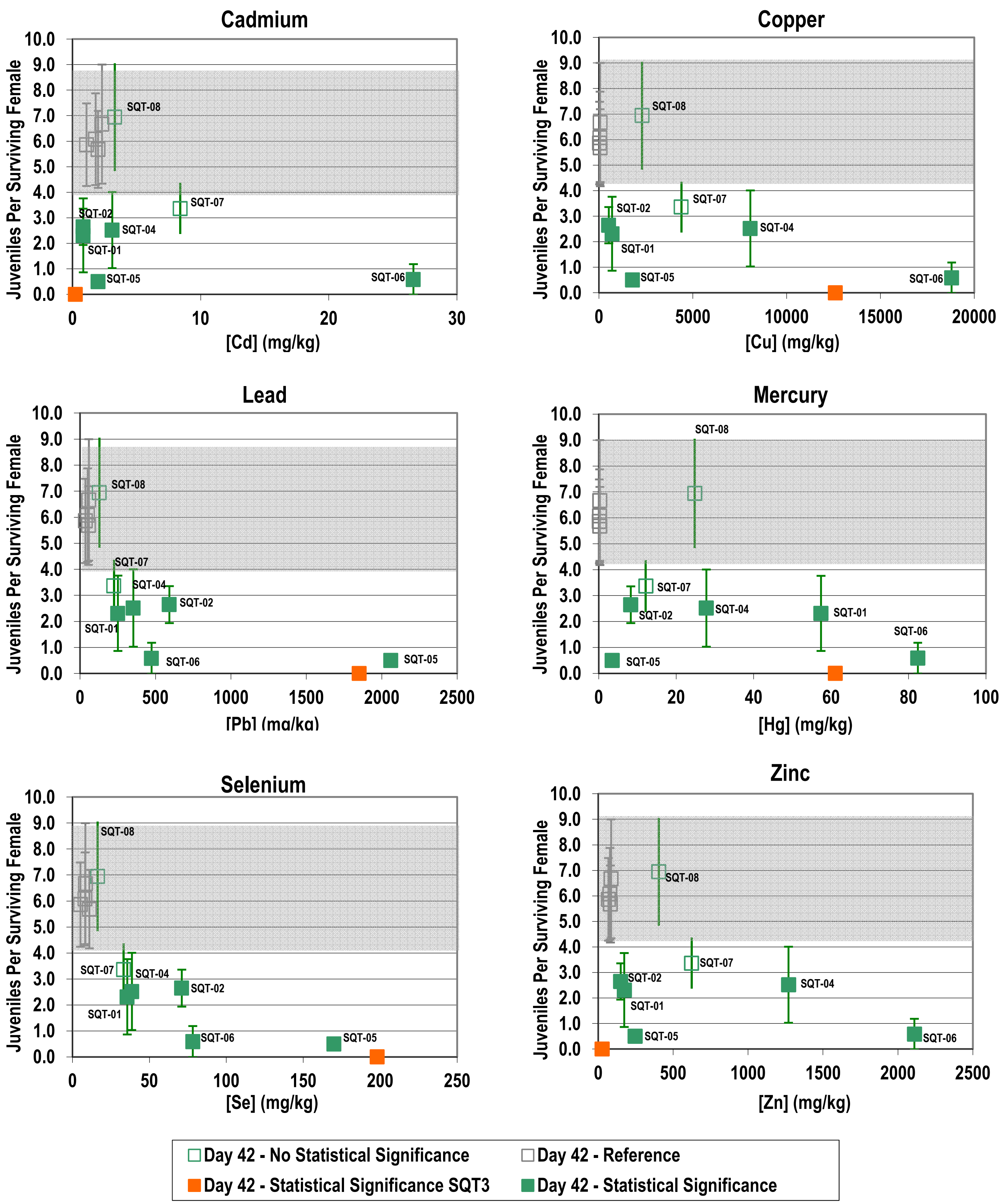


FIGURE 21
CHIRONOMUS RIPARIUS SEDIMENT TOXICITY TEST – DAY 10 SURVIVAL
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

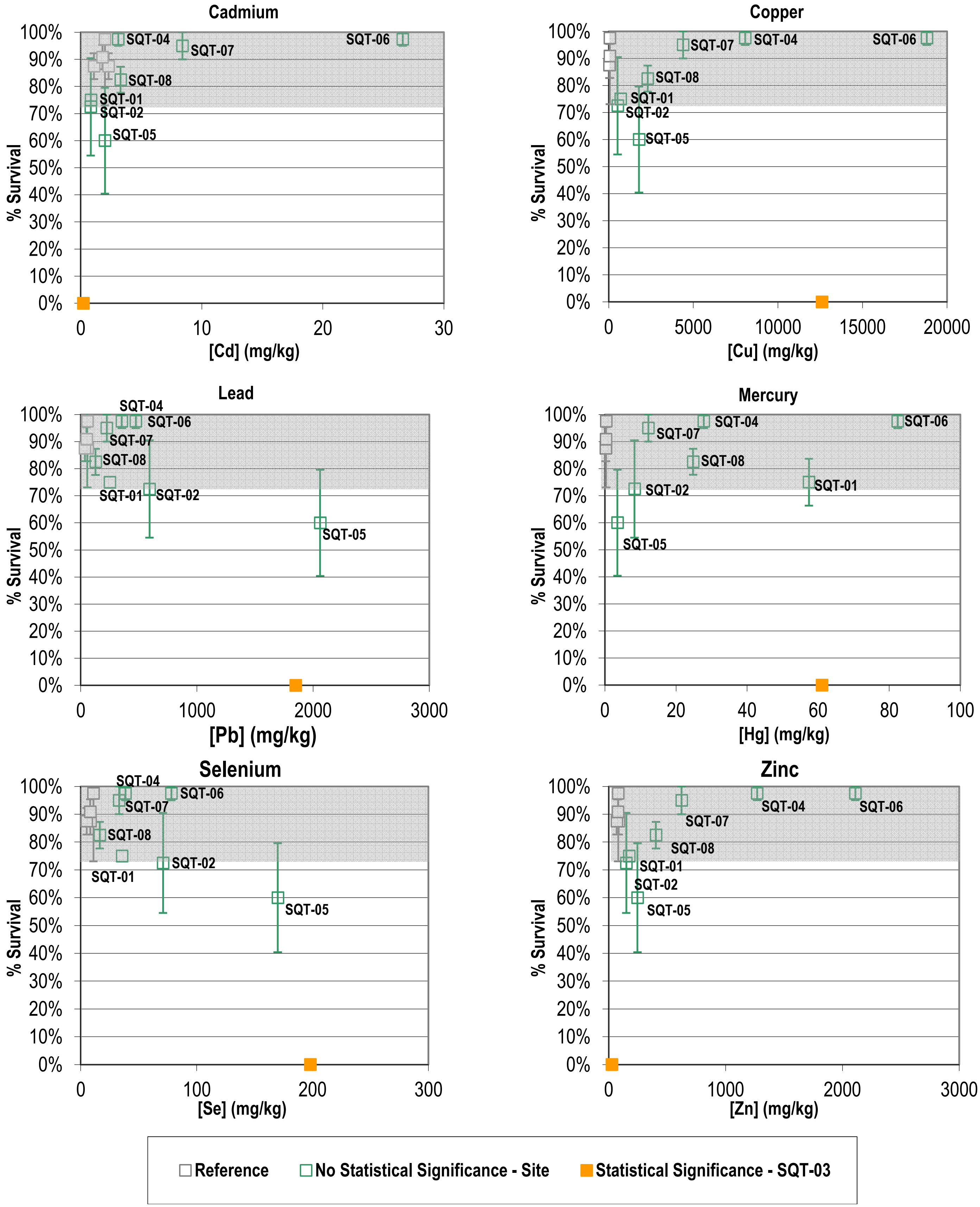


FIGURE 22
CHIRONOMUS RIPARIUS SEDIMENT TOXICITY TEST - DAY 10 BIOMASS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

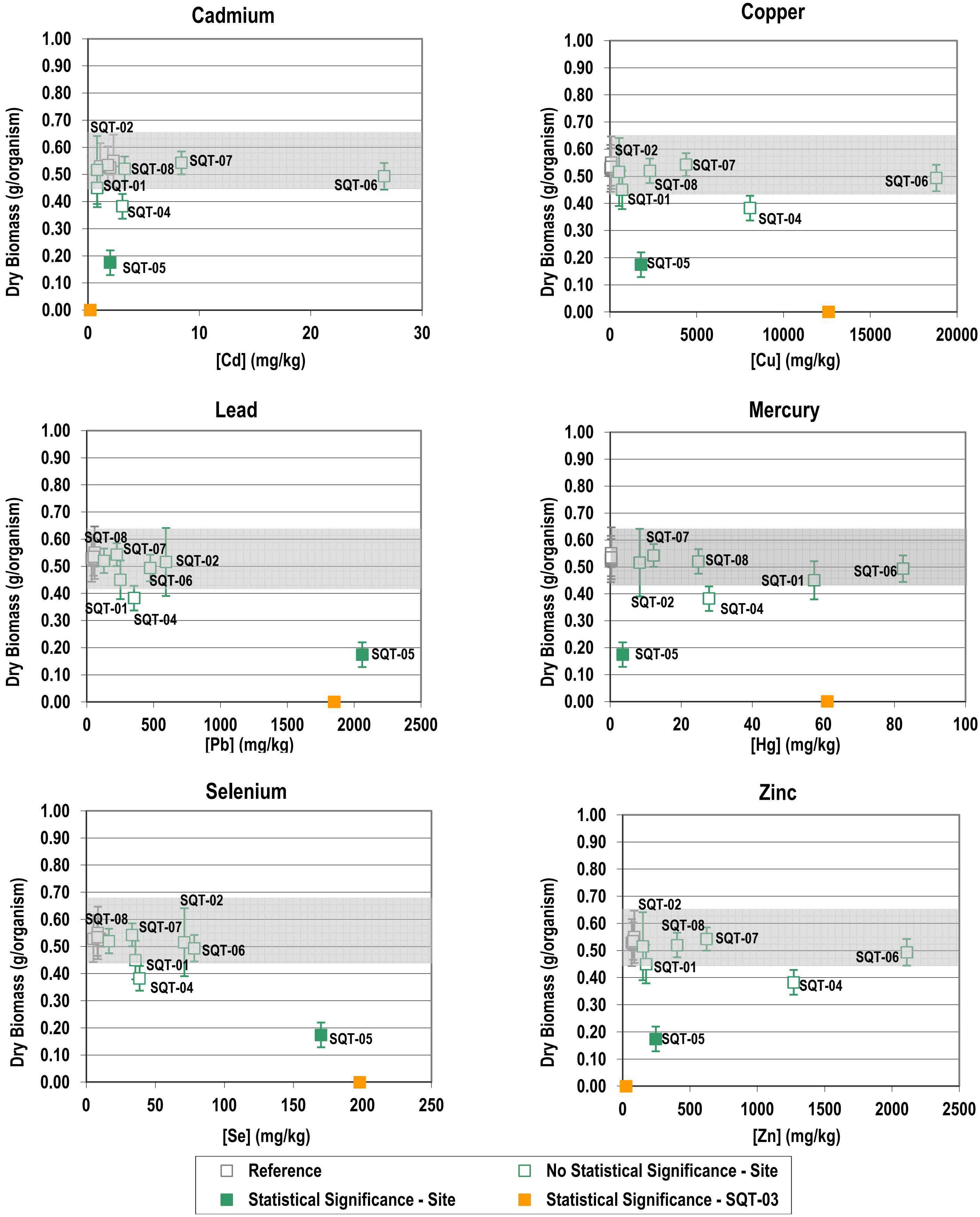


FIGURE 23
CHIRONOMUS RIPARIUS TOXICITY TEST – PERCENT EMERGENCE
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

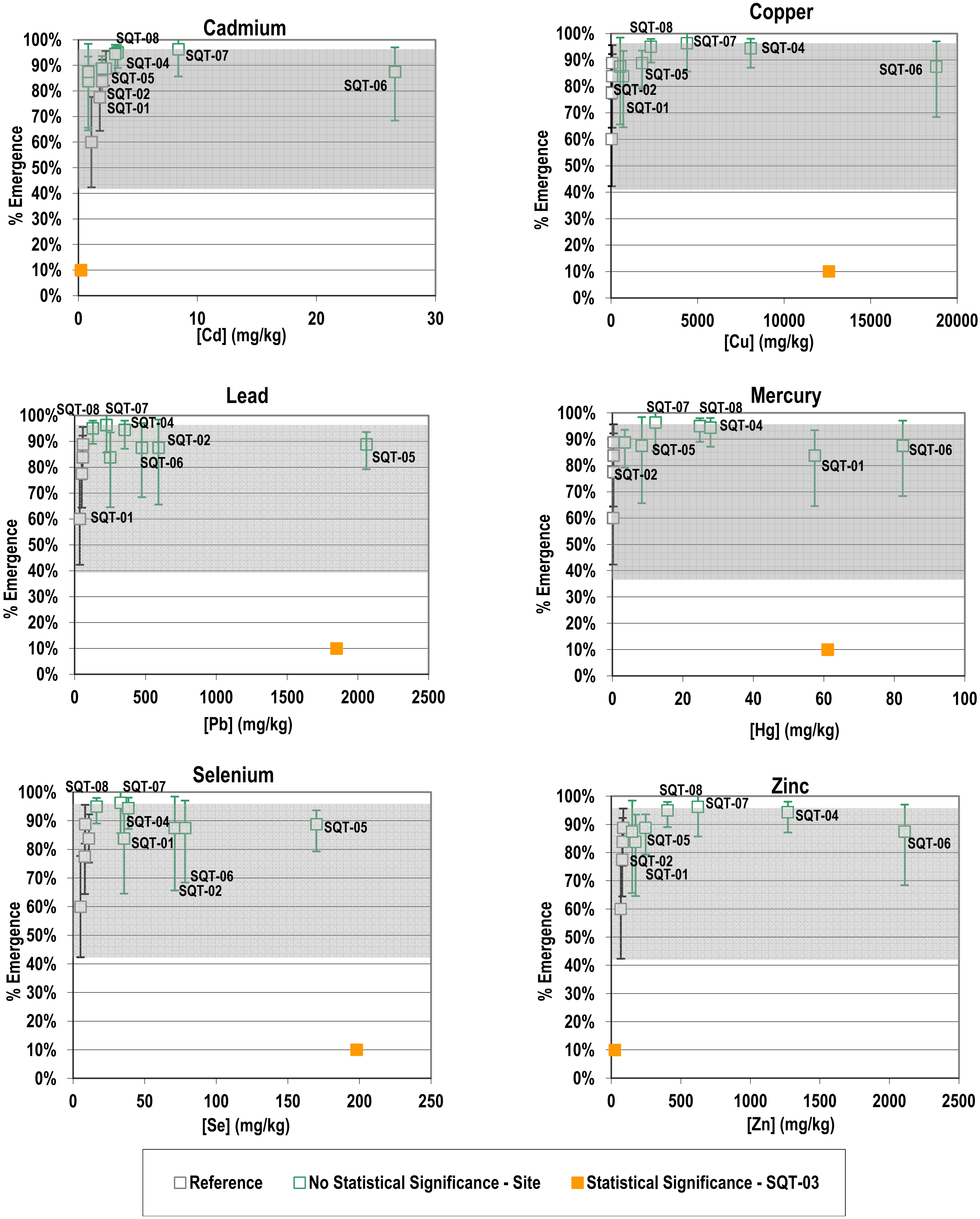
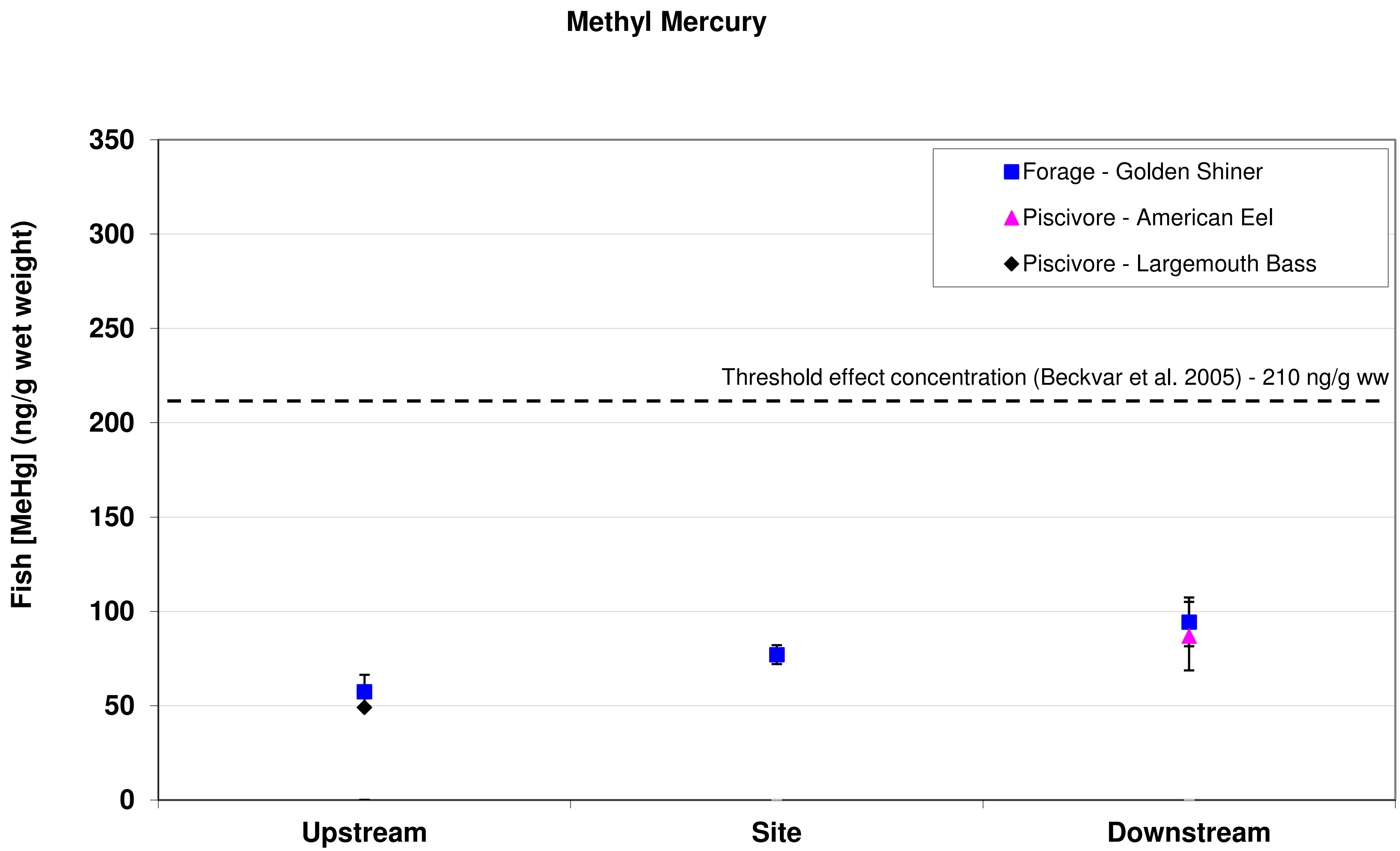


FIGURE 24
FISH TISSUE METHYL MERUCRY CONCENTRATIONS BY REACH
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK



APPENDIX A

New York State Department of Environmental Conservation

Division of Solid and Hazardous Materials

Bureau of Hazardous Waste and Radiation Management, 9th Floor
625 Broadway, Albany, New York 12233-7258

Phone: (518) 402-8594 · **FAX:** (518) 402-9024

Website: www.dec.state.ny.us

June 25, 2009

Mr. Fred Jardinico
Environmental Manager
Dyno Nobel Inc.
161 Ulster Avenue
Ulster Park, NY 12487-5019

Dear Mr. Jardinico:

Re: Dyno Nobel
Sequential Mercury Analysis Work Plan and
Fish and Wildlife Impact Analysis - April 3, 2009

The Department has reviewed the Mercury Analysis work plan submitted on January 29, 2009 and the additional information you submitted on March 20, 2009. Based on these documents and our subsequent phone conversations, we approve of the work plan. Please inform the Department at least seven (7) days prior to the sampling event.

The Department has also reviewed the Fish and Wildlife Impact Analysis report, and has accepted it with the following conditions and notes:

The subject line report was submitted as supplemental information to a previous Fish and Wildlife Impact Analysis (FWIA) submittal. The document is not approved by DFWMR, but is accepted as a flawed document. Dyno Nobel needs to proceed to Step IIC of a FWIA, which includes an analysis of toxic effects of both the adjacent wetland complex, and on-site property. A work plan of the investigation needs to be submitted to the Department for review by DFWMR. The work plan needs to consider items noted in the April 4th, 2008 memo from Mary Jo Crance DFWMR Hazardous Waste Site Evaluation Unit to Paul Patel, which was forwarded to Dyno Nobel. The Department has developed the following comments on the FWIA report:

1. DFWMR does not follow the same risk-assessment methodology as EPA, and does not agree with the conclusions of the EPA-based risk assessment provided within this report.

The results of the Step IIC analysis will be used to determine detrimental risk to the environment.

2. The evaluation of the Dyno Nobel site needs to include an evaluation of copper, lead, cadmium, selenium, zinc and mercury both on site and within the adjacent wetland complex. NYSDEC, DFWMR does not accept the use of AVS/SEM analysis for the availability of metals. If Dyno Nobel wishes to pursue this testing, it may do so, but do not include the results within the FWIA, Step IIC report. Concurrent with biota collection, soil and sediment sampling for metal analysis will be necessary to determine contaminant levels within the biota collection areas.

3. The assessment of the bio-availability of metals on-site needs to include the collection of small mammals within contaminated on-site areas, with the shrews being the target mammal.

4. Dyno Nobel needs to provide a delineation of the reactive soils both off and on-site and provide this information on a figure. Biota sampling should occur as close as possible to areas outside of reactive soils with restricted activities. The boundaries of the reactive soils will need to be verified by a energetic professional engineer with expert credential.

5. The ecological evaluation would need to include:

   a. Multi-seasonal baseline community sampling from impacted and non-impacted areas that includes at a minimum fish and benthic sampling,

   b. Metal tissue analysis, preferably of fish, or alternatively from predatory invertebrates or arachnids, as well as terrestrial small mammals.

   c. Toxicity testing of impacted and non-impacted wetland and stream sediments both during a time-period deemed to have the most anoxic conditions of the year and during a time-period when anoxic conditions do not exist.

The soil samples for the sequential mercury analysis must be collected by August 14, 2009 and a work plan for a Step IIC of a FWIA, which addresses all the concerns listed above, must be submitted to this office by August 31, 2009.

If you have any questions you may contact me at (518) 402-8602 or Mary Jo Crance at (518) 402-8972 .

Sincerely,

/s/

Paul Patel, P.E.
Environmental Engineer
Eastern Engineering Section

Bureau of Hazardous Waste and Radiation Management.

cc: J. Reidy, EPA Reg. 2

ecc: S. Parisio, Reg. 3
K. Gronwald
K. Kulow, DOH
M. Crance, DFW

New York State Department of Environmental Conservation
Division of Solid & Hazardous Materials
Bureau of Hazardous Waste and Radiation Management, 9th Floor
625 Broadway, Albany, NY 12233-7258
Phone: (518) 402-8594 • **Fax:** (518) 402-9024
Website: www.dec.ny.gov

Alexander B. Grannis
Commissioner

December 10, 2009

Mr. Fred Jardinico
Environmental Manager
Dyno Nobel, Inc.
161 Ulster Avenue
Ulster Park, NY 12487-5019

Dear Mr. Jardinico:

Re: Dyno Nobel, Port Ewen, NY Site No. 356001, Response to "Request for Clarification on NYSDEC Comments dated June 25, 2009 on the Fish and Wildlife Impact Analysis Step IIB Report Dated April 3, 2009," Prepared by URS for Ashland Incorporated and Dyno Nobel North America, Dated August 25, 2009, Village of Port Ewen, Ulster County.

The subject line letter was submitted to the New York State Department of Environmental Conservation (NYSDEC) as requested during the conference call on July 29, 2009. The subject line letter asks seventeen questions, of which the majority relate to a United States Environmental Protection Agency (USEPA) Ecological Risk Assessment Guidance for Superfund sites (USEPA ERAGS), which was incorporated into the Fish and Wildlife Impact Assessment (FWIA). The submitted questions were not outlined; however, the outlined response below is being submitted to clarify the confusion about the two documents, and to help guide Dyno Nobel through the FWIA process.

The purpose of the FWIA is to assess environmental impact; the purpose of the USEPA ERAGS is to develop a risk assessment; the Division of fish, Wildlife & Marine Resoures (DFWMR) does not equate the purposes of the two documents. It is not necessary to include a USEPA ERAGS risk assessment within the FWIA, but if Dyno Nobel is interested in doing the additional work of the USEPA ERAGS for inclusion in the FWIA, it may do so under guidance of DFWMR. The USEPA ERAGS can be used as one line of evidence of an impact assessment, but the risk assessment does not eliminate any sampling or toxicity testing element required for the FWIA.

If the risk assessment is to be included within the FWIA, the following items need to be modified:

1. Please segregate the risk assessment into an appendix (perhaps into Appendix G) or a separate document and cite only the risk assessment results into the FWIA report. The result will be reported along with other lines of evidence in the FWIA report. Please

note, if the items below are not satisfactorily addressed, the risk assessment cannot be included in the FWIA;

2. The ecological conceptual model needs to be modified for use in the impact assessment:

   a. The model needs to join off-site and on-site categories together because both have contaminated soils, surface water, sediment and groundwater. The division of the terrestrial and wetland potential ecological receptors is unrealistic. Most of the receptors move between the two areas. Remove the artificial division between the terrestrial and wetland potential ecological receptors;

   b. The ecological conceptual model needs to show the following exposure routes:

      i. Direct ingestion of surface water is a potential exposure route for every receptor;
      ii. Direct ingestion of soil is a potential exposure route for all receptors;
      iii. Direct ingestion of terrestrial biota is a potential exposure route for omnivorous mammals, aerial insectivores, and the specific model species mink and heron;
      iv. Direct ingestion of aquatic biota is a potential exposure route for large herbivores, carnivorous mammals, carnivorous birds, benthic macroinvertebrates, and fish/amphibians; and
      v. Direct contact/absorption is a potential exposure route for terrestrial and aquatic biota;

3. The risk assessment needs to model all receptors of the corrected ecological conceptual site model that have a potential exposure;

4. TRVs need to be developed using NOAELs and/or LOAELs accepted by DFWMR. Some weight for deriving these values will be given to site-specific testing. It is expected that further discussion on this topic between DFWMR and Dyno Nobel will result in an acceptable NOAEL and/or LOAEL derivation. DFWMR will be available to meet and discuss this topic further;

5. Further explanation is needed on how the background dose was calculated. Background dose needs to be derived from off-site, un-impacted sediment, soil, and water measurements. DFWMR will reserve the right to comment further on the background dose calculation after the explanation is provided;

6. The risk assessment model must be calibrated using site-specific tissue data of terrestrial and aquatic invertebrates, small mammals and fish;

7. All calculations of the risk model and calculations of the components of the risk model need to be included in an appendix. For example, the calculation of the 95th Upper Confidence Limit of the soil concentrations used within the risk assessment model needs to be included in the appendix;

8. Additional columns need to be added to the Appendix G tables which include all the input values used in the model calculation;

9. Provide the digital risk assessment calculation spreadsheets in a Microsoft Excel format on a compact disk with the report;

10. Habitat quality of forging areas in and/or around the AOCs and SWMUs listed below is considered of high value. The habitat within and/or around these areas need to be evaluated both in the risk assessment and the impact assessment. Wildlife will selectively forage in these areas. The Area Use Factor need to be weighted towards these areas:

    a. AOCs – A, B, C, D, M, N, O, G, H, J;
    b. SWMU – 23, 27, 52 specifically for the intermittent stream which flows through or near these SWMUs;
    c. SWMUs within 100 feet of tree and/or shrub cover, and that have a vegetated surface;

Further comments on the FWIA:

11. Please note, when listing COPCs in the text, COPCs are any contaminants that exceed NYSDEC sediment LELs, or water or soil criteria used for the protection of ecological resources. If a detection limit of laboratory analysis is not sufficient to measure the contaminant at or below these state criteria, the contaminant defaults to a COPC. Corrections need to be made in the document to list all COPCs;

12. As noted in previous submitted comments, suitable habitats for T&E species are found on-site, or within the impacted off-site areas. Corrections within the text of the document are necessary;

13. The subject line letter asked for clarification on testing procedures which post-date the NYSDEC Technical Guidance for Screening Contaminated Sediments and the FWIA. These documents are currently being updated. These updated guidance documents will clarify NYSDEC's position on the use of sampling techniques developed since publication of the current guideline documents. Until the updated guidance documents are published, DFWMR personnel must be consulted about what impact-assessment methodologies will be used in the FWIA. DFWMR personnel will relay the current position of NYSDEC, which will be included in the updated guidance;

14. Based on current information, as well as on DFWMR experience in evaluating contaminated sites, the use of AVS/SEM cannot be used as the sole basis for establishing remediation goals or determining impacts to environmental resources for the following reasons:

   a. The AVS/SEM approach has been well-tested in the laboratory under controlled conditions, but DFWMR has reviewed very few studies where the AVS/SEM has been applied in the field to successfully establish remediation goals. Some studies that we have reviewed have shown that AVS/SEM alone did not successfully predict a lack of toxicity in the field; that is, AVS/SEM predicted a lack of toxicity but toxicity was observed, even though the source of toxicity might have been attributable to a source besides metals (Delistraty and Yokel 2007);
   b. The AVS/SEM relationship has been shown to vary spatially as well as seasonally, and even diurnally. Also, the AVS/SEM relationship is dependent upon the maintenance of anoxic conditions in sediment. DFWMR has not reviewed studies that convincingly demonstrate that metals precipitated as sulfides are irreversibly bound despite changes in sediment characteristics such as the redox potential and oxygen content. Because of the dynamic nature of sediments, particularly in lotic waters, these are important considerations;
   c. It has been documented that organisms can accumulate concentrations of metals, even in sediments where the AVS concentration greatly exceeds the SEM concentration (De Jonge, et al. 2009). AVS/SEM does not consider bioaccumulation and trophic transfer; or the potential for antagonistic, additive, or synergistic effects;
   d. Studies indicate that dry weight normalization is frequently as good a predictor of toxicity as bioavailability normalizations, such as TOC and AVS (Wenning, et al. 2005);

   The AVS/SEM theory fails particularly at the DynoNobel site because:

   e. Given the intermittent stream and shallow water within the wetland, and the fact that the wetland has a stream flowing through it, it is unlikely that there will long periods of anoxic conditions, a condition which the AVS/SEM theory relies upon. The methodology cannot consistently predict toxic effects in varying redox potential environments; and site conditions indicate that the redox potential will vary seasonally at this site;
   f. AVS/SEM testing is not used for assessing environmental impact of mercury, the contaminant which is of most concern within the wetland and stream sediments. Sulfur-reducing bacteria convert mercury into the more bioavailable and toxic methylated form. This means that while sulfur-reducing bacteria may theoretically render the specified six divalent metals less bioavailable, the bacteria would be available to convert mercury to the more toxic methylmercury form; and

g. Use of AVS/SEM as a predictive tool would need to include collection and analysis for AVS/SEM as well as chronic toxicity tests, bioaccumulation data, and benthic community analysis for a complete assessment of the toxicity of sediments; thus, the AVS/SEM becomes additional testing which Dyno Nobel can do if it chooses, but the results of the community assessment and the toxicity tests will be considered with greater weight in the light of site-specific circumstances. DFWMR is willing to allow for the use of AVS/SEM as a line of evidence in a weight of evidence approach to assessing risks from contaminated sediment. For example, given the situation where metals concentrations in sediment suggested a significant risk but toxicity testing and benthic macroinvertebrate community analysis showed an acceptable benthic community, a high AVS/SEM ratio would suggest that the metals were not bioavailable; however, a finding such as this must still consider the dynamic nature of the sediments in the reversibility of the metal binding;

15. Dyno Nobel needs to complete the FWIA procedure up to and including Step IIC as repeatedly requested by NYSDEC.

The ecological evaluation would need to include:

a. Spring 2010 and summer 2010 baseline community sampling from impacted and non-impacted areas that includes at a minimum fish and benthic sampling;
b. Wetland and terrestrial tissue analysis; which includes but is not limited to fish, oligochaetes, and small mammals (a likely target mammal is shrews). Tissue analysis will be used to evaluate impact to predators as well as impact on the target organisms. NYSDEC disagrees with arguments presented by URS stating that tissue sampling cannot indicate potential environmental resource impact;
c. Toxicity testing of impacted and non-impacted reference wetland and stream sediments;
d. Concurrent with biota collection, soil and sediment sampling for metal analysis will be necessary to determine contaminant levels at the biota collection sampling sites;
e. Dyno Nobel needs to provide a D size figure clearly depicting on-site and off-site areas of restricted activities within or over the soil. The figure or text should define the nature of the restrictions. This figure is necessary to plan the location of on-site and off-site biota sampling, and concurrent soil and/or sediment sampling. Biota sampling will occur as close as possible to areas outside of reactive soils with restricted activities:

    i. Dyno Nobel has noted: "These areas are no longer restricted. The only areas that remain restricted are the landfills and SWMU 48 relative to intrusive activities. There is no evidence at these locations of energetic materials at the surface at these locations. Rather, consistent with agreements reached with the Department during completion of the RCRA Facility Investigation (RFI), investigation within these areas is restricted given the potential for the buried energetic materials and the health and concerns associated with intrusive activities in these areas. As long as the areas are not disturbed, there is no hazard." Please define "intrusive activities" so it can be determined if biota sampling and concurrent soil and sediment sampling could be considered intrusive; and

16. Dyno Nobel has asked:

"Exclusion of areas currently slated for remedial action (Section 4.0; Section 5.0): please confirm if there is agreement that the FWIA Step IIC investigations (e.g., sampling) are not warranted in areas that are slated for remedial action in the current CMS." Pre-remediation baseline sampling would be necessary at locations slated for remedial action. Areas not slated for a remedial action, or slated for a remedial action which would not separate contaminated media from environmental resources (such as a permeable soil cover) would require an impact assessment. The design specifications of the landfill would need to be reviewed prior to determining if environmental resources would have potential exposure.

A work plan for a Step IIC of a FWIA, which addresses all the concerns listed above, must be submitted to this office by January 20, 2010. Please note that if sampling is to be done in any areas that pose a risk to personnel, appropriate safety measures must be maintained, including the use of consultants with expertise in dealing with potentially reactive soil.

If you have any questions you may contact me, at (518) 402-8602, or Mary Jo Crance, at (518) 402-8972 .

Sincerely,

Paul Patel

Paul Patel, P.E.
Environmental Engineer
Eastern Engineering Section
Bureau of Hazardous Waste & Radiation Management
Division of Solid & Hazardous Materials

cc: J. Reidy, USEPA Reg. 2

ecc: K. Brezner, Reg. 3
K. Gronwald
K. Kulow, DOH
M. Crance, DFW

Literature cited:

De Jonge, M., F. Dreesen, J. De Paepe, R. Blust, and L. Bervoets, 2009. Do acid volatile sulfides (AVS) influence the accumulation of sediment-bound metals to benthic invertebrates under natural field conditions? Environ. Sci. Technol. 43(12):4510-4516

Delistraty, D., and J. Yokel, 2007. Chemical and ecotoxicological characterization of Columbia River sediments below the Hanford Site (USA). Ecotoxicology and Environmental Safety 66:16 – 28 (2007)

Wenning, R.J., G.E. Bately, C.G. Ingersoll, and D.W. Moore, editors, 2005. Use of Sediment Quality Guidelines and Related Tools for the Assessment of Contaminated Sediments. Pensacola (FL): Society of Environmental Toxicology and Chemistry (SETAC). 815 p.

New York State Department of Environmental Conservation
Division of Solid & Hazardous Materials
Bureau of Hazardous Waste & Radiation Management, 9th Floor
625 Broadway, Albany, New York 12233-7258
Phone: (518) 402-8594 • **Fax:** (518) 402-9024
Website: www.dec.ny.gov

Alexander B. Grannis
Commissioner

April 15, 2010

Mr. Fred Jardinico
Environmental Manager
Dyno Nobel, Inc.
161 Ulster Avenue
Ulster Park, NY 12487-5019

Dear Mr. Jardinico:

Re: Dyno Nobel Site No. 356001, Response to "Fish and Wildlife Impact Analysis Step IIC Investigation Work Plan" Dated April 1, 2010", Prepared by URS for Ashland Incorporated and Dyno Nobel North America, Village of Port Ewen, Ulster County.

The referenced work plan has been reviewed by the Department and did not fulfill the requirements of our March 12, 2010 letter. However, it was close enough that we are approving the work plan with the following conditions:

Sampling location-

1. Stations need to be selected based on information previous sediment investigations, targeting areas of known high concentrations of each of the COCs. Toxicity test and sediment samples need to be located at the following previous sampling locations; 01-15-1.0, 22-08-1.0, 22-02-1.0, 22-04-1.0, and 22-15-1.0. Benthic community samples will be taken near/around the following samples; 01-15-1.0, 22-15-1.0, and 22-04-1.0. A map that specifically denotes the sampling locations of the sediment collected for the toxicity test/sediment analysis and the benthic community samples, and a map that includes the reference sampling locations, needs to be submitted for approval by the Department.

Toxicity testing-

2. The use of Latin-square sampling design is not appropriate for the current investigation as proposed. Sediment metal analysis, referred in the work plan as "bulk sediment analysis", must be done on an aliquot of the sediments (n=5) that are used in the toxic tests. The laboratory can split the homogenized sediment sample to ensure toxicity testing integrity. The entire metal suite analysis will be done for each sediment aliquot. Analysis of sediment beyond what done for the toxicity test and the on-site tributaries is at the discretion of Dyno Nobel.

3. Additional toxicity testing can be performed in the laboratory to determine a toxic rating curve (through serial dilution) if the initial testing indicates toxicity. The field effort would need to collect additional sediment volume which the laboratory would need to store until the end of the initial tests.

4. The PRP is responsible for contacting the laboratory and asking the volume needed to support all testing purposes. Field work must collect enough sediment for each sample for both the toxicity testing and the bulk sediment analysis.

5. After further review of the site-specific contaminants and the organisms selected for the toxicity tests, the Department would prefer using the metal-contaminant sensitive C. riparius rather than C. dilutus. Revise the toxicity testing work plan to use C. riparius.

6. Growth and reproduction measurement endpoints need to be included in the summary table of toxicity testing results.

AVS-SEM sampling-

7. The Department finds the use of AVS-SEM inappropriate for the wetland/stream complex of 1/22 AOC. The Department does not need the result of the sampling, and therefore it is inappropriate to include this information within the FWIA document. Against the Department's advice, Dyno Nobel is proceeding with the collection of AVS-SEM sampling. Please note, the information will not be used as a line of evidence to determine site impact. Because Dyno Nobel is collecting these samples on their own volition, they can elect to locate samples, and sample depths however they choose.

Reporting of data collection-

8. Laboratory and field data sheets need to be submitted in an appendix of the FWIA. A separate summary data table needs to be included for each aspect of the work plan. For example, there needs to be a separate data summary table for the surface water and sediment chemical analysis, one for the benthic community collection, one for the fish community collection, one each for the tissue analysis types (fish, benthic, small mammal), and one for the toxicity test results.

Fish Collection

9. All fish collected at the first and second sampling stations will be kept until the third station sampling is completed. Target species will be selected based on the common denominators amongst all the stations. A minimum of 5 larger individual fish and 5 composite samples of forage fish are to be collected at each sampling station.

Benthic community collection-

10. A traditional collection device, such as a ponar or mini-ponar will be used to collect benthic community samples in WMA 1/22. Past field inspections did not find phragmite growing profusely in standing water. Areas of benthic sampling will be collected in areas of permanently innodated with water which are unlikely to have thick phragmite root mats. The use of the proposed coring sampler can be retained as a backup sampling device if phragmite growth is problematic.

Small mammal trapping-

11. In order to facilitate the capture of shrews, two changes should be made to the sampling plan. The bait should include a component of meat-based product, such as bacon grease, and the traps should be placed in microhabitats that would favor shrews, such as along or under fallen logs or along visible trails.

12. Five samples will be collected from each sampling grid. The target mammal is the shrew, however if five shrews are not collected from a grid, the sample number (n=5) will be completed using alternate species (i.e., mouse).

Invertebrate collection -

13. The purpose of collecting worms and invertebrates is to understand the transfer of site-specific contaminants to predators higher in the food chain. The worms and invertebrates should not be depurated before tissue analysis.

14. For earthworm tissue analysis, each sample needs only to meet the weight needed for laboratory analysis which was stated in the work plan as 2.5 grams. There is no reason to obtain 20 grams of earthworm tissue for each sample as stated in the workplan. It is reasonable to collect 3 grams of earthworm for each sample to conservatively ensure there is enough tissue to meet laboratory requirements. To collect the 3 grams of tissue, up to 10 sample points would be considered a sufficient effort. Insufficient sample mass collection will not be accepted as evidence that earthworms are not a significant forage base to wildlife. The work plan needs to be revised to reflect the noted sample size and collection effort. If laboratory tissue requirements are not 2.5 grams, the Department should be notified.

On-site tributary sediment collection-

15. Sediment samples will be collected in a coring devise from 0-24". The sediments will be divided and analyzed as follows; 0-6", 6-12", 12 to 18" and 18"-24".

Now that the FWIA has been approved, Dyno must begin the implementation of the FWIA by April 30, 2010. In addition, the FWIA workplan must be modified to incorporate these conditions and a finalized version submitted to this office by April 30, 2010.

Note that for each day past April 30, 2010 that a finalized work plan meeting the above criteria is remains unsubmitted to this office, Dyno Nobel will be in violation of its 373 Permit, and be liable in the case of a first violation, for a civil penalty not to exceed $37,500 and an additional penalty of not more than $37,500 for each day during which such violation continues, after such notice and opportunity to be heard by the commissioner.

If you have any questions you may contact me at (518) 402-8602.

Sincerely,

Paul Patel

Paul Patel, P.E.
Environmental Engineer
Eastern Engineering Section
Bureau of Hazardous Waste & Radiation Management
Division of Solid & Hazardous Materials

cc: C. Stein, USEPA Reg. 2

URS

TO: Paul Patel – NYSDEC
Mary Jo Crance – NYSDEC DFWMR
Rebecca Quail – NYSDEC DFWMR

FROM: Gary Long – URS

DATE: May 26, 2010

PROJECT: Dyno Nobel Port Ewen FWIA Step IIC

CC : John Hoffman, Ashland
Fred Jardinico, Dyno Nobel
Neal Olsen, Dyno Nobel
Nigel Goulding, EHS-Support
Andy Patz, EHS-Support

SUBJECT: **Summary of SQT Station Modifications and Sampling Program Updates
Dyno Nobel Port Ewen FWIA Step IIC Investigation
Port Ewen, New York**

This memorandum provides a summary of the proposed modifications to sediment quality triad (SQT) sampling stations identified in the April 30, 2010 work plan for Fish and Wildlife Impact Analysis (FWIA) Step IIC investigations at the Dyno Nobel Port Ewen Site in Port Ewen, New York (the site). The proposed modifications are based on conditions observed during a site reconnaissance conducted May 11 – 12, 2010 and subsequent discussions with Mary Jo Crance of the Division of Fish, Wildlife, and Marine Resources (DFWMR) during a site walk on May 13, 2010. The proposed modifications are consistent with the summary of the site walk provided by Mary Jo Crance via email on May 14, 2010. Updates to sampling program reference locations and sampling schedule are also provided.

The following elements of the study were discussed during the May 13, 2010 site walk and addressed in the email from DFWMR:

- Subsequent benthic community sampling: It was agreed that any potential benthic community sampling subsequent to the June event would be conducted in late September.
- Refinement of SQT sampling locations: Modifications to the placement of three SQT stations were discussed (identified based on historic sample ID):
  - 22-02-1.0 (west side of SWMU 22): At the time of the reconnaissance there was approximately 6-8 inches of stagnant, standing water at the station. Relocation of the station was discussed because this area is likely an ephemeral habitat that would not support permanent benthic communities and may not be inundated in June; therefore, it would not be appropriate for benthic community sampling or toxicity testing. DFWMR indicated a preference for this station based on historical high mercury concentrations determined in sediments (89 ppm), but agreed that it would be appropriate to move the station if the area was not inundated in June. It was agreed that DFWMR would be called from the field to make a determination regarding this station at the time of sampling. An alternate station, approximately 50 feet west of the original station in an area of greater inundation (flowing water), was staked as a contingency. It is recommended that the surface water sample be collected from the contingency station regardless of conditions at

the original station in June. The potential downside to sediment sampling at the contingency station is that mercury concentrations in the alternate area have not been characterized in previous sampling efforts. The lack of historic data creates uncertainty as to where this data point will fall in the dose-response gradient.

- 22-04-1.0 (northern tip of SWMU 22): At the time of the reconnaissance, the area was saturated but not inundated. DFWMR agreed that the station was not appropriate for benthic community or toxicity testing given the lack of habitat for benthic invertebrate communities. A transect was surveyed from the northern tip of SWMU 22 to the opposite uplands and an alternate station staked at the point of greatest inundation, approximately 75 feet to the north of the original station. The contingency station will be evaluated at the time of sampling to determine its appropriateness for the SQT studies. As with the contingency described above for 22-02-1.0, the potential downside to the alternate station for 22-04-1.0 is the lack of historic chemical data for sediment in this area. The proposed surface water location at 22-04-1.0 will be moved to 22-15-1.0.

- 22-33-1.0: This is the most downstream station proposed in the work plan. The reconnaissance findings at this station indicated that the area had limited sediment (mostly Phragmites root mat) and would not be ideal for SQT studies. A more ideal station was identified approximately 75 feet downstream where the confluence of two drainage channels through the wetland create a sediment depositional area. DFWMR agreed with the location of the alternate station.

- Reference wetland: URS has obtained permission to sample the reference wetland on Scenic Hudson's Gordon/Paul Jayson Property. DFWMR and URS agreed during the site walk that this wetland is the preferred reference wetland for its comparability to the site wetland. URS also has permission from the adjacent landowner, Paul Jayson, to access the wetland from Floyd Ackert Road.

Additional challenges to the investigation that were identified by the reconnaissance survey and communicated to DFWMR during the site walk include:

- Lack of available open water areas to electroshock fish: Much of the wetland is overgrown by Phragmites, limiting the ability to effectively electroshock except in small pockets of open water. In the open water areas, the depth of soft sediment will also limit the mobility of the sampler and the effectiveness of the shocking. DFWMR acknowledged these limitations and indicated that sample will be collected in areas where we are able to safely access and effectively sample; DFWMR confirmed the desire to be present for the fish sampling effort.

- Limited invertebrate sample mass observed in sediment: Test sieving and observations at each SQT station indicate that obtaining requisite sample mass of invertebrates may be challenging. DFWMR indicated that a reasonable effort will have to be made to obtain the sample mass.

- Limited depth of sediment in site drainages: In staking the site drainage locations, the depth of sediment varied from approximately 6 inches (mostly upgradient stations) to greater than 24 inches (mostly downgradient stations). Therefore, the collection of four discrete sampling

URS

6-inch sampling intervals in cores from each station will likely be problematic. As stated in the work plan, 6-inch intervals will be collected from the surface of the sediment to the refusal depth. DFWMR agreed that we will collect the sediment that is available, making sure to collect sufficient sample volume for each targeted interval.

The sampling effort is scheduled to begin the week of June 14, 2010. The tentative schedule for specific tasks include:

- June 14 – 18: Surface water sampling, SQT sampling, benthic invertebrate tissue sampling, and SWMU 35 soil sampling;
- June 21 – 25: Small mammal/earthworm tissue sampling/soil sampling, fish community/tissue sampling (June 22), site drainage sediment sampling;

This schedule is tentative and may be modified based on weather and field conditions; NYSDEC will be notified of any significant changes in schedule.

We would suggest that we also coordinate a project meeting during the week of June 14^{th} between the NYSDEC, DFWMR, and the Dyno Nobel and Ashland team to discuss overall project schedule and strategy.

EHS Support
consider it done

MEMO

To:	Paul Patel - NYSDEC Mary Jo Crance - NYSDEC Keith Gronwald - NYSDEC
From:	Andy Patz - EHS Support Corp
CC:	John Hoffman - Ashland Neal Olsen - Dyno Nobel Fred Jardinico - Dyno Nobel
Date:	June 23, 2010
Re:	Summary of the June 17, 2010 Port Ewen Meeting

We would like to thank you, Mary Jo Crance, and Keith Gronwald for the opportunity to meet and discuss the status of the Port Ewen facility project on June 17, 2010. A draft summary of our discussions is provided below. If you could review the draft summary and provide any comments or clarifications, we will finalize and this memorandum for your files.

June 17, 2010 Project Meeting, Port Ewen, New York

The New York State Department of Environmental Conservation (NYSDEC) and Ashland/ Dyno Nobel (the project team) held a project update meeting on June 17, 2010 at the Port Ewen Dyno Nobel facility. The meeting focused on the ongoing Fish and Wildlife Impact Analysis (FWIA) as well as key tasks that will be required as part of the overall facility investigation and closure. The meeting was very productive and the project team discussed and reviewed several technical issues and general project tasks. The meeting was also an opportunity to introduce new members of the project team to the NYSDEC.

Attendees/ Project Team:
Paul Patel – NYSDEC
Mary Jo Crance- NYSDEC
Keith Gronwald – NYSDEC
John Hoffman – Ashland
Neal Olsen – Dyno Nobel
Fred Jardinico – Dyno Nobel
Gary Long – URS
Nigel Goulding – EHS Support Corp
Andrew Patz - EHS Support Corp

Ecological Assessment Update

The project team reviewed the status of the ongoing FWIA Step IIC field evaluation; the following items were discussed:

- URS provided an overview of progress on the field evaluations and discussed, for the members of the project team and the other NYSDEC staff, the modifications to the sampling locations that URS (Gary Long) and NYSDEC (Mary Jo Crance) had collaboratively agreed on in the field.
- Benthic tissue sample mass
    - URS discussed the challenges the team were facing in collecting sufficient benthic tissue sample mass. A "market basket" approach was proposed where all taxons collected, within each sampling station, would be composited in order to achieve the adequate tissue sample mass. It was agreed by all parties that compositing of the sample into a market basket was acceptable and should be implemented.
    - Despite the compositing of benthic tissue samples, it was noted that the market basket approach provided insufficient sample mass to undertake the analytical testing proposed in the work plan. A number of options were identified and these included :

        (1) Only testing of samples for mercury using the work plan specified EPA Method 1630/1631,
        (2) Analysis of all of the metal analytes outlined in the work plan through a modified Inductively Coupled Plasma Mass Spectrometry (ICP MS) method.

      The benefits of Option 2 were discussed in the meeting (provision of results for all metal constituents) however, the modified method has not yet been approved by EPA. The project team agreed that analysis by ICP MS was the preferred approach. Mary Jo Crance indicated she would discuss the modified method with Larry Skinner (NYSDEC Albany) and confirm that it was acceptable to the NYSDEC. Subsequently, Mary Jo sent an email to the team on June 18, 2010 approving the use of the modified ICP MS method.

    - Samples were collected from the reference wetland (Gordon property) on June 16, 2010. The reference wetland closely resembles the wetlands located at the site from both a physical and taxon distribution perspective. The concern with collection of sufficient benthic tissue sample mass was also recognized at the reference wetland. The project team discussed viable alternatives and options and agreed that the three reference area wetland stations could be composited into one sample for the tissue analysis.

- Possible changes to the field sampling locations were also discussed during the meeting. The project team then adjourned into the field so that the Sediment Quality Triad (SQT) sample locations could be discussed in further detail. The following topics were discussed in the field:

- Sample location SQT -06 was moved to the north due to the lack of standing water in the initially proposed location.
- The SQT -04 sample location was reviewed in the field and the project team discussed moving the sampling location to the west near an area of running water. The group agreed the sample would remain where it was initially proposed in order to better correlate the historical copper and mercury results.
- During sediment sample collection at the SQT-03 location the field technicians noted a sheen and an odor in the sediment (described as a "hydrocarbon like" odor). The project team visited this location and field technicians pulled a macro core sample in the same area; the group observed the sheen and odor. The project team discussed concerns that hydrocarbons may be present in high concentrations and that this could skew the SQT test results by adding an additional stressor. The group agreed to collect a characterization sample (analyzed for semi volatile and volatile organics, sulfide and sulfate by EPA approved methods and fractionated total petroleum hydrocarbons by the Massachusetts method). The results would then be discussed on a conference call with NYSDEC and if the sample contains elevated constituents that could confound the SQT analysis; then the project team and NYSDEC would explore a possible alternative sample location. The project team and NYSDEC identified a viable alternative sample location at sample location 22-31- 1.0. If the characterization results are not elevated the SQT-03 sample will be collected as originally planned. Mary Jo Crance asked that she be contacted (716-989-9655) as soon as the results are available to discuss the sample location decision. Preliminary analytical results from the characterization sample were received and discussed with the Mary Jo Crance on June 23, 2010. Due to concerns over skewing the SQT results and field staff health and safety associated with sample collection in this area (the approved project health and safety plan does not specifically take petroleum hydrocarbons and associated semi volatile and volatile organics into account) all parties agreed to move the SQT sample outside the area with the noted sheen but within the general vicinity of the original SQT-03 location. The sample was collected per the NYSDEC's direction on June 23, 2010.

Mercury Speciation

- Following completion of the field inspection, the project team adjourned back to the meeting room and commenced discussion on the November 2009 Mercury Speciation report. The project team agreed that the weight of evidence indicates that elemental mercury is not present at the site. It was then discussed that there are no viable methods currently available to decisively distinguish between elemental and organic mercury species. Paul Patel noted that he plans to develop a technical memorandum that provides guidance for how to address mercury issues on NYSDEC sites, and that the method would be similar to the approach utilized at the Port Ewen site. Review and approval of this memorandum by NYSDEC senior management will be required which may be delayed due to a current re-structuring effort inside the agency. Ashland and Dyno Nobel offered to provide a detailed discussion of the investigation that has been completed at the Port Ewen site in order to assist Paul in completing his memorandum.

Regulatory Changes

- November 4, 2009 DER-10 Technical Guidance has been finalized.

Groundwater

- The project team agreed that a monitored natural attenuation path was an acceptable long-term end goal for the groundwater issues at the site. Monitoring of the wells will continue under the current program and will be reviewed in the future to assess if the monitoring program can be more effectively and efficiently executed .

Vapor Intrusion

- Dyno Nobel has implemented a plan to reduce the product lines and operations at the site. The plug mold machine building will likely become obsolete in the next 1-2 years. The project team agreed that if the use of the building changes the vapor intrusion program could be re-evaluated. The NYSDEC indicated that the vapor intrusion sampling could be discontinued if:
    - The building was made uninhabitable, which includes disconnecting the utilities and securing all access points to the structure,
    - Provide regular updates to the NYSDEC that the building use has not changed over time; and
    - The plan will ultimately need approval from the Department of Health as well as NYSDEC.
- The project team agreed that future groundwater monitoring reports will include standard language that describes the current and anticipated use of the property. This will address the NYSDEC requirement for regular updates on the plug mold machine building.

Communication and Reporting

- The project team agreed to the following:
    - The June FWIA analytical data will be provided to the NYSDEC with a description of the results but with no interpretation, i.e., a factual report.
    - The project team and NYSDEC will meet in late August to discuss the results of the first round of ecological samples and to address data gaps or redundancies prior to mobilizing to the field to complete the fall sampling event.
    - The project team will meet in November to discuss the results of FWIA Step IIC investigation and to collaboratively interpret and define the data. The goal of the meeting will be to develop consensus on the data interpretation and conclusions of the FWIA Step IIC investigation report.

JUNE 17, 2010 - NYSDEC MEETING

NAME:	COMPANY
FRED JARDINICO	DYNO NOBEL
Andrew Patz	EHS Support Corp
Neal Olsen	Dyno Nobel
Nigel Goulding	EHS Support
John Hoffman	Ashland Inc.
Keith Gruenwald	NYS DEC
Paul Patel	NYS DEC
MJ Crance	NYS DEC

EHS Support
consider it done

MEMO

To: Mary Jo Crance - NYSDEC

From: Nigel Goulding - EHS Support Corp

CC: John Hoffman - Ashland
Neal Olsen - Dyno Nobel
Fred Jardinico - Dyno Nobel
Andrew Patz – EHS Support Corporation
Gary Long – URS

Date: July 9, 2010

Re: Summary of the SQT-3 Characterization Sample Results

Based on the analytical testing completed there appears to be elevated concentrations of petroleum hydrocarbons within sample PE-SQT-SD-03. From observations in the field, the sample comprised a combination of organic matter (fibrous in nature) and some silts. Hydrocarbon sheens were noted in portions of the sample but there was considerable variability through the test cores collected which may contribute to the variability in analytical responses between the different test methods employed.

The following analytical tests were completed on the core samples by Test America:

- Volatile Organic Compounds by method SW846 8260B (Test America Pittsburgh PA)
- Semi-volatile Organic Compounds by method SW846 8270C (Test America Pittsburgh PA)
- Extractable Petroleum Hydrocarbons by the Massachusetts Department Of Environmental Protection (MADEP) method (Test America Westfield MA).

The following Volatile Organic Compounds were detected in the samples tested:

- Carbon disulfide at 4.6J ug/kg
- 1,2,4 Trichlorobenzene at 7.4J ug/kg
- Toluene at 7.9 J ug/kg

No semi-volatile organic compounds were detected in the 8270B analysis however the detection limits were elevated in the test (650ug/kg to 17,000 ug/kg). Due to the presence of other (non-specific) petroleum hydrocarbons in the sample, a 10 fold dilution was likely used and this provided the elevated detection limits.

Nigel Goulding • 4796 Brittonhurst Drive, Hilliard, Ohio 43026
412-977-4474 • nigel.goulding@ehs-support.com • www.ehs-support.com

The presence of other petroleum hydrocarbon compounds was confirmed by the EPH analysis conducted on the sample. Elevated concentrations of aromatic and aliphatic compounds were detected, with the presence of aromatic compounds (post silica gel) indicating that these compounds are likely petrogenic in nature. C11- C22 aromatic's (comprising of PAHs and other undefined ring structures) were detected at a combined concentration of 2,600 mg/kg. Heavy end aliphatic compounds were also detected at high concentrations (13,000 mg/kg).

Based on the chromatogram provided by Test America, these petroleum hydrocarbons cannot be attributed to a defined petroleum source but appear to be heavily weathered in nature and within a range consistent with heating oils and/or emoleum. A more detailed forensic analysis would be needed to better identify the possible type of petroleum product detected.

Considering the testing results discussed, petroleum hydrocarbon compounds are present at high concentrations within the sample collected at PE-SQT-SD-03. The majority of these petroleum hydrocarbons are not identifiable in the more detailed 8260 and 8270 analytical methods and are typically qualified as 'unresolved contaminant mass'. While specific compounds cannot be attributed to this peak in the GC trace, these compounds will likely provide some additional stress to the ecological receptors, either directly via their toxicity and/or indirectly through secondary effects associated with the highly reducing conditions and the production of sulfides. The elevated concentrations of sulfides detected in this sample likely reflects these induced reducing conditions.

TESTAMERICA LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

URS Corporation

Lot #: C0F180425 URS Ashland Port Ewen **Date Reported:** 6/28/10

Project Number: URS PORT EWEN

Client Sample ID: PE-SQT-SD-03

Sample #: 001 Date Sampled: 06/17/10 16:30 Date Received: 06/18/10 Matrix: SOLID

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Volatile Organics by GC/MS					Reviewed
Acetone	ND	98	ug/kg	SW846 8260B	
Benzene	ND	24	ug/kg	SW846 8260B	
Bromodichloromethane	ND	24	ug/kg	SW846 8260B	
Bromoform	ND	24	ug/kg	SW846 8260B	
Bromomethane	ND	24	ug/kg	SW846 8260B	
2-Butanone	ND	24	ug/kg	SW846 8260B	
Carbon disulfide	**4.6 J**	**24**	**ug/kg**	**SW846 8260B**	
Carbon tetrachloride	ND	24	ug/kg	SW846 8260B	
Chlorobenzene	ND	24	ug/kg	SW846 8260B	
Chloroethane	ND	24	ug/kg	SW846 8260B	
Chloroform	ND	24	ug/kg	SW846 8260B	
Chloromethane	ND	24	ug/kg	SW846 8260B	
Cyclohexane	ND	24	ug/kg	SW846 8260B	
Dibromochloromethane	ND	24	ug/kg	SW846 8260B	
1,2-Dibromo-3-chloro-propane	ND	24	ug/kg	SW846 8260B	
1,2-Dibromoethane	ND	24	ug/kg	SW846 8260B	
1,3-Dichlorobenzene	ND	24	ug/kg	SW846 8260B	
1,4-Dichlorobenzene	ND	24	ug/kg	SW846 8260B	
1,2-Dichlorobenzene	ND	24	ug/kg	SW846 8260B	
Dichlorodifluoromethane	ND	24	ug/kg	SW846 8260B	
1,1-Dichloroethane	ND	24	ug/kg	SW846 8260B	
1,2-Dichloroethane	ND	24	ug/kg	SW846 8260B	
1,1-Dichloroethene	ND	24	ug/kg	SW846 8260B	
cis-1,2-Dichloroethene	ND	24	ug/kg	SW846 8260B	
trans-1,2-Dichloroethene	ND	24	ug/kg	SW846 8260B	
1,2-Dichloropropane	ND	24	ug/kg	SW846 8260B	
cis-1,3-Dichloropropene	ND	24	ug/kg	SW846 8260B	
trans-1,3-Dichloropropene	ND	24	ug/kg	SW846 8260B	
Ethylbenzene	ND	24	ug/kg	SW846 8260B	
2-Hexanone	ND	24	ug/kg	SW846 8260B	
Isopropylbenzene	ND	24	ug/kg	SW846 8260B	
Methyl acetate	ND	24	ug/kg	SW846 8260B	
Methylene chloride	ND	24	ug/kg	SW846 8260B	
Methylcyclohexane	ND	24	ug/kg	SW846 8260B	
4-Methyl-2-pentanone	ND	24	ug/kg	SW846 8260B	
Methyl tert-butyl ether	ND	24	ug/kg	SW846 8260B	

(Continued on next page)

TESTAMERICA LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

URS Corporation
URS Ashland Port Ewen
Project Number: URS PORT EWEN

Lot #: C0F180425 **Date Reported:** 6/28/10

Client Sample ID: PE-SQT-SD-03
Sample #: 001 Date Sampled: 06/17/10 16:30 Date Received: 06/18/10 Matrix: SOLID

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Volatile Organics by GC/MS					Reviewed
Styrene	ND	24	ug/kg	SW846 8260B	
1,1,2,2-Tetrachloroethane	ND	24	ug/kg	SW846 8260B	
1,2,4-Trichloro-benzene	**7.4 J**	**24**	**ug/kg**	**SW846 8260B**	
Tetrachloroethene	ND	24	ug/kg	SW846 8260B	
1,1,1-Trichloroethane	ND	24	ug/kg	SW846 8260B	
1,1,2-Trichloroethane	ND	24	ug/kg	SW846 8260B	
Trichloroethene	ND	24	ug/kg	SW846 8260B	
Trichlorofluoromethane	ND	24	ug/kg	SW846 8260B	
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	24	ug/kg	SW846 8260B	
Toluene	**7.9 J**	**24**	**ug/kg**	**SW846 8260B**	
Vinyl chloride	ND	24	ug/kg	SW846 8260B	
Xylenes (total)	ND	73	ug/kg	SW846 8260B	

Results and reporting limits have been adjusted for dry weight.

J Estimated result. Result is less than RL.

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Semivolatile Organic Compounds by GC/MS					Reviewed
Acenaphthene	ND	650	ug/kg	SW846 8270C	
Acenaphthylene	ND	650	ug/kg	SW846 8270C	
Acetophenone	ND	3200	ug/kg	SW846 8270C	
Anthracene	ND	650	ug/kg	SW846 8270C	
Atrazine	ND	3200	ug/kg	SW846 8270C	
Benzo(a)anthracene	ND	650	ug/kg	SW846 8270C	
Benzo(a)pyrene	ND	650	ug/kg	SW846 8270C	
Benzo(b)fluoranthene	ND	650	ug/kg	SW846 8270C	
Benzo(ghi)perylene	ND	650	ug/kg	SW846 8270C	
Benzo(k)fluoranthene	ND	650	ug/kg	SW846 8270C	
Benzaldehyde	ND	3200	ug/kg	SW846 8270C	
1,1'-Biphenyl	ND	3200	ug/kg	SW846 8270C	
bis(2-Chloroethoxy) methane	ND	3200	ug/kg	SW846 8270C	
bis(2-Chloroethyl)-ether	ND	650	ug/kg	SW846 8270C	
bis(2-Ethylhexyl) phthalate	ND	6500	ug/kg	SW846 8270C	

(Continued on next page)

TESTAMERICA LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

URS Corporation

Lot #: C0F180425 URS Ashland Port Ewen **Date Reported:** 6/28/10

Project Number: URS PORT EWEN

Client Sample ID: PE-SQT-SD-03

Sample #: 001 Date Sampled: 06/17/10 16:30 Date Received: 06/18/10 Matrix: SOLID

Semivolatile Organic Compounds by GC/MS — Reviewed

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
4-Bromophenyl phenyl ether	ND	3200	ug/kg	SW846 8270C
Butyl benzyl phthalate	ND	3200	ug/kg	SW846 8270C
Caprolactam	ND	17000	ug/kg	SW846 8270C
Carbazole	ND	650	ug/kg	SW846 8270C
4-Chloroaniline	ND	3200	ug/kg	SW846 8270C
4-Chloro-3-methylphenol	ND	3200	ug/kg	SW846 8270C
2-Chloronaphthalene	ND	650	ug/kg	SW846 8270C
2-Chlorophenol	ND	3200	ug/kg	SW846 8270C
4-Chlorophenyl phenyl ether	ND	3200	ug/kg	SW846 8270C
Chrysene	ND	650	ug/kg	SW846 8270C
Dibenz(a,h)anthracene	ND	650	ug/kg	SW846 8270C
Dibenzofuran	ND	3200	ug/kg	SW846 8270C
3,3'-Dichlorobenzidine	ND	3200	ug/kg	SW846 8270C
2,4-Dichlorophenol	ND	650	ug/kg	SW846 8270C
Diethyl phthalate	ND	3200	ug/kg	SW846 8270C
2,4-Dimethylphenol	ND	3200	ug/kg	SW846 8270C
Dimethyl phthalate	ND	3200	ug/kg	SW846 8270C
Di-n-butyl phthalate	ND	3200	ug/kg	SW846 8270C
4,6-Dinitro-2-methylphenol	ND	17000	ug/kg	SW846 8270C
2,4-Dinitrophenol	ND	17000	ug/kg	SW846 8270C
2,4-Dinitrotoluene	ND	3200	ug/kg	SW846 8270C
2,6-Dinitrotoluene	ND	3200	ug/kg	SW846 8270C
Di-n-octyl phthalate	ND	3200	ug/kg	SW846 8270C
Fluoranthene	ND	650	ug/kg	SW846 8270C
Fluorene	ND	650	ug/kg	SW846 8270C
Hexachlorobenzene	ND	650	ug/kg	SW846 8270C
Hexachlorobutadiene	ND	650	ug/kg	SW846 8270C
Hexachlorocyclopenta-diene	ND	3200	ug/kg	SW846 8270C
Hexachloroethane	ND	3200	ug/kg	SW846 8270C
Indeno(1,2,3-cd)pyrene	ND	650	ug/kg	SW846 8270C
Isophorone	ND	3200	ug/kg	SW846 8270C
2-Methylnaphthalene	ND	650	ug/kg	SW846 8270C
2-Methylphenol	ND	3200	ug/kg	SW846 8270C

(Continued on next page)

TESTAMERICA LABORATORIES, INC.

PRELIMINARY DATA SUMMARY

The results shown below may still require additional laboratory review and are subject to change. Actions taken based on these results are the responsibility of the data user.

URS Corporation

Lot #: C0F180425 | URS Ashland Port Ewen | **Date Reported:** 6/28/10

Project Number: URS PORT EWEN

Client Sample ID: PE-SQT-SD-03

Sample #: 001 Date Sampled: 06/17/10 16:30 Date Received: 06/18/10 Matrix: SOLID

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Semivolatile Organic Compounds by GC/MS					Reviewed
4-Methylphenol	ND	3200	ug/kg	SW846 8270C	
Naphthalene	ND	650	ug/kg	SW846 8270C	
2-Nitroaniline	ND	17000	ug/kg	SW846 8270C	
3-Nitroaniline	ND	17000	ug/kg	SW846 8270C	
4-Nitroaniline	ND	17000	ug/kg	SW846 8270C	
Nitrobenzene	ND	6500	ug/kg	SW846 8270C	
2-Nitrophenol	ND	3200	ug/kg	SW846 8270C	
4-Nitrophenol	ND	17000	ug/kg	SW846 8270C	
N-Nitrosodi-n-propyl-amine	ND	650	ug/kg	SW846 8270C	
N-Nitrosodiphenylamine	ND	3200	ug/kg	SW846 8270C	
2,2'-oxybis (1-Chloropropane)	ND	650	ug/kg	SW846 8270C	
Pentachlorophenol	ND	3200	ug/kg	SW846 8270C	
Phenanthrene	ND	650	ug/kg	SW846 8270C	
Phenol	ND	650	ug/kg	SW846 8270C	
Pyrene	ND	650	ug/kg	SW846 8270C	
2,4,5-Trichloro-phenol	ND	3200	ug/kg	SW846 8270C	
2,4,6-Trichloro-phenol	ND	3200	ug/kg	SW846 8270C	

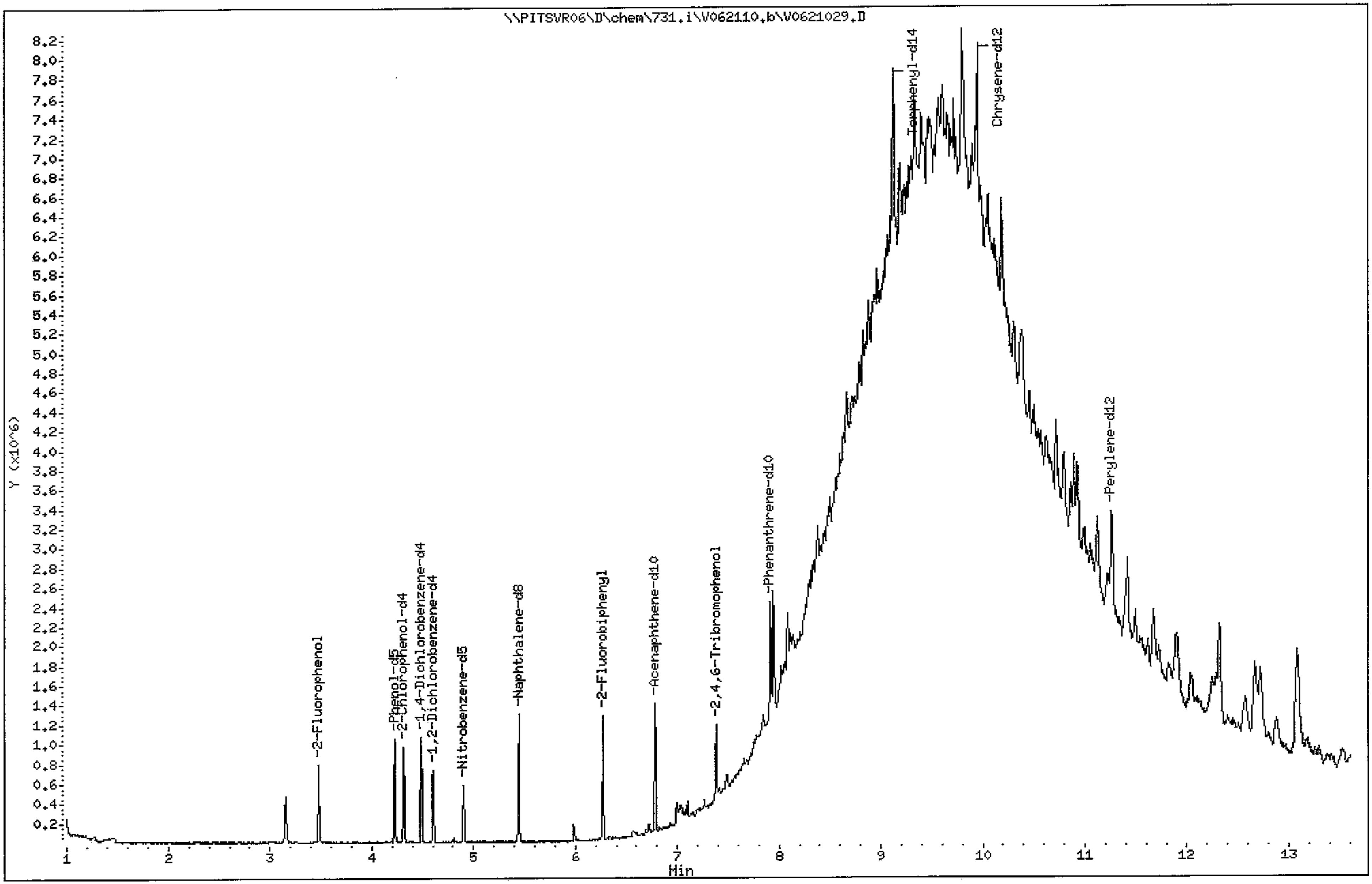
Results and reporting limits have been adjusted for dry weight.

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD	
Inorganic Analysis					Reviewed
Sulfate	**8110**	**48.8**	**mg/kg**	**SW846 9056A**	
Total Residue as Percent Solids	**20.5**	**1.0**	**%**	**SM20 2540G**	
Sulfides, Total 9030B/9034	**823**	**146**	**mg/kg**	**SW846 9030B/9034**	

Results and reporting limits have been adjusted for dry weight.

Data File: \\PITSVR06\D\chem\731.i\V062110.b\V0621029.D
Date : 21-JUN-2010 19:55
Client ID: PE-SQT-SD-03
Sample Info: COF180425-001 X4 6/21/10 soil(0172057)8270c
Volume Injected (uL): 2.0
Column phase: DB5-MS

Instrument: 731.i
Operator: 003200
Column diameter: 0.32



ANALYTICAL REPORT

Job Number: 360-28814-1

Job Description: Laboratory Analysis

For:
TestAmerica Laboratories, Inc.
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238

Attention: Ms. Carrie Gamber

Joseph A. Chimi Jr.

Approved for release.
Joe Chimi
Report Production Representative
6/25/10 3:49 PM

Designee for
Lisa A Worthington
Project Manager II
lisa.worthington@testamericainc.com
06/25/2010

Results relate only to the items tested and the sample(s) as received by the laboratory. The test results in this report meet all NELAC requirements for accredited parameters, exceptions are noted in this report. Pursuant to NELAC, this report may not be reproduced except in full, and with written approval from the laboratory. TestAmerica Westfield Certifications and Approvals: MADEP MA014, RIDOH57, CTDPH 0494, VT DECWSD, NH DES 2539, NELAP FL E87912 TOX, NELAP NJ MA008 TOX, NELAP NY 10843, NY ELAP 10843, North Carolina 647, NELAP PA 68-04386. Field sampling is performed under SOPs WE-FLD-001 and WE-FLD-002.

TestAmerica Laboratories, Inc.
TestAmerica Westfield Westfield Executive Park, 53 Southampton Road, Westfield, MA 01085
Tel (413) 572-4000 Fax (413) 572-3707 www.testamericainc.com

METHOD SUMMARY

Client: TestAmerica Laboratories, Inc. Job Number: 360-28814-1

Description	Lab Location	Method	Preparation Method
Matrix: Solid			
Massachusetts - Extractable Petroleum Hydrocarbons (GC)	TAL WFD	MA DEP MA-EPH	
Microwave Extraction	TAL WFD		SW846 3546
Percent Moisture	TAL WFD	EPA Moisture	

Lab References:

TAL WFD = TestAmerica Westfield

Method References:

EPA = US Environmental Protection Agency

MA DEP = Massachusetts Department Of Environmental Protection

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

METHOD / ANALYST SUMMARY

Client: TestAmerica Laboratories, Inc.   Job Number: 360-28814-1

Method	Analyst	Analyst ID
MA DEP MA-EPH	Sadowski, Scott	SS
EPA Moisture	Kim, Young Ran R	YRK

SAMPLE SUMMARY

Client: TestAmerica Laboratories, Inc. Job Number: 360-28814-1

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
360-28814-1	PE-SQT-SD-03	Solid	06/17/2010 1630	06/18/2010 1020

Ms. Carrie Gamber
TestAmerica Laboratories, Inc.
301 Alpha Drive
RIDC Park
Pittsburgh, PA 15238

Job Number: 360-28814-1

Client Sample ID: **PE-SQT-SD-03**
Lab Sample ID: **360-28814-1**

Date Sampled: 06/17/2010 1630
Date Received: 06/18/2010 1020
Client Matrix: Solid
Percent Solids: 19

Analyte	Result/Qualifier	Unit	RL	Dilution
Method: MA-EPH		Date Analyzed:	06/24/2010 0016	
Prep Method: 3546		Date Prepared:	06/23/2010 1000	
Acenaphthene	ND	mg/Kg	10	2.0
Acenaphthylene	ND	mg/Kg	10	2.0
Anthracene	ND	mg/Kg	10	2.0
Benzo[a]anthracene	ND	mg/Kg	10	2.0
Benzo[a]pyrene	ND	mg/Kg	10	2.0
Benzo[b]fluoranthene	ND	mg/Kg	10	2.0
Benzo[g,h,i]perylene	ND	mg/Kg	10	2.0
Benzo[k]fluoranthene	ND	mg/Kg	10	2.0
Chrysene	ND	mg/Kg	10	2.0
Dibenz(a,h)anthracene	ND	mg/Kg	10	2.0
Fluoranthene	ND	mg/Kg	10	2.0
Fluorene	ND	mg/Kg	10	2.0
Indeno[1,2,3-cd]pyrene	ND	mg/Kg	10	2.0
2-Methylnaphthalene	ND	mg/Kg	10	2.0
Naphthalene	ND	mg/Kg	10	2.0
Phenanthrene	ND	mg/Kg	10	2.0
Pyrene	ND	mg/Kg	10	2.0
C11-C22 Aromatics (unadjusted)	2600	mg/Kg	100	2.0
C11-C22 Aromatics (Adjusted)	2600	mg/Kg	100	2.0
C19-C36 Aliphatics	13000	mg/Kg	100	2.0
C9-C18 Aliphatics	580	mg/Kg	100	2.0
Total EPH	16000	mg/Kg	100	2.0

Surrogate			Acceptance Limits
2-Bromonaphthalene	98	%	40 - 140
2-Fluorobiphenyl	107	%	40 - 140
o-Terphenyl	61	%	40 - 140
1-Chlorooctadecane	60	%	40 - 140

Method: Moisture		Date Analyzed:	06/21/2010 1407	
Percent Moisture	81	%	1.0	1.0

Login Sample Receipt Check List

Client: TestAmerica Laboratories, Inc.

Job Number: 360-28814-1

Login Number: 28814

List Source: TestAmerica Westfield

Creator: Cagan, Marissa

List Number: 1

Question	T / F/ NA	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	3.8C
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	N/A	
If necessary, staff have been informed of any short hold time or quick TAT needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Is the Field Sampler's name present on COC?	True	
Sample Preservation Verified	True	

MEMO

To: Paul Patel - NYSDEC
Mary Jo Crance - NYSDEC
Dan Evans - NYSDEC

From: Andrew Patz - EHS Support Corp

CC: John Hoffman - Ashland
Neal Olsen - Dyno Nobel
Fred Jardinico - Dyno Nobel
Gary Long - URS

Date: October 8, 2010

Re: Summary of the September 15, 2010 Meeting

We appreciate the opportunity to meet with you, Mary Jo Crance, and Dan Evans to discuss the preliminary data generated from the recent Fish and Wildlife Impact Analysis (FWIA) field sampling efforts at Dyno Nobel's Port Ewen, New York facility. A summary of our September 15, 2010 discussions is provided below.

September 15, 2010 Project Meeting

The New York State Department of Environmental Conservation (NYSDEC) and Ashland/ Dyno Nobel (the project team) held a project update meeting on September 15, 2010 at the NYSDEC offices in Albany, New York. The meeting focused on a collaborative review of the preliminary results of the ongoing FWIA effort as well as the data interpretation techniques that will be utilized to better understand the field results.

Attendees/ Project Team:
Paul Patel – NYSDEC
Mary Jo Crance- NYSDEC
Dan Evans - NYSDEC
John Hoffman – Ashland
Fred Jardinico – Dyno Nobel
Gary Long – URS
Nigel Goulding – EHS Support Corp
Andrew Patz - EHS Support Corp

Andrew Patz • 133 Southern Farms Road, Worthington, PA 16262
412-215-7703 • andy.patz@ehs-support.com • www.ehs-support.com

Ecological Assessment Update

The project team reviewed the initial results from the June 2010 sediment quality triad (SQT) sampling; the following items were discussed:

- Surface water sampling
    - No exceedances of the NYSDEC surface water quality standards (SWQS) were noted in the six filtered samples collected at the site.

- Sediment chemistry results
    - Generally, the highest concentrations of metals were noted in or near solid waste management unit (SWMU) 22.
    - The proposed remedial foot print around SWMU 22 tracks well with the identified impacts.
    - Location SQT 8, the down gradient sediment sampling location, contained elevated mercury and copper concentrations.
        - Historic results in the vicinity of this location contained much lower concentrations of mercury and copper.
        - The sample was collected in a fine grained depositional environment.
        - The project team agreed additional review is needed to better understand the implications of this result.

- Preliminary sediment toxicity testing results
    - The SQT 3 location (which was noted to contain and oil like sheen during sample collection efforts in June 2010), was determined to be acutely toxic and was therefore noted as an outlier. The project team agreed additional review of this area is needed, however its location inside the proposed remedial footprint was also noted.
    - Mercury concentrations do not appear to have a direct correlation to toxicity. Mary Jo Crance indicated this result is somewhat expected and toxicity is not the primary assessment endpoint she is interested in for determining mercury impact to the benthic community; her concerns are focused on bioaccumulation.
    - Two metals, lead and selenium, indicate a possible correlation between sediment concentration and toxicity. These metals were typically collocated in the field samples.
        - The project team agreed further evaluation of the lead and selenium relationship is needed to determine the specific risk driver.
        - The team will review the site geochemistry, fraction of organic carbon, soil type, acidity, etc as part of this review.

- Benthic community results
    - URS noted that basic benthic community metrics are generally consistent with the preliminary results of the sediment toxicity testing, particularly at the extremes (e.g., no impacts observed and impacts observed); the project team agreed that the benthic community metrics were a line of evidence in the broader weight of evidence approach.

- URS noted the difference between benthic habitats at SQT stations, specifically locations that were predominantly open water with depositional sediments while others were in Phragmites-dominated habitats with organic root mat substrates. Mary Jo Crance asked that the physical habitat characteristics of each station be noted in the report.
- The project team discussed additional data evaluation techniques- including the potential use of multivariate analysis to better assess the SQT data.

- Fish tissue results
  - Preliminary results of the fish tissue analysis indicate limited risk is posed from the site constituents to this exposure pathway, with the possible exception of selenium; additional evaluation of wildlife ingestion pathways through dose rate modeling is needed to further assess risk to piscivores potentially foraging in the SWMU 1/22 Wetland Complex.
  - Mary Jo Crance expressed concern over the sample size of fish and the elevated mercury concentrations noted in station SQT 8. URS indicated that the forage fish were represented in each reach sampled and that multiple efforts were made to collect piscivorous fish samples however – a limited number of individuals were present in the reaches sampled, particularly at the site and upstream of the site.
  - Mary Jo Crance suggested that additional fish tissue sampling be completed downstream of SQT 8 in order to determine if mercury concentrations in fish tissue are elevated relative to fish tissue samples from the reach downstream of SQT 8. Further sediment sampling downstream of SQT 8 was also requested to identify the downstream extent of elevated mercury concentrations.
  - The team agreed to reconvene via conference call during the week of September 20 to discuss the viability of sampling downstream of SQT 8 and potential sample locations.

- Benthic invertebrate tissue results
  - URS noted a higher proportion of total mercury as inorganic (non-methylated) mercury in benthic invertebrate tissue - potentially due to sediment in the gut tract of the non-depurated tissue samples.
  - Methyl mercury results in all but one benthic invertebrate tissue sample were below the reference value.
  - Other metals showed a general relationship of tissue accumulation with increasing sediment concentration – concentrations in tissues from site samples were consistently greater than concentrations in tissues from reference locations
  - Additional evaluation of wildlife ingestion pathways through dose rate modeling is needed to further assess risk to invertivores potentially foraging in the SWMU 1/22 Wetland Complex.

- SWMU 35 (The Stone Fence Dump)
  - Surface Samples collected at the toe of the dump area indicate metals concentrations are essentially equivalent to background concentrations in the region.

- Site drainage sediment characterization
  - Elevated mercury concentrations were noted at discrete depths in the two site drainage areas.
  - There are no obvious patterns in the mercury concentrations in the site drainage areas, i.e., no horizontal or vertical correlation between sample locations could be determined from the limited number of collected samples. The group agreed that the primary source of mercury in the SWMU 1/22 Wetland Complex is associated with the SMWU1/ 22 however, the site drainages are a relatively minor mercury contributor.

- Bioaccumulation results
  - Earthworms on the southern portion of the site (Grid S-3) contained the higher concentrations of mercury relative to concentrations of mercury in soil.
  - Additional evaluation of wildlife ingestion pathways through dose rate modeling is needed to further assess risk to vermivores (e.g., shrew and robin) potentially foraging in the Active Plant
  - Next steps in understanding the bioaccumulation results will be to evaluate the differences noticed between worm tissue samples collected in the northern and southern portions of the site.
    - One possible factor is the difference in soil type between the two areas.
      - Determine if geochemistry is impacting bioavailability.

- Next steps:
  - As the dose rate models for wildlife receptors are developed, the NYSDEC will be closely involved in order to ensure key model assumptions are understood and agreed to by the project team prior to initiating the model runs.
  - The team agreed that because the site samples were not depurated, the incidental sediment/soil ingestion parameter would not be included in dose rate models; this parameter will be removed to avoid double counting of sediment/soil present in the gut tract of non-depurated tissue samples.
  - The team agreed selenium would be closely evaluated due to its low toxicity reference value (TRV).
  - Mary Jo Crance indicated the NYSDEC derives TRVs from EPA approved databases. Specifically when identifying a no observable adverse effects level (NOAEL) the NYSDEC requires multiple references. Mary Jo will work with Tim Sinnot (NYSDEC toxicologist) to determine the number of species that will need to be represented in the NOAEL assessment and provide feedback to the project team.
  - The project team will work closely in developing the strategy for developing TRVs to ensure both NYSDEC and Dyno Nobel/Ashland are in agreement with the approach.

- A follow up call was held on September 29, 2010 to discuss further evaluation of the mercury concentrations downstream of SQT 8. The project team agreed to the following:
  - Four (4) sediment samples will be collected down gradient of SQT 8, with the most northerly sample being collected just before where the stream crosses Mountain View Road.
  - Sample locations will be targeted to low energy, depositional areas that contain fine-grained sediments. Final sample locations will be determined based on field observations and communicated to the NYSDEC.
  - Sediment samples will be collected from the 0-1 foot below ground (bgs) surface interval as well as from the 1-2 foot bgs interval.
  - The analytical methods and constituents reported will be consistent with the other SQT stations.
  - The samples will be collected as part of the fall SQT sampling event scheduled for mid October, pending site access approval by the property owner. If access is not granted an alternative sampling plan will be developed and discussed with the NYSDEC.
  - The NYSDEC team will be notified via email over the next week as to the final field schedule.
  - Fish tissue sampling locations will be determined based on the results of the proposed sediment samples. Tissue sampling will be completed in June of 2011 to correlate with the fish tissue samples collected in June of 2010.

- Communication and reporting
  - The project team agreed to the following:
    - The fall sampling effort scope will be adjusted based on the project team discussions and decisions during the week of September 20, 2010.
    - A meeting will be held in February 2011 when the fall sampling results have been received to develop consensus on the data interpretation and conclusions of the FWIA Step IIC investigation report.

Port Ewen Site

NYSDEC meeting SEPTEMBER 15, 2010

Attendee:

NAME	Representing
Andrew Patz	Ashland / Dyno Nobel EHS Support Corp
Mary Jo Crance	NYSDEC, DFWMR.
Paul Patel	NYSDEC, DSHM?
Nigel Goulding	EHS Support
John Hoffman	Ashland Inc
Fred Jardinico	Dyno Nobel
Dan Evans	NYSDEC, DSHM
Gary Long	URS

URS Corporation
335 Commerce Drive; Suite 300
Fort Washington, PA 19034
Telephone: (215) 367-2500
Facsimile: (215) 367-1000

MEMORANDUM

TO:	Paul Patel – NYSDEC Mary Jo Crance – NYSDEC DFWMR	DATE:	January 3, 2011
FROM:	Gary Long	PROJECT:	Dyno Nobel Port Ewen Fish and Wildlife Impact Assessment
URS JOB NO.:	19998508 19998509	cc :	John Hoffman (Hercules) Fred Jardinico (Dyno Nobel) Neal Olsen (Dyno Nobel)
SUBJECT:	**Summary of Downstream Sampling Results** **Dyno Nobel Port Ewen Facility** Port Ewen, New York		

Overview

This memorandum presents the results of additional sediment sampling conducted in Plantasie Creek downstream of the SWMU 1/22 Wetland Complex at the Dyno Nobel Port Ewen Facility in Port Ewen, New York. The additional sediment sampling was requested by the New York State Department of Environmental Conservation (NYSDEC) during a meeting on September 15, 2010 to review the preliminary results of the Step IIC Fish and Wildlife Impact Analysis (FWIA) field investigation conducted in June 2010. NYSDEC requested additional sediment sampling downstream of the SWMU 1/22 Wetland Complex to further characterize the concentrations of metals in sediments, particularly mercury, that were elevated at station SQT-08, the farthest downstream sediment quality triad (SQT) station evaluated during the June 2010 FWIA field investigation.

Sampling Approach

Based on discussions with NYSDEC during a conference call on September 29, 2010, four proposed sediment stations (PE-DNS-SD-01 through PE-DNS-SD-04) were established downstream of the SWMU 1/22 Wetland Complex (see attached figure). Sediment depositional features in the vicinity of the proposed sampling locations were targeted for sample collection based on field observations. Samples were collected at each station from 0.0 – 1.0 feet using 2-inch diameter butyrate plastic core liners. At the request of NYSDEC, collection of deeper sediment intervals was attempted at each station; however, recovery of deeper material (1.0 -1.5 feet) was only accomplished at station PE-SD-DNS-01. Samples were analyzed for target metals including cadmium, copper, lead, mercury, selenium, and zinc; additional sediment characterization included total organic carbon (TOC) content and grain size distribution. Sampling at PE-DNS-SD-04 was conducted on October 28, 2010; however, the remaining three stations could not be sampled until November 11, 2010 due to coordination issues with the property owner to gain access to the stream.

Summary of Results

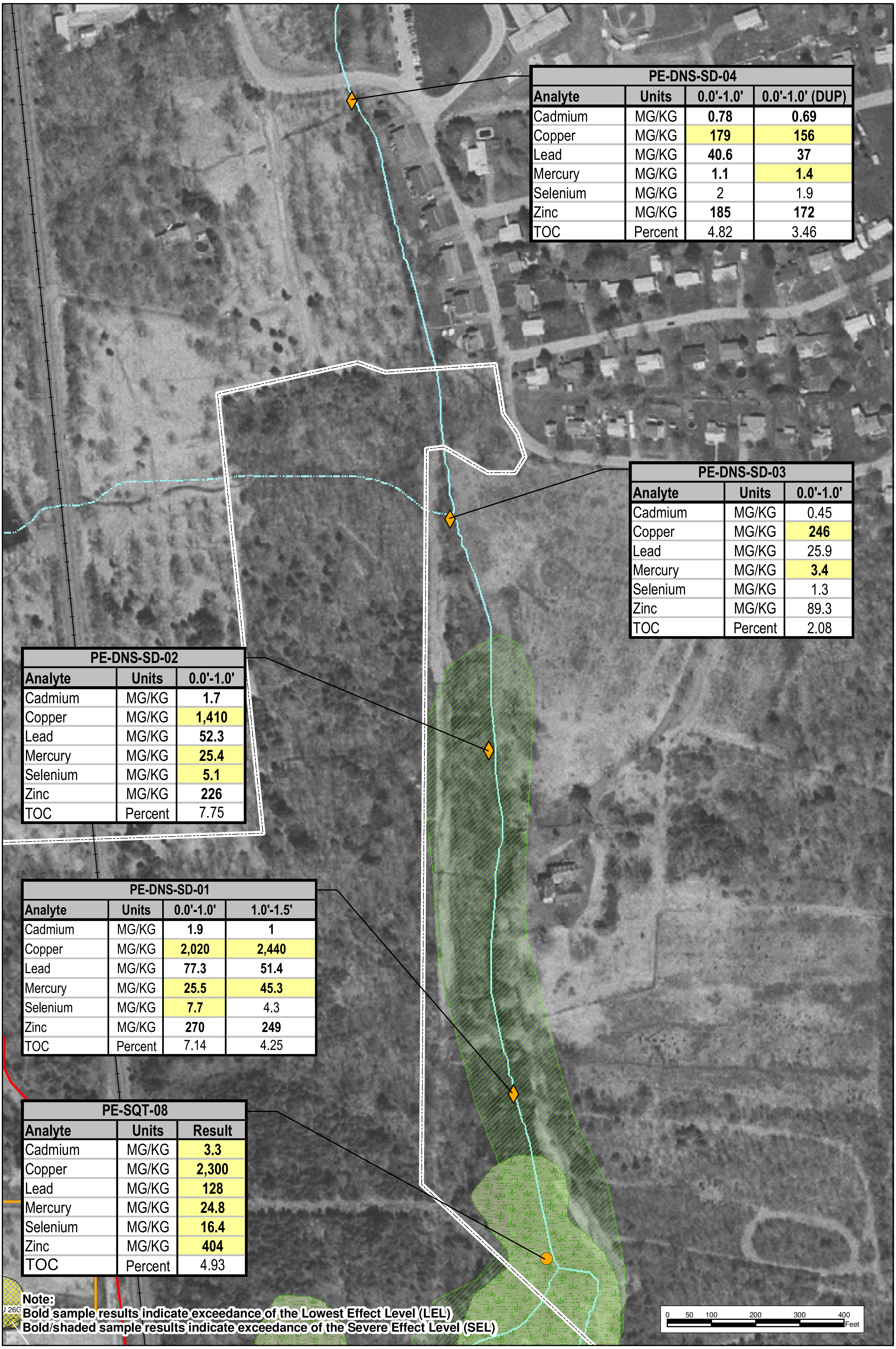
Analytical results of the downstream sediment sampling are presented in Table 1 and posted on the attached figure. For reference, sample results are presented relative to NYSDEC sediment criteria for metals (NYSDEC 1999). Sample results exceeding the lowest effect level (LEL) are presented in bold; results exceeding the severe effects level (SEL) are shaded and bold.

The results of the downstream sediment sampling indicate elevated concentrations of metals, particularly copper and mercury, in the surface interval at the first two downstream stations (PE-DNS-SD-01 and PE-DNS-SD-02). The deeper sediment interval at PE-DNS-SD-01 generally contained comparable concentrations to the surface interval for most metals, with the exception of mercury, which was elevated in the deeper interval relative to the surface interval. Concentrations of metals at PE-DNS-SD-01 and PE-DNS-SD-02 were generally consistent with concentrations observed in the surface interval at station SQT-08. Concentrations of metals, particularly copper and mercury, were substantially lower in sediments at downstream stations PE-DNS-SD-03 and PE-DNS-SD-04 relative to upstream stations.

The distribution of sediment metals in depositional areas downstream of the SWMU 1/22 Wetland Complex is generally consistent with channel morphology and flow conditions. As illustrated in Photos 1 and 2 of the attached photographic log, the reach from SQT-08 to PE-DNS-SD-02 is characterized by a broad channel with limited stream velocity that is consistent with past beaver activity that impeded stream flow. As a result of limited flow, this reach represents a sediment depositional zone where fine-grained sediments have accumulated over time. As illustrated in Photos 3 and 4, the stream channel becomes narrower and the stream banks become more defined at downstream stations PE-DNS-SD-03 and PE-DNS-SD-04. Channel morphology in this downstream reach becomes more variable, with small riffle complexes becoming evident. Due to the change in channel morphology, sediment depositional areas at stations PE-DNS-SD-03 and PE-DNS-SD-04 are limited to the channel margins; the thickness of sediment depositional features is also reduced at these stations relative to the thickness of sediment deposition at upstream stations PE-DNS-SD-01 and PE-DNS-SD-02. Greater concentrations of metals observed at upstream stations PE-DNS-SD-01 and PE-DNS-SD-02 are consistent with a more extensive zone of sediment deposition immediately downstream of the SWMU 1/22 Wetland Complex; lower metals concentrations at stations PE-DNS-SD-03 and PE-DNS-SD-04 are consistent with more limited sediment deposition downstream.

Reference

NYSDEC. 1999. *Technical Guidance for Screening Contaminated Sediments*. NYSDEC, Division of Fish, Wildlife, and Marine Resources. January 25, 1999.



PE-DNS-SD-04

Analyte	Units	0.0'-1.0'	0.0'-1.0' (DUP)
Cadmium	MG/KG	**0.78**	**0.69**
Copper	MG/KG	**179**	**156**
Lead	MG/KG	**40.6**	**37**
Mercury	MG/KG	**1.1**	**1.4**
Selenium	MG/KG	2	1.9
Zinc	MG/KG	**185**	**172**
TOC	Percent	4.82	3.46

PE-DNS-SD-03

Analyte	Units	0.0'-1.0'
Cadmium	MG/KG	0.45
Copper	MG/KG	**246**
Lead	MG/KG	25.9
Mercury	MG/KG	**3.4**
Selenium	MG/KG	1.3
Zinc	MG/KG	89.3
TOC	Percent	2.08

PE-DNS-SD-02

Analyte	Units	0.0'-1.0'
Cadmium	MG/KG	**1.7**
Copper	MG/KG	**1,410**
Lead	MG/KG	**52.3**
Mercury	MG/KG	**25.4**
Selenium	MG/KG	**5.1**
Zinc	MG/KG	**226**
TOC	Percent	7.75

PE-DNS-SD-01

Analyte	Units	0.0'-1.0'	1.0'-1.5'
Cadmium	MG/KG	**1.9**	**1**
Copper	MG/KG	**2,020**	**2,440**
Lead	MG/KG	**77.3**	**51.4**
Mercury	MG/KG	**25.5**	**45.3**
Selenium	MG/KG	**7.7**	4.3
Zinc	MG/KG	**270**	**249**
TOC	Percent	7.14	4.25

PE-SQT-08

Analyte	Units	Result
Cadmium	MG/KG	**3.3**
Copper	MG/KG	**2,300**
Lead	MG/KG	**128**
Mercury	MG/KG	**24.8**
Selenium	MG/KG	**16.4**
Zinc	MG/KG	**404**
TOC	Percent	4.93

Note:
Bold sample results indicate exceedance of the Lowest Effect Level (LEL)
Bold/shaded sample results indicate exceedance of the Severe Effect Level (SEL)

Legend

- New Sediment Sample Location
- SQT STATION
- BIOLOGICAL TISSUE AND SOIL SAMPLING GRID
- RAILROAD
- PERENNIAL STREAM
- INTERMITTENT STREAM
- SWAMP/MARSH
- NYSDEC MAPPED CLASS 2 WETLANDS
- NYSDEC MAPPED CLASS 3 WETLANDS
- APPROXIMATE SWMU/AOC BOUNDARY
- APPROXIMATE SITE BOUNDARY
- APPROXIMATE PROPERTY BOUNDARY

N

OFF-SITE DOWNSTREAM SAMPLING LOCATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NY

DRAFT

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service
- National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

URS
Fort Washington, PA

Q:\GIS_Data\HERCULES\Projects\Figure Active Plant Area Sample Postings.mxd

DRAFT

TABLE 1
SUMMARY OF DOWNSTREAM SAMPLING RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	Minimum Detection	Maximum Detection	PE-DNS-SD-01(0-1.0)	PE-DNS-SD-01(1-1.5)	PE-DNS-SD-02(0-1.0)	PE-DNS-SD-03(0-1.0)	PE-DNS-SD-04(0-1.0)	PE-DNS-SD-04(0-1.0)-DUP
Cadmium	mg/kg	5	5	0.45	1.9	**1.9**	**1**	**1.7 E**	0.45	**0.78**	**0.69**
Copper	mg/kg	5	5	179	2440	**2020**	**2440**	**1410**	**246**	**179**	**156**
Lead	mg/kg	5	5	25.9	77.3	**77.3**	**51.4**	**52.3**	25.9	**40.6**	**37**
Mercury	mg/kg	5	5	1.1	45.3	**25.5**	**45.3**	**25.4**	**3.4**	**1.1**	**1.4**
Selenium	mg/kg	5	5	1.3	7.7	**7.7**	4.3	**5.1 E**	1.3	2	1.9
Zinc	mg/kg	5	5	89.3	270	**270**	**249**	**226**	89.3	**185**	**172**
Percent Fines	%	5	5	84.1	90.9	84.1	84.1	85.9	87.6	90.9	NA
TOC	mg/kg	5	5	20800	77500	71400	42500	77500	20800	48200	34600

Notes:
TOC - Total organic carbon
DUP - Duplicate sample, not included in summary.
E - ICP Serial Dilution percent deviation was greater than 10%
NA - Not analyzed
Bold: Exceeds LEL (See sediment screening criteria table below for LEL values)
Bold/Shade: Exceeds SEL (See sediment screening criteria table below for SEL values)

NYSDEC Sediment Screening Criteria

Metal	LEL (mg/kg)	SEL (mg/kg)
Cadmium	0.6	9
Copper	16	110
Lead	31	110
Mercury	0.15	1.3
Selenium	NS	5[a]
Zinc	120	270

Notes:
LEL - Lowest Effect Level
SEL - Severe Effect Level
NS - No screening value available
a) Nagpal N.K., L.W. Pommen, and L.G. Swain. 1995. Approved and working criteria for water quality. ISBN 0-7726-2522-0. Water Quality Branch. Ministry of Environment, Land and Parks. Victoria, British Columbia.

DRAFT

URS	**PHOTOGRAPHIC LOG**

Client Name:	**Site Location:**	**Project No.**
Dyno Nobel/Ashland	Port Ewen, New York	19998508.00002 19998509.00002

Photo No. 1	**Date:** 11/11/2010

Direction Photo Taken:

S

PE-DNS-SD-01

View: Looking upstream from sampling location PE-DNS-SD-01

PE-SQT-08 is approximately at far extent of view.

Photo No. 2	**Date:** 11/11/2010

Direction Photo Taken:

S

PE-DNS-SD-02

View: Looking upstream from sampling location PE-DNS-SD-02

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Dyno Nobel/Ashland	Port Ewen, New York	19998508.00002 19998509.00002

Photo No.	Date:
3	11/11/2010

Direction Photo Taken:

S

PE-DNS-SD-03

View: Looking upstream from sampling location PE-DNS-SD-03

Photo No.	Date:
4	10/28/2010

Direction Photo Taken:

S

PE-DNS-SD-04

View: Looking upstream at sampling location from bridge at Mountain View Road

MEMO

To: Paul Patel - NYSDEC - DER
Mary Jo Crance - NYSDEC - DFWMR
David Crosby- NYSDEC - DER
Keith Gronwald- DER
Rebecca Quail - NYSDEC - DFWMR

From: Andrew Patz - EHS Support, Inc.

CC: John Hoffman - Ashland
Neal Olsen - Dyno Nobel
Fred Jardinico - Dyno Nobel
Gary Long - URS

Date: March 16, 2011

Re: Summary of the February 24, 2011 Meeting

We appreciate the opportunity to meet with you to discuss the preliminary data generated from the recent Fish and Wildlife Impact Analysis (FWIA) exposure evaluations completed at Dyno Nobel's Port Ewen, New York facility. A summary of our February 24, 2011 discussions is provided below.

February 24, 2011 Project Meeting

The New York State Department of Environmental Conservation (NYSDEC) and Ashland/ Dyno Nobel (the project team) held a project update meeting on February 24, 2011 at the NYSDEC offices in Albany, New York. The meeting focused on a collaborative review of the preliminary results of the FWIA Step IIC Data Analysis. The goal of the meeting was to discuss the results of the data analysis as well as the valuation and conclusions in advance of submitting the Step IIC report; in order to gain consensus on the data evaluation and reduce the administrative burden on both parties in reviewing and responding to multiple submissions of the FWIA report.

Attendees/ Project Team:
Paul Patel - NYSDEC - DER
Mary Jo Crance - NYSDEC - DFWMR
David Crosby– NYSDEC - DER
Keith Gronwald- NYSDEC - DER
Rebecca Quail - NYSDEC - DFWMR
John Hoffman – Ashland
Gary Long – URS

Nigel Goulding – EHS Support, Inc.
Andrew Patz - EHS Support, Inc.

FWIA Step IIC Data Review

The discussion points below are related to the Power Point slides presented during the meeting, the Power Point slide deck is provided on a secure internet site at https://ehs-support.sharefile.com/f/fof6baf5-460a-4b0f-9e35-fa1c3fbef8b8.

- **SWMU 1/22 Exposure Evaluation**
  - Fish Community Evaluation
    - Fish community within the wetland is limited, this may be associated with a lack of open water habitat
      - Mary Jo indicated she would typically expect to see up to 6-12 different species in an un-impacted community and she considered the presence of only three species in the study area a lower result than anticipated.
      - The group agreed that there is uncertainty in this portion of the evaluation as it is difficult to determine if the limited fish community in the wetland is due to the lack of open water habitat or site specific stressors.
    - No risk to fish community was observed based on surface water data and tissue residue information for mercury.
      - The results are below the NYSDEC surface water standards which are derived to be protective of aquatic life.
      - Discussed the conservative approach utilized in the evaluation, as the lowest hardness in the data set was selected for the calculation of hardness-dependent surface water standards.

- **Benthic Invertebrate Community Evaluation**
  - Discussed the evaluation and weighting techniques outlined in the workplan and used in the initial evaluation.
  - After the initial discussion of the SQT results, Mary Jo noted that the literature indicates an antagonistic relationship between mercury (Hg) and selenium (Se). She requested we review the literature and provide a discussion of mercury and selenium antagonism in the report.
  - Mary Jo also noted the potential interactions of multiple other stressors and suggested that multivariate approaches be considered in the data analysis.
  - Mary Jo requested that the Fall 2010 benthic community data be resent to her, she also requested a summary matrix of field parameters in order to compare the Summer and Fall habitat parameters (e.g., water depths) at benthic stations.
  - Sediment Quality Triad (SQT) weight-of-evidence (WOE) indicates impacted benthic communities (primarily toxicity testing) at stations with close proximity to SWMU 1 and SWMU 22 (SQT-3, SQT-4, SQT-5, SQT-6)

- SQT WOE indicates slight or no impacts at SQT-1, SQT-2, SQT-7, and SQT-8
- Mary Jo and Rebecca indicated they need to further review the WOE evaluation to determine if they agree on which stations are impacted.
- The group agreed to work collaboratively to develop an evaluation approach during a series of conference calls that will be scheduled in the next 2-3 weeks.
    - A conference call schedule and dial in number will be provided during the week of February 28, 2011.

- Sediment toxicity testing results are most consistent with concentration gradients of Se and Pb
    - Se and lead (Pb) concentrations at SQT stations are highly correlated (R^2=0.95)
    - Rebecca Quail requested that a comparison similar to the evaluation completed for Se and Pb be provided for all of the metals that were analyzed (e.g., correlation matrix).

- **Semi-Aquatic Wildlife Exposure Evaluation**
    - Discussed the preliminary model run results and the fact that this information may change as we continue to refine the model parameters with Mary Jo – however, the results were provided for discussion and range finding purposes.
        - Mary Jo requested that the width of the corridor around the stream north of the site, utilized to determine the receptor exposure area, be provided.
        - Mary Jo requested that the exposure evaluation also take into account the site drainage ditches after they cross under the railroad tracks on the eastern portion of the site. The group agreed that this information would be calculated and provided to Mary Jo and that its inclusion in the model discussed during the pending conference calls.
    - Greatest risk estimated for tree swallow based on conservative estimate with uncertainty:
        - Assumes 100% area use due to limited foraging range
        - Estimates of concentration in emergent insect prey – not measured
            - <u>Gary indicated</u> he prefers to utilize the aquatic results and apply a correction factor, as all metals concentrations except methyl-mercury, are reduced as the metals bind and remain in the emergent insect's exoskeleton. Mary Jo agreed.
            - David Crosby asked additional questions on the correction factors for several other metals. The correction factors for all of the metal COCs will be provided to the NYSDEC.
    - <u>Potential risk to other receptors are negligible to low based on area use-adjusted doses for the current model.</u>

- **Active Plant Area Exposure Evaluation**
    - Terrestrial Wildlife Exposure Evaluation
        - Discussed the preliminary model run results and the fact that this information may change as we continue to refine the model parameters

with Mary Jo – however, the results were provided for discussion and range finding purposes.
        - Mary Jo indicated that the group will have additional discussions on the home range of certain receptors as well as the No Observable Adverse Effect Level (NOAEL) and Lowest Adverse Effect Level (LOAEL) does utilized for certain metals.
    - Overall- Wildlife risk associated with elevated selenium concentrations in earthworms and small mammal tissues
    - Risks to long-ranging birds (hawk) and mammals (fox) are low to moderate for selenium, but still exceed the estimated LOAEL.
    - For metals other than selenium, risks to long-ranging receptors are negligible ($HQ_{NOAEL} < 1$) for the current model.
    - Northern plant: Generally has greater selenium concentrations in both tissue types relative to the southern grids; potentially associated with burn pads in this section of the plant.
    - Selenium bioaccumulation rates are greater at the site than observed in the literature – more study will be needed to understand this dynamic.
    - NYSDEC raised questions regarding the extent of the reactive soils and the definition disposal area extent. The January 1997 Interim Corrective Measures (ICM) report for Explosives will be provided to the NYSDEC for their files.

- **Additional Site Characterizations**
    - SWMU 35 Perimeter Soil Evaluation
        - No risk associated with metals concentrations in perimeter soils. Rebecca requested the locations of the soil samples be placed on a figure with the topography of the area.
    - On-Site Drainage Sediment Characterization
        - As reviewed in September, sediment results from site drainages indicate potential migration pathways
    - Downstream Sediment Characterization
        - Elevated concentrations of site-related metals (e.g., Hg, Cu) observed in sediments downstream of SWMU 1/22
        - Metals concentrations consistent with sediment depositional patterns which are influenced by channel morphology and water velocity
        - Substantial decrease in metals concentrations between stations DNS-02 and DNS-03 where channel changes from a broad, low velocity wetland stream to a narrower, more defined channel with variable channel features (e.g., riffles)

- **Schedule**
    - David Crosby requested that the group develop a preliminary schedule of key project milestones and deliverables, the following draft schedule is the results of those discussions:

        - FWIA Step IIC Report
            - Report submitted to the NYSDEC by March 31, 2011

- NYSDEC to review and provide comments by late April or early May
- Report is finalized in July 2011

- Site Visit
  - The NYSDEC requested that the project team tour the facility in May or June based on David Crosby and Paul Patel's availability
- Hg Speciation
  - The Hg speciation approach will need to be approved by the NYSDEC prior to the CMS revisions.
- Citizen's Availability Session (CAS)
  - The NYSDEC requested a CAS be planned for the summer of 2011
  - Dyno Nobel and Ashland will work collaboratively with the NYSDEC to develop a fact sheet and site figures that outline the remedial options at the site to the public
  - Per our discussions the meeting will include the following:
    - The meeting will be held locally at a location to be determined at a later date and will include representatives from Dyno Nobel and Ashland as well as the NYSDEC and Department of Health
    - A slideshow will be designed on a "loop" however no formal presentation will be made – the focus will be on addressing public questions and concerns
- Corrective Measures Study (CMS)
  - The CMS will be revised and submitted for NYSDEC review in October 2011
  - Work will begin on the CMS in April after the FWIA report results have been agreed upon
- Statement of Basis
  - Statement of Basis (SoB) will be issued by the NYSDEC in the December 2011
- Remedial Design
  - This phase will be initiated when the SoB is issued
  - This will include the updating of the existing deed restrictions to include a cap maintenance plan for the proposed on site landfill areas as well as the indoor air concerns in the shell house
- Annual Meeting
  - The NYSDEC requested that an annual meeting be held in January or February to discuss annual goals and project schedule

NYSDEC / DYNO Nobel Port Ewen Meeting

2/24/11

ANDY PATZ EHSSUPPORT Corp
Nigel Golding EHS Support
John Hoffman Ashland Inc.
Mary Jo CRANCE - NYSDEC
Keith Gronwald NYSDEC - DER
Rebecca Quail DEC - DFWMR
David Crosby DEC - DER
Paul Patel DEC DER

APPENDIX B

TOXICOLOGICAL EVALUATION OF FRESHWATER SEDIMENT SAMPLES

Ashland Port Ewen Site, New York

42 Day *Hyalella azteca*
Survival, Growth and Reproduction Sediment Toxicity Test

Prepared For:

Test America
301 Alpha Drive
Pittsburgh, Pennsylvania 15238

URS Corporation
335 Commerce Drive, Suite 300
Fort Washington, Pennsylvania 19034

Prepared By:

EnviroSystems, Incorporated
1 Lafayette Road
Hampton, New Hampshire 03842

July 2010
Reference Number 19820-10-07

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TOXICOLOGICAL EVALUATION
OF FRESHWATER SEDIMENT SAMPLES

Ashland Port Ewen Site, New York
42 Day *Hyalella azteca*
Survival, Growth and Reproduction Sediment Toxicity Test

1.0 INTRODUCTION

This report presents the results of chronic exposure partial life cycle toxicity tests conducted on sediment samples collected from the Ashland Port Ewen project site located in New York. Samples were provided by URS Corporation, Fort Washington, Pennsylvania. Testing was based on programs and protocols developed by the ASTM (2009) and US EPA (2000). The toxicity of the samples was assessed by conducting survival, growth and reproduction tests using the freshwater amphipod, *Hyalella azteca*. Toxicity tests and supporting analyses were performed at EnviroSystems, Incorporated (ESI), Hampton, New Hampshire.

Toxicity tests expose groups of organisms to environmental samples, a laboratory control and field reference sites for a specified period to assess potential impacts on a variety of endpoints, such as survival, growth or reproduction. Analysis of variance techniques are used to determine the relative toxicity of the samples as compared to the laboratory control and/or field reference sites. Endpoints for this study included survival (measured on days 28, 35 and 42), growth (measured on days 28 and 42, as mean dry weight and mean dry biomass), reproduction (measured on days 35 and 42 as juvenile production per surviving amphipod and day 42 as juveniles per surviving female amphipod).

2.0 MATERIALS AND METHODS

2.1 General Methods, Biological Evaluations

Toxicological and analytical protocols used in this program follow procedures outlined in *Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates* (ASTM Method E 1706-05, 2009), *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates* (US EPA 2000) and *Standard Methods for the Examination of Water and Wastewater*, 20th Edition (APHA 1998). These protocols provide standard approaches for physical and chemical analysis and for the evaluation of toxicological effects of sediments on aquatic invertebrates.

2.2 Test Species

H. azteca were obtained from Aquatic Research Organisms, Hampton, New Hampshire. Organisms used in the 42 day exposure assay were approximately 7 days old at the start of the assay.

2.3 Test Samples and Laboratory Control Sediment

Sediment samples collected from the Ashland Port Ewen project site were received at ESI under chain of custody. Once received, samples were inspected to determine integrity, given unique sample numbers and logged into the laboratory sample management database. Once logged in, the samples were placed in a secure refrigerated, 2 - 4 °C, storage area. A listing of sample sites, sample collection, and receipt information is summarized in Table 1.

The control substrate was an artificial sediment prepared according to guidance presented in the EPA/ASTM method. Organic detritus from Chironomid cultures plus disintegrated paper pulp was used to provide organic content. Overlying water for the sediment toxicity tests was a mixture of natural surface water, collected from the upper portion of the Taylor River watershed in Hampton Falls, New Hampshire, and moderately hard reconstituted water. Use of natural surface water mixed with artificial reconstituted water is recommended by the protocol (EPA 2000, ASTM 2009).

2.4 *Hyalella azteca* Survival and Growth Toxicity Tests

Prior to test initiation, test sediments were homogenized under a nitrogen atmosphere. Sediments were placed in test vessels and overlying water was immediately added. The vessels were left undisturbed overnight to stabilize. The chambers received one volume addition daily until organisms were added.

Test vessels were 400 mL glass beakers containing 100 mL of sediment and approximately 250 mL of overlying water. Test vessels were drilled at a consistent height above their bases and the hole covered with Nytex® screen. The screened hole facilitates water exchange while retaining test organisms. Vessels were maintained in a water bath during the test. Depth of the water in the bath was set below the drain hole in the test vessel to eliminate flow of water from the bath into the test vessel. Test chambers were randomly placed in the water bath after addition of test sediments. Placement locations were generated by the CETIS® software program. The randomization work sheets are included in the data appendix. The water bath was maintained in a limited access, temperature controlled room. Temperatures in the room and water bath were independently set at a temperature of 23°C. Temperature was recorded on an hourly frequency using a temperature logger placed in a surrogate vessel. The photoperiod in the test chamber was set at 16:8 hour light:dark. Lighting was supplied by cool white florescent bulbs.

A total of 10 amphipods were randomly selected from the pool of organisms and added to each treatment. Each treatment group included 12 replicates and a surrogate test chamber that was used to obtain water qualities during the assay without disturbing the test animals. The surrogate chamber was treated the same as actual test chambers with the addition of animals and food, but was not used to determine endpoint data.

Prior to the daily overlying water renewal, dissolved oxygen, pH, specific conductance and temperature were measured in the surrogate chamber for each treatment. Overlying water in each replicate was then renewed. The volume of water added to each test chamber was approximately two volumes. Water exchanges were facilitated by use of a distribution system designed to provide equal, regulated flow to each chamber. The system was activated manually by the addition of water during the assay. After overlying water renewal each replicate was fed 1.0 mL of a yeast/trout chow/alfalfa suspension. Alkalinity, ammonia and hardness of the overlying water were measured on days 0, 7, 14, 21, 28, 35 and 42. The total organic carbon of the overlying water was measured on days 0 and 28. Additionally the pore water was sampled at the start and end of the assay to determine ammonia levels. Water quality records are available in Appendix A.

After 28 days exposure, all replicates of each test treatment were terminated to collect data for initial survival. Each test chamber was gently swirled to loosen the sediments and the test material was dumped into a stainless steel sieve. The sediments were washed through the sieve using freshwater and material left on the screen was sorted to recover the organisms. This process was continued until the entire sample was evaluated.

Surviving amphipods from 4 replicates identified for day 28 survival and growth analysis were counted and placed on tared weighing pans. Pans were dried overnight at 104°C to obtain dry weight to the nearest 0.01 mg. The mean dry weight of surviving organisms was determined to assess growth.

Surviving amphipods from the remaining 8 replicates were enumerated and then returned to test chambers, filled with a 50:50 mix of natural surface water and moderately hard reconstituted water. The test vessels were returned to the water bath for the additional 14 day exposure. During this period, water quality monitoring, water exchanges and feeding were conducted in the same manner as during the initial 28 day exposure. Survival and juvenile counts were recorded on Days 35 and 42, in the remaining eight replicates of each test treatment. Growth, measured as dry weight and dry biomass, was determined on Day 42.

2.5 Statistical Analysis

Survival, growth and reproduction were analyzed using CETIS® software to determine significant differences between the test sediments and both the laboratory control and reference site sediments. Data sets were evaluated to determine normality of distribution and homogeneity of sample variance. Data sets were subsequently evaluated using the appropriate parametric or non-parametric Analysis of Variance

(ANOVA) statistic. Statistical comparisons were made for the following endpoints; survival on days 28, 35 and 42; dry weight and dry biomass on days 28 and 42; juveniles produced per surviving amphipod on days 35 and 42; and juveniles produced per surviving female amphipod on day 42. Pair-wise comparisons were made using the appropriate statistical evaluation. Statistical difference was evaluated at α=0.05.

2.6 Quality Control

As part of the laboratory quality control program, reference toxicant evaluations are conducted by ESI on a regular basis for each test species. These results provide relative health and response data while allowing for comparison with historic data sets. Results are summarized in Table 2.

2.7 Protocol Deviations

Review of data generated during the 42-Day exposure period documented the following protocol deviations.

There were a few replicates that had more than 10 animals added to test vessels at the assay start.

The temperature data logger for the assay was pulled on Day 8 on 07/22/10 and was not replaced until Day 12 on 07/26/10, resulting in a loss of 4 days of hourly temperature readings. According to ESI's SOP and the method described in the ASTM (2009), temperature should be monitored hourly during the assay. Since this is described as a "should" statement and not a "must" statement, the data remains valid. Additionally, water qualities observed during this time were within protocol limits and conditions in the laboratory remained consistent. It is likely that readings during the four days would have been similar to those observed during the remainder of the assay.

There were some instances when the observed survival counts on Day 35 were lower than counts on Day 42. Since the observations are made while the animals are swimming in the test chamber, it was assumed that the lower count made on Day 35 was not accurate and these counts were corrected to reflect the actual number alive.

It is the opinion of ESI's study director that these deviations did not adversely affect the outcome of the assay.

TABLE 1. Summary of Sample Collection Information. Ashland Port Ewen Site, New York. July 2010.

			Sample Collected		Sample Received	
Field ID	ESI Code	Designation	Date	Time	Date	Time
PE-SQT-09	19820-008	reference	06/16/10	1000	06/18/10	1330
PE-SQT-10	19820-009	reference	06/16/10	1300	06/18/10	1330
PE-SQT-11	19820-010	reference	06/16/10	1600	06/18/10	1330
PE-SQT-01	19820-001	test	06/14/10	1645	06/16/10	1100
PE-SQT-02	19820-002	test	06/15/10	1315	06/16/10	1100
PE-SQT-05	19820-003	test	06/15/10	1600	06/16/10	1100
PE-SQT-06	19820-004	test	06/15/10	1000	06/16/10	1100
PE-SQT-04	19820-005	test	06/17/10	1415	06/18/10	1330
PE-SQT-07	19820-006	test	06/17/10	1200	06/18/10	1330
PE-SQT-08	19820-007	test	06/17/10	0830	06/18/10	1330
PE-SQT-03	19820-011	test	06/23/10	1430	06/24/10	1100

Table 2. Reference Toxicant Evaluation. Ashland Port Ewen Site, New York. July 2010.

Date	Endpoint		Value	Historic Mean/ Central Tendency	Acceptable Range	Reference Toxicant
Hyalella azteca						
08/26/10	Survival	LC-50	0.0265	0.0100	0.000 - 0.051	Cadmium (mg/L)

3.0 RESULTS AND DISCUSSION

3.1 Laboratory Control and Project Reference Site Performance

At the end of the 28 day exposure period, mean survival in laboratory control sediment was 87.5% with a coefficient of variation (CV) of 18.95%. Amphipods recovered from laboratory control sediment had a mean dry weight of 0.443 mg/amphipod, with a CV of 43.24%. The dry weight of a representative group of amphipods at the start of the assay was 0.016 mg/individual. The minimum test acceptability criteria for survival in the laboratory control is ≥80%. The minimum acceptable criteria for growth is a demonstration of increased dry weight after 28 days exposure. The minimum acceptable criteria for reproduction is a demonstration of juvenile production. These criteria were met indicating that the organisms were healthy and not stressed by handling and that the overlying water did not adversely impact the results of the assay. Table 3 provides a summary of assay acceptability criteria and laboratory control achievement. Table 4 summarizes the reference site performance.

During daily water quality observations the temperature recorded for the assay had a mean value of 23.23°C with a range of 21.23 to 24.75°C. Confirmation temperature data collected in a surrogate replicate documented a mean temperature of 23.5°C with a range of 21.2 to 25.5°C. Test acceptability criteria requires a mean temperature of 23±1°C, with maximum temporary fluctuations of 23±3°C.

Table 3. Summary of Acceptable Endpoints and Measurements. Ashland Port Ewen Site, New York. July 2010.

Endpoint / Measurement	Protocol Criteria		Study 19881
Survival	lab mean ≥ 80%	Mean Survival %	87.5%
		Protocol Met	Yes
Growth	Measured Growth	start dry wt. (mg)	0.016
		end dry wt. (mg)	0.443
		Protocol Met	Yes
Reproduction	juveniles produced in lab	day 35 j / amphipod	0.439
		day 42 j / amphipod	4.605
		Protocol Met	Yes
Temperature	mean: 23°±1°C	daily / hourly	23.23 / 23.5
	minimum: 20°C	daily / hourly	21.23 / 21.2
	maximum: 26°C	daily / hourly	24.75 / 25.5
		Protocol Met	Yes / Yes

Table 4. Summary of Project Reference Site Performance. Ashland Port Ewen Site, New York. July 2010.

		Mean Percent Survival			Mean Dry Weight (mg)		Mean Dry Biomass (mg)		Juveniles per Surviving Amphipod		Juveniles per Surviving Female
Field ID	ESI Code	Day 28	Day 35	Day 42	Day 28	Day 42	Day 28	Day 42	Day 35	Day 42	Day 42
PE-SQT-09	19820-008	83.33	76.25	76.25	0.507	0.839	0.418	0.615	0.851	4.957	6.667
PE-SQT-10	19820-009	80.00	73.75	72.50	0.565	0.749	0.469	0.537	0.313	3.027	5.682
PE-SQT-11	19820-010	80.83	80.00	76.25	0.504	0.776	0.409	0.578	0.808	3.601	5.862

3.2 Summary

This program utilized protocols developed by the U.S. EPA and ASTM to assess the potential toxicological impacts that exposure to sediments from the Ashland Port Ewen project site would have on freshwater invertebrates. Table 5 provides a summary of sample sites that demonstrated a negative effect, based on the finding of statistically significant reduction in an endpoint as compared to the laboratory control or reference site. Tables 6 through 15 provide summaries of assay endpoints and detailed statistical results for each sample location. Table 16 summarizes overlying water qualities measured during the test. Laboratory bench sheets, detailed summaries of survival, dry weights, emergence and associated statistical support data are included in Appendix A.

Table 5. Summary of Significant Endpoints. Ashland Port Ewen Site, New York. July 2010.

Finding of Significant Difference(s) between Project Sites and

		Lab Control (19820-000)										PE-SQT-09 (19820-008)										PE-SQT-10 (19820-009)										PE-SQT-11 (19820-010)										Composite Ref (19820-099)									
		survival			dry wt		dry bio.		juveniles per surviving			survival			dry wt		dry bio.		juveniles per surviving			survival			dry wt		dry bio.		juveniles per surviving			survival			dry wt		dry bio.		juveniles per surviving			survival			dry wt		dry bio.		juveniles per surviving		
									♂♀		♀								♂♀		♀								♂♀		♀								♂♀		♀								♂♀		♀
Field ID	ESI Code	day 28	day 35	day 42	day 28	day 42	day 28	day 42	day 35	day 42	day 42	day 28	day 35	day 42	day 28	day 42	day 28	day 42	day 35	day 42	day 42	day 28	day 35	day 42	day 28	day 42	day 28	day 42	day 35	day 42	day 42	day 28	day 35	day 42	day 28	day 42	day 28	day 42	day 35	day 42	day 42	day 28	day 35	day 42	day 28	day 42	day 28	day 42	day 35	day 42	day 42
PE-SQT-09	19820-008																																																		
PE-SQT-10	19820-009																																																		
PE-SQT-11	19820-010																																																		
PE-SQT-01	19820-001	X	X	X				X	X	X	X	X	X	X		X		X	X	X	X	X	X	X		X		X			X	X	X	X		X		X	X	X	X	X	X	X		X	X	X	X	X	X
PE-SQT-02	19820-002	X	X							X	X	X				X	X	X	X	X	X	X				X	X	X		X	X	X	X			X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
PE-SQT-05	19820-003	X	X	X			X	X	X			X	X	X			X	X	X			X	X	X			X	X				X	X	X			X	X	X			X	X	X			X	X	X	X	
PE-SQT-06	19820-004	X	X	X	X		X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X	X
PE-SQT-04	19820-005	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X
PE-SQT-07	19820-006	X					X			X					X	X	X	X		X					X		X								X		X	X	X			X			X	X	X	X		X	X
PE-SQT-08	19820-007	X																																								X					X				
PE-SQT-03	19820-011	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

4.0 REFERENCES

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Table 6. Day 28 *Hyalella azteca* Survival Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.

Day 28 Survival Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	12	87.50%	50.0%	100.0%	18.95%
PE-SQT-09	19820-008	12	83.33%	50.0%	100.0%	20.04%
PE-SQT-10	19820-009	12	80.00%	40.0%	100.0%	18.46%
PE-SQT-11	19820-010	12	80.83%	60.0%	100.0%	15.34%
Comp Ref	19820-099	36	81.67%	40.0%	100.0%	17.92%
PE-SQT-01	19820-001	12	61.67%	20.0%	90.0%	34.46%
PE-SQT-02	19820-002	12	64.17%	10.0%	90.0%	33.53%
PE-SQT-05	19820-003	12	9.17%	0.0%	40.0%	135.30%
PE-SQT-06	19820-004	12	35.00%	0.0%	90.0%	78.48%
PE-SQT-04	19820-005	12	25.83%	10.0%	60.0%	68.97%
PE-SQT-07	19820-006	12	70.83%	30.0%	100.0%	28.53%
PE-SQT-08	19820-007	12	70.83%	30.0%	100.0%	29.16%
PE-SQT-03	19820-011	12	0.00%	0.0%	0.0%	0.00%

Day 28 Survival Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	87.50%	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	83.33%	0.2531	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	80.00%	0.0862	No	0.2539	No	-	-	-	-	-	-
PE-SQT-11	19820-010	80.83%	0.1051	No	0.2977	No	0.5650	No	-	-	-	-
Comp Ref	19820-099	81.67%	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	61.67%	0.0009	Yes	0.0041	Yes	0.0098	Yes	0.0065	Yes	0.0004	Yes
PE-SQT-02	19820-002	64.17%	0.0021	Yes	0.0089	Yes	0.0072	Yes	0.0148	Yes	0.0019	Yes
PE-SQT-05	19820-003	9.17%	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes
PE-SQT-06	19820-004	35.00%	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes
PE-SQT-04	19820-005	25.83%	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes
PE-SQT-07	19820-006	70.83%	0.0144	Yes	0.0518	No	0.1200	No	0.0926	No	0.0303	Yes
PE-SQT-08	19820-007	70.83%	0.0164	Yes	0.0569	No	0.1294	No	0.1010	No	0.0337	Yes
PE-SQT-03	19820-011	0.00%	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes

Table 7. Day 35 *Hyalella azteca* Survival Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.

Day 35 Survival Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	8	75.00%	10.0%	100.0%	39.04%
PE-SQT-09	19820-008	8	76.25%	30.0%	100.0%	28.85%
PE-SQT-10	19820-009	8	73.75%	30.0%	100.0%	29.83%
PE-SQT-11	19820-010	8	80.00%	60.0%	100.0%	18.90%
Comp Ref	19820-099	24	76.67%	30.0%	100.0%	25.12%
PE-SQT-01	19820-001	8	43.75%	10.0%	70.0%	48.78%
PE-SQT-02	19820-002	8	63.75%	40.0%	80.0%	25.07%
PE-SQT-05	19820-003	8	8.75%	0.0%	40.0%	155.00%
PE-SQT-06	19820-004	8	30.00%	0.0%	80.0%	77.66%
PE-SQT-04	19820-005	8	25.00%	0.0%	60.0%	82.81%
PE-SQT-07	19820-006	8	71.25%	20.0%	100.0%	35.54%
PE-SQT-08	19820-007	8	71.25%	40.0%	100.0%	29.48%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 35 Survival Statistical Analysis			Statistically Significant Difference (less than) as Compared to				
			Lab Control (19820-000)	PE-SQT-09 (19820-008)	PE-SQT-10 (19820-009)	PE-SQT-11 (19820-010)	Composite Ref (19820-099)
Field ID	ESI Code	Mean	p Value	p Value	p Value	p Value	p Value
Lab Control	19820-000	75.00%	- -	- -	- -	- -	- -
PE-SQT-09	19820-008	76.25%	0.5230 No	- -	- -	- -	- -
PE-SQT-10	19820-009	73.75%	0.4498 No	0.4124 No	- -	- -	- -
PE-SQT-11	19820-010	80.00%	0.6395 No	0.6442 No	0.7284 No	- -	- -
Comp Ref	19820-099	76.67%	- -	- -	- -	- -	- -
PE-SQT-01	19820-001	43.75%	0.0147 Yes*	0.0043 Yes	0.0071 Yes	0.0010 Yes	0.0002 Yes
PE-SQT-02	19820-002	63.75%	0.1525 No* 0.0085 Yes*	0.0844 No	0.1302 No	0.0252 Yes	0.0403 Yes
PE-SQT-05	19820-003	8.75%	<0.0001 Yes	<0.0001 Yes	<0.0001 Yes	<0.0001 Yes	<0.0001 Yes
PE-SQT-06	19820-004	30.00%	0.0028 Yes	0.0007 Yes	0.0011 Yes	0.0002 Yes	<0.0001 Yes
PE-SQT-04	19820-005	25.00%	0.0010 Yes	0.0002 Yes	0.0003 Yes	<0.0001 Yes	<0.0001 Yes
PE-SQT-07	19820-006	71.25%	0.3807 No	0.3358 No	0.4144 No	0.2136 No	0.2648 No
PE-SQT-08	19820-007	71.25%	0.3822 No	0.3326 No	0.4175 No	0.1999 No	0.2667 No
PE-SQT-03	19820-011	0.00%	<0.0001 Yes	<0.0001 Yes	<0.0001 Yes	<0.0001 Yes	<0.0001 Yes*

Note: "NS" Indicates No Survivors.

"*" Indicates cases where a statistical outlier was detected and statistical comparisons were made with and without the outlier. Instances where the calculated p Value resulted in a different finding with respect to rejection, both p values are presented.

Table 8. **Day 42 *Hyalella azteca* Survival Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.**

Day 42 Survival Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	8	68.86%	10.0%	100.0%	42.25%
PE-SQT-09	19820-008	8	76.25%	30.0%	100.0%	28.85%
PE-SQT-10	19820-009	8	72.50%	30.0%	100.0%	31.06%
PE-SQT-11	19820-010	8	76.25%	60.0%	100.0%	20.96%
Comp Ref	19820-099	24	75.00%	30.0%	100.0%	26.08%
PE-SQT-01	19820-001	8	38.75%	10.0%	70.0%	52.41%
PE-SQT-02	19820-002	8	63.75%	40.0%	80.0%	25.07%
PE-SQT-05	19820-003	8	8.75%	0.0%	40.0%	155.00%
PE-SQT-06	19820-004	8	28.75%	0.0%	80.0%	81.97%
PE-SQT-04	19820-005	8	22.50%	0.0%	60.0%	88.09%
PE-SQT-07	19820-006	8	66.25%	10.0%	100.0%	41.88%
PE-SQT-08	19820-007	8	68.75%	30.0%	100.0%	37.64%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 42 Survival Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	68.86%	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	76.25%	0.7079	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	72.50%	0.6078	No	0.3755	No	-	-	-	-	-	-
PE-SQT-11	19820-010	76.25%	0.7145	No	0.4946	No	0.6289	No	-	-	-	-
Comp Ref	19820-099	75.00%	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	38.75%	0.0169	Yes	0.0016	Yes	0.0036	Yes	0.0008	Yes	0.0001	Yes
PE-SQT-02	19820-002	63.75%	0.3025	No*	0.0844	No	0.1593	No	0.0651	No	0.0637	No
PE-SQT-05	19820-003	8.75%	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes
PE-SQT-06	19820-004	28.75%	0.0055	Yes	0.0006	Yes	0.0012	Yes	0.0003	Yes	<0.0001	Yes
PE-SQT-04	19820-005	22.50%	0.0014	Yes	<0.0001	Yes	0.0002	Yes	<0.0001	Yes	<0.0001	Yes
PE-SQT-07	19820-006	66.25%	0.4210	No	0.2156	No	0.3068	No	0.2056	No	0.1667	No
PE-SQT-08	19820-007	68.75%	0.5249	No	0.3047	No	0.4130	No	0.2975	No	0.2851	No
PE-SQT-03	19820-011	0.00%	<0.0001	Yes*	0.0001	Yes*	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes

Note: "NS" Indicates No Survivors.

"*" Indicates cases where a statistical outlier was detected and statistical comparisons were made with and without the outlier. Instances where the calculated p Value resulted in a different finding with respect to rejection, both p values are presented.

Table 9. Day 28 *Hyalella azteca* Growth, Dry Weight, Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.

Day 28 Dry Weight Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	4	0.443	0.197	0.610	43.24%
PE-SQT-09	19820-008	4	0.507	0.478	0.520	3.89%
PE-SQT-10	19820-009	4	0.565	0.444	0.696	19.00%
PE-SQT-11	19820-010	4	0.504	0.375	0.574	17.52%
Comp Ref	19820-099	12	0.525	0.375	0.696	15.02%
PE-SQT-01	19820-001	4	0.430	0.161	0.700	54.60%
PE-SQT-02	19820-002	4	0.444	0.341	0.533	18.57%
PE-SQT-05	19820-003	4	0.493	0.415	0.570	22.25%
PE-SQT-06	19820-004	4	0.095	0.077	0.112	18.19%
PE-SQT-04	19820-005	4	0.209	0.098	0.360	58.99%
PE-SQT-07	19820-006	4	0.345	0.313	0.394	10.00%
PE-SQT-08	19820-007	4	0.485	0.362	0.650	24.85%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 28 Dry Weight Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	0.443	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	0.507	0.7229	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	0.565	0.8449	No	0.8346	No	-	-	-	-	-	-
PE-SQT-11	19820-010	0.504	0.7086	No	0.4771	No	0.2090	No	-	-	-	-
Comp Ref	19820-099	0.525	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	0.430	0.4666	No	0.2794	No	0.1680	No	0.2871	No	0.2413	No
PE-SQT-02	19820-002	0.444	0.5029	No	0.0934	No	0.0621	No	0.1779	No	0.0491	Yes
PE-SQT-05	19820-003	0.493	0.6203	No	0.3939	No	0.2419	No	0.4468	No	0.3056	No
PE-SQT-06	19820-004	0.095	0.0140	Yes	<0.0001	Yes	0.0004	Yes	0.0003	Yes	<0.0001	Yes
PE-SQT-04	19820-005	0.209	0.0428	Yes	0.0015	Yes	0.0024	Yes	0.0040	Yes	<0.0001	Yes
PE-SQT-07	19820-006	0.345	0.1773	No	<0.0001	Yes	0.0040	Yes	0.0077	Yes	0.0003	Yes
PE-SQT-08	19820-007	0.485	0.6373	No	0.3638	No	0.1798	No	0.4011	No	0.2224	No
PE-SQT-03	19820-011	NS	-	-	-	-	-	-	-	-	-	-

Note: "NS" Indicates No Survivors.

Table 10. Day 28 *Hyalella azteca* Growth, Dry Biomass, Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.

Day 28 Biomass Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	4	0.369	0.197	0.488	33.31%
PE-SQT-09	19820-008	4	0.418	0.364	0.516	16.25%
PE-SQT-10	19820-009	4	0.469	0.355	0.626	24.72%
PE-SQT-11	19820-010	4	0.409	0.375	0.459	9.69%
Comp Ref	19820-099	12	0.432	0.355	0.626	18.11%
PE-SQT-01	19820-001	4	0.313	0.129	0.490	49.13%
PE-SQT-02	19820-002	4	0.234	0.042	0.336	57.64%
PE-SQT-05	19820-003	4	0.035	0.000	0.083	119.40%
PE-SQT-06	19820-004	4	0.038	0.000	0.067	78.82%
PE-SQT-04	19820-005	4	0.054	0.012	0.129	95.26%
PE-SQT-07	19820-006	4	0.205	0.169	0.250	16.45%
PE-SQT-08	19820-007	4	0.308	0.136	0.585	65.68%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 28 Biomass Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	0.369	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	0.418	0.7453	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	0.469	0.8594	No	0.7607	No	-	-	-	-	-	-
PE-SQT-11	19820-010	0.409	0.7184	No	0.4062	No	0.1807	No	-	-	-	-
Comp Ref	19820-099	0.432	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	0.313	0.2950	No	0.1286	No	0.0782	No	0.1372	No	0.0286	Yes
PE-SQT-02	19820-002	0.234	0.0952	No	0.0254	Yes	0.0193	Yes	0.0240	Yes	0.0013	Yes
PE-SQT-05	19820-003	0.035	0.0011	Yes	<0.0001	Yes	0.0002	Yes	<0.0001	Yes	<0.0001	Yes*
PE-SQT-06	19820-004	0.038	0.0010	Yes	<0.0001	Yes	0.0002	Yes	<0.0001	Yes	<0.0001	Yes*
PE-SQT-04	19820-005	0.054	0.0016	Yes	0.0001	Yes	0.0003	Yes	<0.0001	Yes	<0.0001	Yes*
PE-SQT-07	19820-006	0.205	0.0208	Yes	0.0007	Yes	0.0023	Yes	0.0001	Yes	<0.0001	Yes*
PE-SQT-08	19820-007	0.308	0.3132	No	0.1713	No	0.1087	No	0.1843	No	0.0437	Yes
PE-SQT-03	19820-011	0.000	0.0005	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes*

Note: "NS" Indicates No Survivors.

"*" Indicates cases where a statistical outlier was detected and statistical comparisons were made with and without the outlier. Instances where the calculated p Value resulted in a different finding with respect to rejection, both p values are presented.

Table 11. Day 42 *Hyalella azteca* Growth, Dry Weight, Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.

Day 42 Dry Weight Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	8	0.5030	0.110	0.783	37.23%
PE-SQT-09	19820-008	8	0.8389	0.621	1.217	20.34%
PE-SQT-10	19820-009	8	0.7487	0.646	0.891	11.41%
PE-SQT-11	19820-010	8	0.7763	0.632	1.040	18.54%
Comp Ref	19820-099	24	0.7880	0.621	1.217	17.44%
PE-SQT-01	19820-001	8	0.4832	0.230	0.878	43.91%
PE-SQT-02	19820-002	8	0.5806	0.333	0.853	25.18%
PE-SQT-05	19820-003	8	0.9806	0.723	1.310	25.40%
PE-SQT-06	19820-004	8	0.7009	0.461	0.870	19.84%
PE-SQT-04	19820-005	8	0.6554	0.440	0.940	25.78%
PE-SQT-07	19820-006	8	0.6468	0.346	0.863	27.24%
PE-SQT-08	19820-007	8	0.7092	0.314	0.913	27.24%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 42 Dry Weight Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	0.5030	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	0.8389	0.9989	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	0.7487	0.9977	No*	0.1012	No*	-	-	-	-	-	-
PE-SQT-11	19820-010	0.7763	0.9972	No	0.2202	No	0.6757	No	-	-	-	-
Comp Ref	19820-099	0.7880	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	0.4832	0.4231	No	0.0012	Yes	0.0027	Yes	0.0030	Yes	<0.0001	Yes
PE-SQT-02	19820-002	0.5806	0.8143	No	0.0029	Yes	0.0070	Yes	0.0087	Yes	0.0005	Yes
PE-SQT-05	19820-003	0.9806	0.9981	No	0.8657	No	0.9831	No	0.9517	No	0.9854	No
PE-SQT-06	19820-004	0.7009	0.9804	No	0.0564	No	0.2149	No	0.1614	No	0.0759	No
PE-SQT-04	19820-005	0.6554	0.9379	No	0.0285	Yes	0.0956	No	0.0790	No	0.0206	Yes
PE-SQT-07	19820-006	0.6468	0.9320	No	0.0219	Yes	0.0816	No	0.0649	No	0.0129	Yes
PE-SQT-08	19820-007	0.7092	0.9760	No	0.0881	No	0.3023	No*	0.2219	No	0.1073	No
PE-SQT-03	19820-011	NS	-	-	-	-	-	-	-	-	-	-

Note: "NS" Indicates No Survivors.

"*" Indicates cases where a statistical outlier was detected and statistical comparisons were made with and without the outlier. Instances where the calculated p Value resulted in a different finding with respect to rejection, both p values are presented.

Table 12. Day 42 *Hyalella azteca* Growth, Dry Biomass, Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.

Day 42 Dry Biomass Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	8	0.3849	0.011	0.705	54.09%
PE-SQT-09	19820-008	8	0.6148	0.365	0.810	24.32%
PE-SQT-10	19820-009	8	0.5374	0.212	0.704	28.11%
PE-SQT-11	19820-010	8	0.5782	0.489	0.728	14.69%
Comp Ref	19820-099	24	0.5768	0.212	0.810	22.60%
PE-SQT-01	19820-001	8	0.2071	0.042	0.527	81.89%
PE-SQT-02	19820-002	8	0.3627	0.208	0.502	29.06%
PE-SQT-05	19820-003	8	0.0761	0.000	0.289	133.50%
PE-SQT-06	19820-004	8	0.1827	0.000	0.369	61.04%
PE-SQT-04	19820-005	8	0.1449	0.000	0.352	83.16%
PE-SQT-07	19820-006	8	0.4165	0.085	0.604	47.57%
PE-SQT-08	19820-007	8	0.4784	0.157	0.663	39.45%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 42 Biomass Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	0.3849	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	0.6148	0.9881	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	0.5374	0.9421	No	0.1603	No	-	-	-	-	-	-
PE-SQT-11	19820-010	0.5782	0.9855	No	0.2787	No	0.4487	No*	-	-	-	-
Comp Ref	19820-099	0.5768	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	0.2071	0.0411	Yes	<0.0001	Yes	0.0005	Yes	<0.0001	Yes	<0.0001	Yes
PE-SQT-02	19820-002	0.3627	0.3961	No	0.0008	Yes	0.0090	Yes	0.0002	Yes	0.0001	Yes
PE-SQT-05	19820-003	0.0761	0.0010	Yes	<0.0001	Yes	<0.0001	Yes*	<0.0001	Yes	<0.0001	Yes
PE-SQT-06	19820-004	0.1827	0.0148	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes
PE-SQT-04	19820-005	0.1449	0.0068	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes
PE-SQT-07	19820-006	0.4165	0.6198	No	0.0202	Yes	0.0958	No	0.0261	Yes	0.0066	Yes
PE-SQT-08	19820-007	0.4784	0.8186	No	0.0657	No	0.2506	No	0.0970	No	0.0547	No
PE-SQT-03	19820-011	<0.0001	0.0006	Yes*	<0.0001	Yes	0.0001	Yes*	<0.0001	Yes	<0.0001	Yes

Note: "NS" Indicates No Survivors.

"*" Indicates cases where a statistical outlier was detected and statistical comparisons were made with and without the outlier. Instances where the calculated p Value resulted in a different finding with respect to rejection, both p values are presented.

Table 13. Day 35 *Hyalella azteca* Juvenile Production per Amphipod Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.

Day 35 Juvenile Production Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	8	0.439	0.00	1.11	96.47%
PE-SQT-09	19820-008	8	0.851	0.00	2.63	100.80%
PE-SQT-10	19820-009	8	0.313	0.00	1.17	137.60%
PE-SQT-11	19820-010	8	0.808	0.33	1.43	56.49%
Comp Ref	19820-099	24	0.657	0.00	2.63	96.94%
PE-SQT-01	19820-001	8	0.063	0.00	0.50	282.80%
PE-SQT-02	19820-002	8	0.153	0.00	0.67	167.60%
PE-SQT-05	19820-003	8	0.000	0.00	0.00	-
PE-SQT-06	19820-004	8	0.191	0.00	1.00	198.40%
PE-SQT-04	19820-005	8	0.286	0.00	2.00	264.60%
PE-SQT-07	19820-006	8	0.345	0.00	1.29	148.00%
PE-SQT-08	19820-007	8	0.974	0.00	3.33	113.00%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 35 Juvenile Production Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	0.439	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	0.851	0.8779	No*	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	0.313	0.2815	No	0.0676	No*	-	-	-	-	-	-
PE-SQT-11	19820-010	0.808	0.9416	No	0.4508	No*	0.9787	No	-	-	-	-
Comp Ref	19820-099	0.657	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	0.063	0.0179	Yes	0.0074	Yes*	0.1172	No*	0.0004	Yes	0.0021	Yes*
PE-SQT-02	19820-002	0.153	0.0617	No	0.0292	Yes*	0.2869	No	0.0016	Yes	0.0132	Yes*
PE-SQT-05	19820-003	0.000	0.0353	Yes	0.0408	Yes*	0.0932	No*	0.0008	Yes	0.0078	Yes*
PE-SQT-06	19820-004	0.191	0.1272	No	0.0416 *0.0575	Yes No	0.2679	No	0.0072	Yes	0.0167	Yes
PE-SQT-04	19820-005	0.286	0.0603 *0.0110	No Yes	0.0469	Yes	0.1984	No*	0.0103	Yes*	0.0182	Yes
PE-SQT-07	19820-006	0.345	0.3468	No	0.0869	No*	0.4796	No	0.0384	Yes	0.0877	No
PE-SQT-08	19820-007	0.974	0.8897	No*	0.5969	No	0.9320	No*	0.6508	No*	0.7304	No
PE-SQT-03	19820-011	NS	-	-	-	-	-	-	-	-	-	-

Note: "NS" Indicates No Survivors.

"*" Indicates cases where a statistical outlier was detected and statistical comparisons were made with and without the outlier. Instances where the calculated p Value resulted in a different finding with respect to rejection, both p values are presented.

Table 14. Day 42 *Hyalella azteca* Juvenile Production per Amphipod Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.

Day 42 Juvenile Production Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	8	4.605	0.29	8.56	65.72%
PE-SQT-09	19820-008	8	4.957	0.44	8.67	56.87%
PE-SQT-10	19820-009	8	3.027	0.67	5.33	48.03%
PE-SQT-11	19820-010	8	3.601	0.33	7.86	63.27%
Comp Ref	19820-099	24	3.862	0.33	8.67	59.76%
PE-SQT-01	19820-001	8	1.435	0.00	5.71	155.30%
PE-SQT-02	19820-002	8	1.725	0.14	3.38	71.39%
PE-SQT-05	19820-003	8	0.375	0.00	1.00	127.70%
PE-SQT-06	19820-004	8	0.524	0.00	3.00	210.60%
PE-SQT-04	19820-005	8	1.643	0.00	5.00	130.00%
PE-SQT-07	19820-006	8	2.219	0.00	5.14	83.15%
PE-SQT-08	19820-007	8	4.982	0.90	10.89	69.67%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 42 Juvenile Production Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	4.605	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	4.957	0.5933	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	3.027	0.1024	No	0.0536	No	-	-	-	-	-	-
PE-SQT-11	19820-010	3.601	0.2329	No	0.1540	No	0.7213	No	-	-	-	-
Comp Ref	19820-099	3.862	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	1.435	0.0159	Yes	0.0075	Yes	0.0564	No	0.0376	Yes	0.0072	Yes
PE-SQT-02	19820-002	1.725	0.0129	Yes	0.0051	Yes	0.0370	Yes	0.0299	Yes	0.0094	Yes
PE-SQT-05	19820-003	0.375	0.1492	No	0.1137	No	0.1151	No	0.1587	No	0.0032	Yes
PE-SQT-06	19820-004	0.524	0.0048	Yes	0.0020	Yes	0.0028	Yes	0.0060	Yes	0.0005	Yes
PE-SQT-04	19820-005	1.643	0.0251	Yes	0.0125	Yes	0.0807	No	0.0556	No	0.0153	Yes
PE-SQT-07	19820-006	2.219	0.0388	Yes	0.0187	Yes	0.1737	No	0.1019	No	0.0392	Yes
PE-SQT-08	19820-007	4.982	0.5898	No	0.5062	No	0.9181	No	0.8186	No	0.8479	No
PE-SQT-03	19820-011	NS	-	-	-	-	-	-	-	-	-	-

Note: "NS" Indicates No Survivors.

Table 15. Day 42 *Hyalella azteca* Juvenile Production per Female Amphipod Summary and Statistical Analysis. Ashland Port Ewen Site, New York. July 2010.

Day 42 Juvenile/Female Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	8	6.479	0.67	13.80	66.85%
PE-SQT-09	19820-008	8	6.667	0.00	13.00	69.95%
PE-SQT-10	19820-009	8	5.682	1.00	10.67	53.13%
PE-SQT-11	19820-010	8	5.862	2.00	11.75	55.23%
Comp Ref	19820-099	24	6.079	0.00	13.00	59.03%
PE-SQT-01	19820-001	8	2.310	0.00	6.67	125.40%
PE-SQT-02	19820-002	8	2.646	0.25	4.50	53.58%
PE-SQT-05	19820-003	8	0.500	0.50	0.50	0.00%
PE-SQT-06	19820-004	8	0.583	0.00	3.00	205.80%
PE-SQT-04	19820-005	8	2.517	0.00	7.00	118.20%
PE-SQT-07	19820-006	8	3.364	1.00	7.20	59.30%
PE-SQT-08	19820-007	8	6.944	1.80	12.00	60.74%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 42 Juvenile/Female Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	6.479	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	6.667	0.5327	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	5.682	0.3378	No	0.3118	No	-	-	-	-	-	-
PE-SQT-11	19820-010	5.862	0.3813	No	0.3542	No	0.5437	No	-	-	-	-
Comp Ref	19820-099	6.079	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	2.310	0.0252	Yes	0.0263	Yes	0.0233	Yes	0.0257	Yes	0.0087	Yes
PE-SQT-02	19820-002	2.646	0.0223	Yes	0.0240	Yes	0.0110	Yes	0.0120	Yes	0.0071	Yes
PE-SQT-05	19820-003	0.500	0.1172	No	0.1263	No	0.0748	No	0.0862	No	0.0711	No
PE-SQT-06	19820-004	0.583	0.0037	Yes	0.0038	Yes	0.0011	Yes	0.0016	Yes	0.0005	Yes
PE-SQT-04	19820-005	2.517	0.0396	Yes	0.0409	Yes	0.0372	Yes	0.0401	Yes	0.0171	Yes
PE-SQT-07	19820-006	3.364	0.0526	No	0.0533	No	0.0542	No	0.0539	No	0.0340	Yes
PE-SQT-08	19820-007	6.944	0.5845	No	0.5487	No	0.7488	No	0.7043	No	0.7107	No
PE-SQT-03	19820-011	NS	-	-	-	-	-	-	-	-	-	-

Note: "NS" Indicates No Survivors.

Table 16. Summary of Overlying Water Qualities. Ashland Port Ewen Site, New York. July 2010.

Field ID	ESI Code	Sample Number	Day	Conductivity (uS/cm)	Alkalinity (mg/L)	Hardness (mg/L)	Ammonia (mg/L)
Lab Control	19820-000	000	0	320	61	81	0.16
PE-SQT-01	19820-001	001	0	366	72	94	2.6
PE-SQT-02	19820-002	002	0	304	53	79	0.21
PE-SQT-05	19820-003	003	0	317	67	89	0.29
PE-SQT-06	19820-004	004	0	332	52	79	<0.1
PE-SQT-04	19820-005	005	0	334	52	77	0.77
PE-SQT-07	19820-006	006	0	330	68	90	0.19
PE-SQT-08	19820-007	007	0	326	69	85	0.33
PE-SQT-09	19820-008	008	0	304	57	77	0.3
PE-SQT-10	19820-009	009	0	301	53	77	0.31
PE-SQT-11	19820-010	010	0	289	50	71	0.67
PE-SQT-03	19820-011	011	0	1099	<2	130	1.1
Lab Control	19820-000	000	7	343	81	100	<0.1
PE-SQT-01	19820-001	001	7	338	77	94	1.5
PE-SQT-02	19820-002	002	7	320	67	89	0.26
PE-SQT-05	19820-003	003	7	328	77	94	0.15
PE-SQT-06	19820-004	004	7	333	72	92	0.36
PE-SQT-04	19820-005	005	7	326	71	89	0.57
PE-SQT-07	19820-006	006	7	342	84	100	0.19
PE-SQT-08	19820-007	007	7	333	80	90	<0.1
PE-SQT-09	19820-008	008	7	408	69	88	0.3
PE-SQT-10	19820-009	009	7	327	71	86	<0.1
PE-SQT-11	19820-010	010	7	314	67	78	0.35
PE-SQT-03	19820-011	011	7	468	<2	110	0.7
Lab Control	19820-000	000	14	360	92	110	<0.1
PE-SQT-01	19820-001	001	14	333	78	92	<0.1
PE-SQT-02	19820-002	002	14	325	77	89	<0.1
PE-SQT-05	19820-003	003	14	338	84	90	<0.1
PE-SQT-06	19820-004	004	14	348	70	94	0.29
PE-SQT-04	19820-005	005	14	337	73	93	<0.1
PE-SQT-07	19820-006	006	14	361	84	94	<0.1
PE-SQT-08	19820-007	007	14	402	81	98	<0.1
PE-SQT-09	19820-008	008	14	390	79	91	<0.1
PE-SQT-10	19820-009	009	14	381	75	94	<0.1
PE-SQT-11	19820-010	010	14	385	80	96	<0.1
PE-SQT-03	19820-011	011	14	453	7.8	100	0.32
Lab Control	19820-000	000	21	382	82	100	<0.1
PE-SQT-01	19820-001	001	21	369	64	95	<0.1
PE-SQT-02	19820-002	002	21	366	71	93	<0.1
PE-SQT-05	19820-003	003	21	377	82	100	<0.1
PE-SQT-06	19820-004	004	21	379	67	98	<0.1
PE-SQT-04	19820-005	005	21	365	69	95	<0.1
PE-SQT-07	19820-006	006	21	393	89	110	<0.1
PE-SQT-08	19820-007	007	21	357	78	95	<0.1
PE-SQT-09	19820-008	008	21	355	76	93	<0.1

Field ID	ESI Code	Sample Number	Day	Conductivity (uS/cm)	Alkalinity (mg/L)	Hardness (mg/L)	Ammonia (mg/L)
PE-SQT-10	19820-009	009	21	350	69	94	<0.1
PE-SQT-11	19820-010	010	21	343	67	93	<0.1
PE-SQT-03	19820-011	011	21	372	24	95	0.32
Lab Control	19820-000	000	28	359	71	94	<0.15
PE-SQT-01	19820-001	001	28	353	70	100	<0.15
PE-SQT-02	19820-002	002	28	351	69	92	<0.15
PE-SQT-05	19820-003	003	28	355	72	96	<0.15
PE-SQT-06	19820-004	004	28	359	68	94	<0.15
PE-SQT-04	19820-005	005	28	359	67	92	<0.15
PE-SQT-07	19820-006	006	28	369	76	99	<0.15
PE-SQT-08	19820-007	007	28	336	77	92	<0.15
PE-SQT-09	19820-008	008	28	327	73	92	<0.15
PE-SQT-10	19820-009	009	28	326	69	90	<0.15
PE-SQT-11	19820-010	010	28	324	66	88	<0.15
PE-SQT-03	19820-011	011	28	334	43	86	<0.15
Lab Control	19820-000	000	35	330	62	88	<0.1
PE-SQT-01	19820-001	001	35	329	65	92	<0.1
PE-SQT-02	19820-002	002	35	334	67	92	<0.1
PE-SQT-05	19820-003	003	35	398	83	110	<0.1
PE-SQT-06	19820-004	004	35	331	64	88	<0.1
PE-SQT-04	19820-005	005	35	331	64	82	<0.1
PE-SQT-07	19820-006	006	35	331	66	91	0.33
PE-SQT-08	19820-007	007	35	344	68	94	0.25
PE-SQT-09	19820-008	008	35	332	66	91	0.18
PE-SQT-10	19820-009	009	35	325	66	89	0.2
PE-SQT-11	19820-010	010	35	331	66	90	0.15
PE-SQT-03	19820-011	011	35	336	67	92	<0.1
Lab Control	19820-000	000	42	378	71	90	<0.1
PE-SQT-01	19820-001	001	42	347	70	94	<0.1
PE-SQT-02	19820-002	002	42	347	71	95	<0.1
PE-SQT-05	19820-003	003	42	350	73	96	<0.1
PE-SQT-06	19820-004	004	42	350	69	96	<0.1
PE-SQT-04	19820-005	005	42	344	69	94	<0.1
PE-SQT-07	19820-006	006	42	346	67	94	<0.1
PE-SQT-08	19820-007	007	42	345	73	94	<0.1
PE-SQT-09	19820-008	008	42	347	71	95	<0.1
PE-SQT-10	19820-009	009	42	350	71	94	<0.1
PE-SQT-11	19820-010	010	42	345	73	93	<0.1
PE-SQT-03	19820-011	011	42	349	73	91	<0.1

Additional water quality data are provided in Appendix A.

APPENDIX A:
RAW DATA & STATISTICAL SUPPORT

TOXICOLOGICAL EVALUATION
OF FRESHWATER SEDIMENT SAMPLES

Ashland Port Ewen Site, New York

Chironomus riparius
Chronic Exposure Sediment Evaluation

Prepared For:

Test America
301 Alpha Drive
Pittsburgh, Pennsylvania 15238

URS Corporation
335 Commerce Drive, Suite 300
Fort Washington, Pennsylvania 19034

Prepared By:

EnviroSystems, Incorporated
1 Lafayette Road
Hampton, New Hampshire 03842

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Reference Number 19820-10-07

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OF SEDIMENT SAMPLES:

Ashland Port Ewen Site, New York
Chironomus riparius
Chronic Exposure Sediment Evaluation

1.0 INTRODUCTION

This report presents the results of chronic exposure partial life cycle toxicity tests conducted on sediment samples collected from the Ashland Port Ewen project site located in New York. Samples were provided by URS Corporation, Fort Washington, Pennsylvania. Testing was based on programs and protocols developed by the ASTM (2009) and US EPA (2000). The toxicity of the samples was assessed by conducting long term, partial life cycle, survival and growth tests using the freshwater midge, *Chironomus riparius*. Toxicity tests and supporting analyses were performed at EnviroSystems, Incorporated (ESI), Hampton, New Hampshire.

Toxicity tests expose groups of organisms to environmental samples, a laboratory control and field reference sites for a specified period to assess potential impacts on a variety of endpoints, such as survival, growth or reproduction. Analysis of variance techniques are used to determine the relative toxicity of the samples as compared to the laboratory control and/or field reference sites. Endpoints for this study included survival, growth (measured as ash free dry weight and ash free dry biomass), percent emergence and mean time to emergence.

2.0 MATERIALS AND METHODS

2.1 General Methods, Biological Evaluations

Toxicological and analytical protocols used in this program follow procedures outlined in *Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates* (ASTM 2009), *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates* (US EPA 2000) and *Standard Methods for the Examination of Water and Wastewater*, 20th Edition (APHA 1998). These protocols provide standard approaches for physical and chemical analysis and for the evaluation of toxicological effects of sediments on aquatic invertebrates.

2.2 Test Species

C. riparius were obtained from Aquatic Research Organisms, Hampton, New Hampshire. Egg cases were shipped to ESI after they were deposited. At ESI egg cases were transferred to a culture vessel and placed in an incubator. Observations and water additions were made daily until the assay was started. Once larvae hatched and left the egg casing, they were collected and added to the test vessels.

2.3 Test Samples and Laboratory Control Sediment

Sediment samples collected from the Ashland Port Ewen project site were received at ESI under chain of custody. Once received, samples were inspected to determine integrity, given unique sample numbers and logged into the laboratory sample management database. Once logged in, the samples were placed in a secure refrigerated, 2 - 4 °C, storage area. A listing of sample sites, sample collection, and receipt information is summarized in Table 1.

The control substrate was an artificial sediment prepared according to guidance presented in the EPA/ASTM method. Organic detritus from Chironomid cultures plus disintegrated paper pulp was used to provide organic content. Overlying water for the sediment toxicity tests was natural surface water, collected from the upper portion of the Taylor River watershed in Hampton Falls, New Hampshire. Use of natural surface water is recommended by the protocol (EPA 2000, ASTM 2009).

2.4 *C. riparius* Emergence Assay

The midge partial life cycle tests were conducted according to ASTM method E 1706-95 found in *Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates* (2009) and method 100.5 found in *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-*

associated Contaminants with Freshwater Invertebrates (EPA 2000). The midge partial life cycle test is divided into two exposure periods; an initial 10 day survival and growth evaluation followed by an emergence phase. Endpoints of the initial 10 day exposure were survival and growth, measured as both ash free dry weight and ash free dry biomass. Endpoints for the remainder of the assay included survival, percent emergence and mean time to emergence. The period of exposure for the assay is variable and treatments are terminated independently of one another, once seven days has passed without emergence of an adult fly.

Prior to test initiation, test sediments were homogenized under a nitrogen atmosphere. Sediments were placed in the test vessels and overlying water was immediately added. The vessels were left undisturbed overnight to stabilize. During this period, the chambers received one volume addition daily. On day 0 organisms were added to the test vessels below the water surface using a glass transfer pipet with the assistance of a dissecting microscope.

Test vessels were 400 mL glass beakers containing 100 mL of sediment and approximately 250 mL of overlying water. Test vessels were drilled at a consistent height above their bases and the hole covered with Nytex® screen. The screened hole facilitates water exchange while retaining test organisms. Vessels were maintained in a water bath during the test. Depth of the water in the bath was set below the drain hole in the test vessel to eliminate flow of water from the bath into the test vessel. Test chambers were randomly placed in the water bath after addition of test sediments. Placement locations were generated by the CETIS® software program. The randomization work sheets are included in the data appendix. The water bath was maintained in a limited access, temperature controlled room. Temperatures in the room and water bath were independently set at a temperature of 23°C. Temperature was recorded on an hourly frequency using a temperature logger placed in a surrogate vessel. The photoperiod in the test chamber was set at 16:8 hour light:dark. Lighting was supplied by cool white florescent bulbs.

A total of 10 larvae were randomly selected from the pool of organisms and added to each treatment. Each treatment group included 12 replicates and a surrogate test chamber that was used to obtain water qualities during the assay without disturbing the test animals. The surrogate chamber was treated the same as actual test chambers with the addition of animals and food, but was not used to determine endpoint data.

Prior to the daily overlying water renewal, dissolved oxygen, pH, specific conductance and temperature were measured in the surrogate chamber for each treatment. Overlying water in each replicate was then renewed. The volume of water added to each test chamber was approximately two volumes. Water exchanges were facilitated by use of a distribution system designed to provide equal, regulated flow to each chamber. The system was activated manually by the addition of water during the assay. After overlying water renewal each replicate was fed 1 mL of 6 g/L Tetramin® flake fish food suspension. Alkalinity, ammonia and hardness of the overlying water were measured on days 0, 7, 14, 21 and 28. Additionally the pore water was sampled at the start and end of the assay to determine ammonia levels. Water quality records are available in Appendix A.

After 10 days exposure, four replicates of each test treatment were terminated to collect data for the initial survival and growth portion of the tests. Each test chamber was gently swirled to loosen the sediments and the test material was dumped onto an appropriately sized screen. The sediments were washed through the sieve using freshwater and material left on the screen was sorted to recover organisms. This process was continued until the entire sample was evaluated. Surviving larvae were placed on tared weighing pans; partially and fully emerged organisms were recorded in survival counts but excluded in weight measurements. Pans were dried overnight at 104°C to obtain dry weight to the nearest 0.01 mg. The organisms were then fired in a muffle furnace for two hours at 550 °C to obtain the ash free dry weight to the nearest 0.01 mg. The mean weight of surviving organisms was determined to assess growth.

The remaining 8 replicates of each treatment were covered with emergence traps. The emergence traps were designed so that flies may emerge from the sediment and water without escaping. Traps were designed to allow for water exchange and ample airflow to the test vessel. Vessels were renewed and fed in the same manner as during the initial 10 day portion of the tests. Prior to daily water renewal, each vessel was inspected for emerged flies. Emerged flies were counted on a daily basis. Instances of partial emergence were also recorded.

2.5 Statistical Analysis

Survival, growth and emergence data were analyzed using CETIS® software to determine significant differences between the test sediments and the laboratory control and reference sediments. Data sets were evaluated to determine normality of distribution and homogeneity of sample variance. Data sets were subsequently evaluated using the appropriate parametric or non-parametric Analysis of Variance (ANOVA) statistic. Pair-wise comparisons were made using the appropriate statistical evaluation. Endpoints evaluated included; day 10 ash free dry weight and biomass, survival, mean emergence and mean time to emergence. Statistical difference was evaluated at α=0.05.

2.6 Quality Control

As part of the laboratory quality control program, reference toxicant evaluations are conducted on a regular basis for each test species. These results provide relative health and response data while allowing for comparison with historic data sets. Results were within the range observed for this species and is consistent with results obtained with *Chironomus dilutus*, a closely related species routinely evaluated. Results are summarized in Table 2.

2.7 Protocol Deviations

Review of data collected during this assay documented two deviations from protocol methods. First there were instances where the number animals added to the test vessel at the start of the assay exceeded 10 per replicate. The second deviation relates to temperature monitoring during the assay. The temperature data logger for the assay was pulled on Day 6 on 07/22/10 and was not replaced until Day 10 on 07/26/10, resulting in a loss of 4 days of hourly temperature readings. According to ESI's SOP and the method described in the ASTM (2009), temperature should be monitored hourly during the assay. Since this is described as a “should” statement and not a “must” statement, the data remains valid. Additionally, water qualities observed during this time were within protocol limits and conditions in the laboratory remained consistent. It is likely that readings during the four days would have been similar to those observed during the remainder of the assay.

It is the opinion of ESI's study director that these deviations did not adversely affect the outcome of the assay.

TABLE 1. Summary of Sample Collection Information. Ashland Port Ewen Site, New York. July 2010.

			Sample Collected		Sample Received	
Field ID	ESI Code	Designation	Date	Time	Date	Time
PE-SQT-09	19820-008	reference	06/16/10	1000	06/18/10	1330
PE-SQT-10	19820-009	reference	06/16/10	1300	06/18/10	1330
PE-SQT-11	19820-010	reference	06/16/10	1600	06/18/10	1330
PE-SQT-01	19820-001	test	06/14/10	1645	06/16/10	1100
PE-SQT-02	19820-002	test	06/15/10	1315	06/16/10	1100
PE-SQT-05	19820-003	test	06/15/10	1600	06/16/10	1100
PE-SQT-06	19820-004	test	06/15/10	1000	06/16/10	1100
PE-SQT-04	19820-005	test	06/17/10	1415	06/18/10	1330
PE-SQT-07	19820-006	test	06/17/10	1200	06/18/10	1330
PE-SQT-08	19820-007	test	06/17/10	0830	06/18/10	1330
PE-SQT-03	19820-011	test	06/23/10	1430	06/24/10	1100

Table 2. Reference Toxicant Evaluation. Ashland Port Ewen Site, New York. July 2010.

Date	Endpoint		Value	Historic Mean/ Central Tendency	Acceptable Range	Reference Toxicant
Chironomus riparius						
07/26/10	Survival	LC-50	2.59	-	1.2 - 300	Cadmium (mg/L)
Milani *et al.*, 2003		LC-50	0.02	-	1.2-300	Cadmium (mg/L)
Chironomus dilutus						
05/21/10	Survival	LC-50	3.42	3.18	0.0 - 8.8	Cadmium (mg/L)

3.0 RESULTS AND DISCUSSION

3.1 Laboratory Control and Project Reference Site Performance

At the end of the 10 day exposure period survival in the laboratory control treatment was 92.5% with a coefficient of variation (CV) of 5.41%. The minimum test acceptability criteria for survival in the laboratory control is ≥70%. The ash free dry weight was 0.8492 mg with a CV of 20.31%. The minimum acceptable criteria for growth is a mean ash free dry weight (AFDW) of ≥0.48 mg/larvae after 10 days exposure. The percent emerged for the laboratory control was 86.9% with a CV of 15.97%. The recommended minimum for the laboratory control is at least 50%. These criteria were met indicating that the organisms were healthy and not stressed by handling. Table 4 provides a summary of assay acceptability criteria and laboratory control achievement. Table 5 summarizes the reference site performance.

During daily water quality observations the temperature recorded for the assay had a mean value of 23.2°C with a range of 21.4 to 24.6°C. Confirmation temperature data collected in a surrogate replicate documented a mean temperature of 23.5°C with a range of 21.2 to 25.5°C. Test acceptability criteria requires a mean temperature of 23±1°C, with maximum temporary fluctuations of 23±3°C.

Table 3. Summary of Acceptable Endpoints and Measurements. Ashland Port Ewen Site, New York. July 2010.

Endpoint / Measurement	Protocol Limit		19882
Mean Survival - Day 10	lab ≥ 70%	%	92.5%
		Protocol Met	Yes
Ash Free Dry Weight	lab ≥ 0.48 mg	mg/individual	0.8492
		Protocol Met	Yes
Percent Emergence	lab ≥ 50%	%	86.9%
		Protocol Met	Yes
Mean Time to Emergence	Not Specified	Days	13.56
		Protocol Met	Not Specified
Temperature	mean: 23°±1°C	daily / hourly	23.2 / 23.5
	minimum: 20°C	daily / hourly	21.4 / 21.2
	maximum: 26°C	daily / hourly	24.6 / 25.5
		Protocol Met	Yes / Yes

Table 4. Summary of Project Reference Site Performance. Ashland Port Ewen Site, New York. July 2010.

Field ID	ESI Code	Mean Percent Survival	Ash Free Dry Weight (mg)	Ash Free Dry Biomass (mg)	Percent Emergence	Mean Time to Emergence (Days)
PE-SQT-09	19820-008	87.5%	0.6173	0.5502	88.8%	14.31
PE-SQT-10	19820-009	97.5%	0.5403	0.5241	83.8%	14.46
PE-SQT-11	19820-010	87.5%	0.6144	0.5292	60.0%	16.81

3.2 Summary

This program utilized protocols developed by the U.S. EPA and ASTM to assess the potential toxicological impacts that exposure to sediments from the Ashland Port Ewen project site would have on freshwater invertebrates. Table 5 provides a summary of sample sites that demonstrated a negative effect, based on the finding of statistically significant reduction in an endpoint as compared to the laboratory control or reference site. Tables 6 through 10 provide summaries of assay endpoints and detailed statistical results for each sample location. Table 11 summarizes overlying water qualities measured during the test. Laboratory bench sheets, detailed summaries of survival, dry weights, emergence and associated statistical support data are included in Appendix A.

Table 5. Summary of Significant Endpoints. Ashland Port Ewen Site, New York. July 2010.

		Finding of Significant Difference(s) between Project Sites and																								
		Lab Control (19820-000)					PE-SQT-09 (19820-008)					PE-SQT-10 (19820-009)					PE-SQT-11 (19820-010)					Composite Ref (19820-099)				
Field ID	ESI Code	survival	ash free dry wt	ash free dry biomass	% emergence	time to emergence	survival	ash free dry wt	ash free dry biomass	% emergence	time to emergence	survival	ash free dry wt	ash free dry biomass	% emergence	time to emergence	survival	ash free dry wt	ash free dry biomass	% emergence	time to emergence	survival	ash free dry wt	ash free dry biomass	% emergence	time to emergence
PE-SQT-09	19820-008																									
PE-SQT-10	19820-009																									
PE-SQT-11	19820-010																									
Comp Ref	19820-099																									
PE-SQT-01	19820-001			X		X						X										X				
PE-SQT-02	19820-002					X																				
PE-SQT-05	19820-003		X	X		X		X	X		X		X	X		X		X	X				X	X		X
PE-SQT-06	19820-004		X	X		X																				
PE-SQT-04	19820-005		X	X		X		X			X		X	X		X							X	X		
PE-SQT-07	19820-006		X	X		X																				
PE-SQT-08	19820-007			X		X						X														
PE-SQT-03	19820-011	X	*	X	X		X	*	X	X		X	*	X	X		X	*	X	X		X	X	X	X	

* No surviving organisms

4.0 REFERENCES

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TABLE 6. Summary of Day 10 Survival Data: *C. riparius.* Ashland Port Ewen Site, New York. July 2010.

Day 10 Survival Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	4	92.5%	90.0%	100.0%	5.41%
PE-SQT-09	19820-008	4	87.5%	80.0%	100.0%	10.94%
PE-SQT-10	19820-009	4	97.5%	90.0%	100.0%	5.13%
PE-SQT-11	19820-010	4	87.5%	80.0%	100.0%	10.94%
Comp Ref	19820-099	12	90.83%	80.0%	100.0%	9.91%
PE-SQT-01	19820-001	4	75.0%	60.0%	100.0%	23.09%
PE-SQT-02	19820-002	4	72.5%	20.0%	100.0%	49.57%
PE-SQT-05	19820-003	4	60.0%	10.0%	100.0%	65.26%
PE-SQT-06	19820-004	4	97.5%	90.0%	100.0%	5.13%
PE-SQT-04	19820-005	4	97.5%	90.0%	100.0%	5.13%
PE-SQT-07	19820-006	4	95.0%	80.0%	100.0%	10.53%
PE-SQT-08	19820-007	4	82.5%	70.0%	90.0%	11.61%
PE-SQT-03	19820-011	4	0.0%	0.0%	0.0%	0.00%

Day 10 Survival Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	92.5%	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	87.5%	0.1951	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	97.5%	0.8965	No	0.9432	No	-	-	-	-	-	-
PE-SQT-11	19820-010	87.5%	0.1951	No	0.5000	No	0.0568	No	-	-	-	-
Comp Ref	19820-099	90.8%	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	75.0%	0.0501	No	0.1267	No	0.0234	Yes	0.1267	No	0.0147	Yes
PE-SQT-02	19820-002	72.5%	0.1754	No*	0.2253	No*	0.1310	No*	0.2253	No*	0.1935	No
PE-SQT-05	19820-003	60.0%	0.0991	No	0.1107	No	0.0768	No	0.1107	No	0.1082	No
PE-SQT-06	19820-004	97.5%	0.8965	No	0.9432	No	0.4429	No	0.9432	No	0.9068	No
PE-SQT-04	19820-005	97.5%	0.8965	No	0.9432	No	0.4429	No	0.9432	No	0.9068	No
PE-SQT-07	19820-006	95.0%	0.6648	No	0.8399	No	0.4429	No	0.8399	No	0.7764	No
PE-SQT-08	19820-007	82.5%	0.0568	No	0.2440	No	0.0161	Yes	0.2440	No	0.1060	No
PE-SQT-03	19820-011	0.0%	0.0143	Yes*	<0.0001	Yes	0.0143	Yes*	<0.0001	Yes	0.0005	Yes

Note:

"*" Indicates cases where a statistical outlier was detected and statistical comparisons were made with and without the outlier. Instances where the calculated p Value resulted in a different finding with respect to rejection, both p values are presented.

TABLE 7. Summary of Day 10 Growth Data, Ash Free Dry Weight: *C. riparius.* Ashland Port Ewen Site, New York. July 2010.

Day 10 Ash Free Dry Weight (mg) Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	4	0.8492	0.6912	1.0570	20.31%
PE-SQT-09	19820-008	4	0.6173	0.4275	0.7830	24.94%
PE-SQT-10	19820-009	4	0.5403	0.4592	0.6456	14.33%
PE-SQT-11	19820-010	4	0.6144	0.3458	0.8156	34.61%
Comp Ref	19820-099	12	0.5907	0.3458	0.8156	25.01%
PE-SQT-01	19820-001	4	0.7074	0.5537	0.8814	18.99%
PE-SQT-02	19820-002	4	0.7157	0.6218	0.7788	9.60%
PE-SQT-05	19820-003	4	0.2282	0.0100	0.4100	72.15%
PE-SQT-06	19820-004	4	0.5034	0.4056	0.5800	16.04%
PE-SQT-04	19820-005	4	0.3958	0.2987	0.5322	28.14%
PE-SQT-07	19820-006	4	0.5842	0.5225	0.6244	7.54%
PE-SQT-08	19820-007	4	0.6605	0.4989	0.8257	24.53%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 10 Ash Free Dry Weight (mg) Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	0.8492	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	0.6173	0.0458	Yes	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	0.5403	0.0085	Yes	0.2028	No	-	-	-	-	-	-
PE-SQT-11	19820-010	0.6144	0.0686	No	0.4915	No	0.7318	No	-	-	-	-
Comp Ref	19820-099	0.5907	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	0.7074	0.1211	No	0.7940	No	0.9628	No	0.7562	No	0.9076	No
PE-SQT-02	19820-002	0.7157	0.1002	No	0.8563	No	0.9927	No	0.8002	No	0.9349	No
PE-SQT-05	19820-003	0.2282	0.0010	Yes	0.0068	Yes	0.0070	Yes	0.0142	Yes	0.0005	Yes
PE-SQT-06	19820-004	0.5034	0.0055	Yes	0.1191	No	0.2674	No	0.1834	No	0.1429	No
PE-SQT-04	19820-005	0.3958	0.0022	Yes	0.0293	Yes	0.0386	Yes	0.0592	No	0.0155	Yes
PE-SQT-07	19820-006	0.5842	0.0124	Yes	0.3470	No	0.8193	No	0.3952	No	0.4671	No
PE-SQT-08	19820-007	0.6605	0.0810	No	0.6438	No	0.8856	No	0.6291	No	0.7820	No
PE-SQT-03	19820-011	NS	-	-	-	-	-	-	-	-	-	-

Note: “NS” Indicates No Survivors.

TABLE 8. Summary of Day 10 Growth Data, Ash Free Dry Biomass: *C. riparius.* Ashland Port Ewen Site, New York. July 2010.

Day 10 Ash Free Dry Biomass (mg) Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	4	0.7353	0.6470	0.9510	19.74%
PE-SQT-09	19820-008	4	0.5502	0.3420	0.7830	35.05%
PE-SQT-10	19820-009	4	0.5241	0.4592	0.5810	9.54%
PE-SQT-11	19820-010	4	0.5292	0.3458	0.7340	32.56%
Comp Ref	19820-099	12	0.5345	0.3420	0.7830	25.83%
PE-SQT-01	19820-001	4	0.4500	0.2769	0.6170	31.44%
PE-SQT-02	19820-002	4	0.5160	0.1420	0.6770	48.58%
PE-SQT-05	19820-003	4	0.1743	0.0010	0.3280	81.70%
PE-SQT-06	19820-004	4	0.4933	0.3650	0.5800	19.84%
PE-SQT-04	19820-005	4	0.3825	0.2987	0.4790	23.78%
PE-SQT-07	19820-006	4	0.5425	0.4180	0.6040	15.62%
PE-SQT-08	19820-007	4	0.5202	0.4370	0.6170	17.44%
PE-SQT-03	19820-011	NS	-	-	-	-

Day 10 Ash Free Dry Biomass (mg) Statistical Analysis			Statistically Significant Difference (less than) as Compared to				
			Lab Control (19820-000)	PE-SQT-09 (19820-008)	PE-SQT-10 (19820-009)	PE-SQT-11 (19820-010)	Composite Ref (19820-099)
Field ID	ESI Code	Mean	p Value	p Value	p Value	p Value	p Value
Lab Control	19820-000	0.7353	- -	- -	- -	- -	- -
PE-SQT-09	19820-008	0.5502	0.0881 No	- -	- -	- -	- -
PE-SQT-10	19820-009	0.5241	0.0166 Yes*	0.4009 No	- -	- -	- -
PE-SQT-11	19820-010	0.5292	0.0585 No	0.4380 No	0.5217 No	- -	- -
Comp Ref	19820-099	0.5345	- -	- -	- -	- -	- -
PE-SQT-01	19820-001	0.4500	0.0153 Yes	0.2170 No	0.1806 No	0.2519 No	0.1546 No
PE-SQT-02	19820-002	0.5160	0.0903 No	0.4177 No	0.4756 No	0.4667 No	0.4257 No
PE-SQT-05	19820-003	0.1743	0.0007 Yes	0.0101 Yes	0.9914 No	0.0096 Yes	0.0003 Yes
PE-SQT-06	19820-004	0.4933	0.0163 Yes	0.3087 No	0.0018 Yes	0.3647 No	0.2964 No
PE-SQT-04	19820-005	0.3825	0.0031 Yes	0.0834 No	0.2976 No	0.0914 No	0.0307 Yes
PE-SQT-07	19820-006	0.5425	0.0308 Yes	0.4719 No	0.0171 Yes	0.5528 No	0.5420 No
PE-SQT-08	19820-007	0.5202	0.0229 Yes	0.3939 No	0.6392 No	0.4648 No	0.4256 No
PE-SQT-03	19820-011	0.0000	0.0143 Yes*	0.0053 Yes	0.4715 No	0.0043 Yes	<0.0001 Yes

Note: “NS” Indicates No Survivors.

“*” Indicates cases where a statistical outlier was detected and statistical comparisons were made with and without the outlier. Instances where the calculated p Value resulted in a different finding with respect to rejection, both p values are presented.

TABLE 9. Summary of Percent Emergence Data: *C. riparius.* Ashland Port Ewen Site, New York. July 2010.

Percent Emergence Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	8	86.9%	65.0%	100.0%	15.97%
PE-SQT-09	19820-008	8	88.8%	60.0%	100.0%	15.28%
PE-SQT-10	19820-009	8	83.8%	50.0%	100.0%	20.12%
PE-SQT-11	19820-010	8	60.0%	0.0%	100.0%	58.93%
Comp Ref	19820-099	24	77.5%	0.0%	100.0%	33.82%
PE-SQT-01	19820-001	8	83.8%	50.0%	100.0%	22.96%
PE-SQT-02	19820-002	8	87.5%	40.0%	100.0%	25.00%
PE-SQT-05	19820-003	8	88.8%	75.0%	100.0%	10.75%
PE-SQT-06	19820-004	8	87.5%	50.0%	100.0%	21.81%
PE-SQT-04	19820-005	8	94.4%	80.0%	100.0%	7.72%
PE-SQT-07	19820-006	8	96.3%	70.0%	100.0%	11.02%
PE-SQT-08	19820-007	8	95.0%	85.0%	100.0%	6.29%
PE-SQT-03	19820-011	8	10.0%	0.0%	50.0%	177.30%

Percent Emergence Statistical Analysis			Statistically Significant Difference (less than) as Compared to									
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	86.9%	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	88.8%	0.6057	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	83.8%	0.3458	No	0.2619	No	-	-	-	-	-	-
PE-SQT-11	19820-010	60.0%	0.0326	Yes	0.0249	Yes	0.0542	No	-	-	-	-
Comp Ref	19820-099	77.5%	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	83.8%	0.3574	No	0.2787	No	0.5608	No	0.9414	No	0.7263	No
PE-SQT-02	19820-002	87.5%	0.7131	No	0.6773	No	0.8089	No	0.9588	No	0.9241	No
PE-SQT-05	19820-003	88.8%	0.6213	No	0.5000	No	0.7614	No	0.9714	No	0.8009	No
PE-SQT-06	19820-004	87.5%	0.6395	No	0.6008	No	0.7473	No	0.9633	No	0.8893	No
PE-SQT-04	19820-005	94.4%	0.9014	No	0.8405	No	0.9380	No	0.9845	No	0.9768	No
PE-SQT-07	19820-006	96.3%	0.9348	No	0.9197	No	0.9675	No	0.9880	No	0.9945	No
PE-SQT-08	19820-007	95.0%	0.9248	No	0.8736	No	0.9516	No	0.9860	No	0.9801	No
PE-SQT-03	19820-011	10.0%	<0.0001	Yes	<0.0001	Yes	<0.0001	Yes	0.0015	Yes	0.0001	Yes

TABLE 10. Summary of Time of Emergence Data: *C. riparius.* Ashland Port Ewen Site, New York. July 2010.

Mean Time of Emergence(Days) Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Lab Control	19820-000	8	13.56	11.78	14.50	6.67%
PE-SQT-09	19820-008	8	14.31	13.17	16.25	6.84%
PE-SQT-10	19820-009	8	14.46	13.89	14.91	2.76%
PE-SQT-11	19820-010	8	16.81	14.13	19.00	9.76%
Comp Ref	19820-099	24	15.12	13.17	19.00	10.23%
PE-SQT-01	19820-001	8	14.93	13.20	18.82	11.87%
PE-SQT-02	19820-002	8	15.44	13.20	19.75	13.37%
PE-SQT-05	19820-003	8	16.61	13.56	22.47	17.33%
PE-SQT-06	19820-004	8	14.32	13.86	15.08	3.53%
PE-SQT-04	19820-005	8	15.82	14.25	21.33	14.43%
PE-SQT-07	19820-006	8	15.90	13.55	21.60	16.12%
PE-SQT-08	19820-007	8	15.36	13.44	17.63	9.55%
PE-SQT-03	19820-011	8	16.33	14.00	21.00	24.74%

Mean Time of Emergence(Days) Statistical Analysis			Statistically Significant Difference (less than) as Compared to							
			Lab Control (19820-000)		PE-SQT-09 (19820-008)		PE-SQT-10 (19820-009)		PE-SQT-11 (19820-010)		Composite Ref (19820-099)	
Field ID	ESI Code	Mean	p Value		p Value		p Value		p Value		p Value	
Lab Control	19820-000	13.56	-	-	-	-	-	-	-	-	-	-
PE-SQT-09	19820-008	14.31	0.0665	No	-	-	-	-	-	-	-	-
PE-SQT-10	19820-009	14.46	0.0113	Yes	0.3531	No	-	-	-	-	-	-
PE-SQT-11	19820-010	16.81	0.0002	Yes	0.0015	Yes	0.0050	Yes	-	-	-	-
Comp Ref	19820-099	15.12	-	-	-	-	-	-	-	-	-	-
PE-SQT-01	19820-001	14.93	0.0357	Yes	0.2001	No	0.5204	No	0.9729	No	0.6984	No
PE-SQT-02	19820-002	15.44	0.0166	Yes	0.0918	No	0.1131	No	0.9081	No	0.3590	No
PE-SQT-05	19820-003	16.61	0.0106	Yes	0.0254	Yes	0.0372	Yes	0.5634	No	0.0371	Yes
PE-SQT-06	19820-004	14.32	0.0290	Yes	0.4950	No	0.7241	No	0.9958	No	0.8843	No
PE-SQT-04	19820-005	15.82	0.0003	Yes	0.0190	Yes	0.0190	Yes	0.8205	No	0.1114	No
PE-SQT-07	19820-006	15.90	0.0035	Yes	0.0652	No	0.1172	No	0.7821	No	0.2351	No
PE-SQT-08	19820-007	15.36	0.0052	Yes	0.0570	No	0.0649	No	0.9526	No	0.3515	No
PE-SQT-03	19820-011	16.33	0.1802	No	0.2411	No	0.2532	No	0.6066	No	0.5480	No

Table 11. Summary of Water Qualities: *C. riparius.* Ashland Port Ewen Site, New York. July 2010.

Field ID	ESI Code	Sample Number	Day	Conductivity (uS/cm)	Alkalinity (mg/L)	Hardness (mg/L)	Ammonia (mg/L)
Lab Control	19820-000	000	0	250	43	50	0.12
PE-SQT-01	19820-001	001	0	222	42	46	1.3
PE-SQT-02	19820-002	002	0	192	31	44	<0.1
PE-SQT-05	19820-003	003	0	211	45	53	0.38
PE-SQT-06	19820-004	004	0	201	33	43	<0.1
PE-SQT-04	19820-005	005	0	205	37	45	0.12
PE-SQT-07	19820-006	006	0	216	44	51	0.19
PE-SQT-08	19820-007	007	0	210	44	49	0.53
PE-SQT-09	19820-008	008	0	192	35	42	<0.1
PE-SQT-10	19820-009	009	0	195	37	44	0.36
PE-SQT-11	19820-010	010	0	190	36	41	0.5
PE-SQT-03	19820-011	011	0	583	<2	62	0.78
Lab Control	19820-000	000	7	404	91	100	0.78
PE-SQT-01	19820-001	001	7	363	78	87	1.3
PE-SQT-02	19820-002	002	7	356	78	87	0.8
PE-SQT-05	19820-003	003	7	372	88	97	0.14
PE-SQT-06	19820-004	004	7	362	73	87	0.67
PE-SQT-04	19820-005	005	7	365	77	90	0.79
PE-SQT-07	19820-006	006	7	383	89	100	0.18
PE-SQT-08	19820-007	007	7	363	81	91	0.31
PE-SQT-09	19820-008	008	7	355	77	87	0.23
PE-SQT-10	19820-009	009	7	356	80	90	0.24
PE-SQT-11	19820-010	010	7	341	72	81	0.67
PE-SQT-03	19820-011	011	7	446	<2	110	0.14
Lab Control	19820-000	000	14	378	87	100	0.17
PE-SQT-01	19820-001	001	14	332	76	91	<0.1
PE-SQT-02	19820-002	002	14	317	70	84	<0.1
PE-SQT-05	19820-003	003	14	341	86	97	<0.1
PE-SQT-06	19820-004	004	14	343	72	91	0.3
PE-SQT-04	19820-005	005	14	332	80	90	<0.1
PE-SQT-07	19820-006	006	14	351	85	98	<0.1
PE-SQT-08	19820-007	007	14	320	75	84	<0.1
PE-SQT-09	19820-008	008	14	329	80	89	<0.1
PE-SQT-10	19820-009	009	14	334	79	92	0.18
PE-SQT-11	19820-010	010	14	326	75	89	<0.1
PE-SQT-03	19820-011	011	14	370	49	100	0.35
Lab Control	19820-000	000	21	375	94	98	<0.1
PE-SQT-01	19820-001	001	21	345	85	92	<0.1
PE-SQT-02	19820-002	002	21	346	80	92	<0.1
PE-SQT-05	19820-003	003	21	343	91	98	<0.1
PE-SQT-06	19820-004	004	21	350	86	94	<0.1
PE-SQT-04	19820-005	005	21	343	82	90	<0.1
PE-SQT-07	19820-006	006	21	356	91	98	<0.1
PE-SQT-08	19820-007	007	21	350	98	95	<0.1
PE-SQT-09	19820-008	008	21	346	87	97	<0.1

Field ID	ESI Code	Sample Number	Day	Conductivity (uS/cm)	Alkalinity (mg/L)	Hardness (mg/L)	Ammonia (mg/L)
PE-SQT-10	19820-009	009	21	348	82	93	<0.1
PE-SQT-11	19820-010	010	21	332	74	88	<0.1
PE-SQT-03	19820-011	011	21	339	56	85	<0.1
Lab Control	19820-000	000	28	394	84	93	<0.15
PE-SQT-01	19820-001	001	28	346	85	95	<0.15
PE-SQT-02	19820-002	002	28	343	80	93	<0.15
PE-SQT-05	19820-003	003	28	348	84	95	<0.15
PE-SQT-06	19820-004	004	28	354	85	97	<0.15
PE-SQT-04	19820-005	005	28	346	88	96	<0.15
PE-SQT-07	19820-006	006	28	361	94	100	<0.15
PE-SQT-08	19820-007	007	28	356	93	100	<0.15
PE-SQT-09	19820-008	008	28	341	85	94	<0.15
PE-SQT-10	19820-009	009	28	343	86	94	<0.15
PE-SQT-11	19820-010	010	28	339	83	87	<0.15
PE-SQT-03	19820-011	011	28	324	60	82	<0.15

Additional water quality data are provided in Appendix A.

APPENDIX A:
RAW DATA & STATISTICAL SUPPORT

APPENDIX C

TABLE C-1
SQT SEDIMENT - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	PE-SQT-01	PE-SQT-02	PE-SQT-02 DUP	PE-SQT-03	PE-SQT-04	PE-SQT-05	PE-SQT-06	PE-SQT-07	PE-SQT-08	PE-SQT-09	PE-SQT-10	PE-SQT-11
Metals															
Aluminum	mg/kg	3	3										18,100.0 [J']	14,200.0 [J']	15,200.0 [J']
Antimony	mg/kg	3	3										0.36 [B' J']	0.39 [B' J']	0.22 [B' J']
Arsenic	mg/kg	3	3										4.9	7	3.2
Barium	mg/kg	3	3										208	192	192
Beryllium	mg/kg	3	3										1.5	1.3	0.97
Cadmium	mg/kg	12	12	0.84	0.83	0.85	0.22	3.1	2	26.6	8.4	3.3	2.3	2	1.1
Calcium	mg/kg	3	3										18,200.0	25,600.0	7,210.0
Chromium	mg/kg	3	3										18.2 [J']	16.2 [J']	17.4 [J']
Cobalt	mg/kg	3	3										5.5	5	5.6
Copper	mg/kg	12	12	702.0 [J']	524.0 [J']	593.0 [J']	12,600.0 [J']	8,070.0 [J']	1,790.0 [J']	18,800.0 [J']	4,390.0 [J']	2,300.0 [J']	68.0 [J']	68.4 [J']	37.2 [J']
Iron	mg/kg	3	3										15,000.0	18,600.0	14,100.0
Lead	mg/kg	12	12	251.0	592.0	641.0	1,850.0 [J']	353.0	2,060.0	474.0	224.0	128.0	58.1	56.7	36.2
Magnesium	mg/kg	3	3										2,260.0	1,500.0	2,400.0
Manganese	mg/kg	3	3										223.0	134.0	217.0
Mercury	mg/kg	12	12	57.4	8.3	8.0	61.1	27.8	3.5	82.4	12.2	24.8	0.29	0.32	0.19
Nickel	mg/kg	3	3										22.3 [J']	23.3 [J']	16.6 [J']
Potassium	mg/kg	3	3										820.0	603.0	876.0
Selenium	mg/kg	12	12	35.6	71.0	69.4	198.0	38.6	170.0	78.2	33.2	16.4	8.4	11.0	5.2
Silver	mg/kg	3	3										0.32	0.33	0.20
Sodium	mg/kg	3	3										301.0	376.0	129.0
Thallium	mg/kg	3	3										0.26	0.22	0.24
Vanadium	mg/kg	3	3										35.6	34.7	25.5
Zinc	mg/kg	12	12	174.0	150.0	143.0	26.2	1,270.0	246.0	2,110.0	623.0	404.0	85.9	81.3	68.3
Other Sediment Parameters															
Percent Solids	%	12	12	24.0	21.2	21.0	41.9	25.7	18.3	19.9	19.0	23.6	21.0	23.5	39.3
Total organic carbon	%	12	12	6.64	4.32	11.5	5.57	5.42	6.52	10.6	8.35	4.93	21.4	28.1	11.8

Notes:

[J] Result is estimated due to a minor quality control anomaly
[U] Result is a non-detect < the detection limit (DL)
[B'] Estimated result; less than the RL
[J'] Method blank contamination
[E'] Matrix interference

TABLE C-2
REFERENCE SQT SEDIMENT - SUMMARY OF ORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	PE-SQT-09	PE-SQT-10	PE-SQT-10-DUP	PE-SQT-11
Organochlorine Pesticides							
4,4'-DDD	µg/kg	4	0	4 U	4 U	4 U	3 U
4,4'-DDE	µg/kg	4	4	4	8	9	3 PG"
4,4'-DDT	µg/kg	4	0	4 U	4 U	4 U	3 U
Aldrin	µg/kg	4	0	4 U	4 U	4 U	6 U
alpha-BHC	µg/kg	4	1	1 J" PG"	4 U	4 U	3 U
alpha-Chlordane	µg/kg	4	0	4 U	4 U	4 U	3 U
beta-BHC	µg/kg	4	0	4 U	4 U	4 U	3 U
delta-BHC	µg/kg	4	0	4 U	4 U	4 U	3 U
Dieldrin	µg/kg	4	1	4 U	4 U	4 U	0.42 J" PG"
Endosulfan I	µg/kg	4	0	4 U	4 U	4 U	3 U
Endosulfan II	µg/kg	4	0	4 U	4 U	4 U	3 U
Endosulfan sulfate	µg/kg	4	0	4 U	4 U	4 U	3 U
Endrin	µg/kg	4	1	4 U	4 U	4 U	1 J" PG"
Endrin aldehyde	µg/kg	4	0	4 U	4 U	4 U	3 U
Endrin ketone	µg/kg	4	0	4 U	4 U	4 U	3 U
gamma-BHC	µg/kg	4	4	2 J" PG"	2 J" PG"	1 J" PG"	1 J" PG"
gamma-Chlordane	µg/kg	4	0	4 U	4 U	4 U	3 U
Heptachlor	µg/kg	4	0	4 U	4 U	4 U	3 U
Heptachlor epoxide	µg/kg	4	0	4 U	4 U	4 U	3 U
Methoxychlor	µg/kg	4	0	8 U	8 U	7 U	5 U
Toxaphene	µg/kg	4	0	160 U	170 U	150 U	100 U
Volatile Organic Compounds							
1,1,1-Trichloroethane	µg/kg	4	0	24 U	32 U	33 U	13 U
1,1,2,2-Tetrachloroethane	µg/kg	4	0	24 U	32 U	33 U	13 U
1,1,2-Trichloro-1,2,2-trifluoroethan	µg/kg	4	0	24 U	32 U	33 U	13 U
1,1,2-Trichloroethane	µg/kg	4	0	24 U	32 U	33 U	13 U
1,1-Dichloroethane	µg/kg	4	0	24 U	32 U	33 U	13 U
1,1-Dichloroethene	µg/kg	4	0	24 U	32 U	33 U	13 U
1,2,4-Trichlorobenzene	µg/kg	4	0	24 U	32 U	33 U	13 U
1,2-Dibromo-3-chloropropane	µg/kg	4	0	24 U	32 U	33 U	13 U
1,2-Dibromoethane	µg/kg	4	0	24 U	32 U	33 U	13 U
1,2-Dichlorobenzene	µg/kg	4	0	24 U	32 U	33 U	13 U
1,2-Dichloroethane	µg/kg	4	0	24 U	32 U	33 U	13 U
1,2-Dichloropropane	µg/kg	4	0	24 U	32 U	33 U	13 U
1,3-Dichlorobenzene	µg/kg	4	0	24 U	32 U	33 U	13 U
1,4-Dichlorobenzene	µg/kg	4	0	24 U	32 U	33 U	13 U
2-Butanone	µg/kg	4	0	24 U	32 U	33 U	13 U
2-Hexanone	µg/kg	4	0	24 U	32 U	33 U	13 U
4-Methyl-2-pentanone	µg/kg	4	0	24 U	32 U	33 U	13 U
Acetone	µg/kg	4	1	95 U	41 J"	130 U	51 U
Benzene	µg/kg	4	0	24 U	32 U	33 U	13 U
Bromodichloromethane	µg/kg	4	0	24 U	32 U	33 U	13 U
Bromoform	µg/kg	4	0	24 U	32 U	33 U	13 U
Bromomethane	µg/kg	4	0	24 U	32 U	33 U	13 U
Carbon disulfide	µg/kg	4	0	24 U	32 U	33 U	13 U
Carbon tetrachloride	µg/kg	4	0	24 U	32 U	33 U	13 U
Chlorobenzene	µg/kg	4	0	24 U	32 U	33 U	13 U
Chloroethane	µg/kg	4	0	24 U	32 U	33 U	13 U
Chloroform	µg/kg	4	0	24 U	32 U	33 U	13 U
Chloromethane	µg/kg	4	0	24 U	32 U	33 U	13 U
cis-1,2-Dichloroethene	µg/kg	4	0	24 U	32 U	33 U	13 U
cis-1,3-Dichloropropene	µg/kg	4	0	24 U	32 U	33 U	13 U
Cyclohexane	µg/kg	4	0	24 U	32 U	33 U	13 U
Dibromochloromethane	µg/kg	4	0	24 U	32 U	33 U	13 U
Dichlorodifluoromethane	µg/kg	4	0	24 U	32 U	33 U	13 U
Ethylbenzene	µg/kg	4	0	24 U	32 U	33 U	13 U
Isopropylbenzene	µg/kg	4	0	24 U	32 U	33 U	13 U
Methyl acetate	µg/kg	4	0	24 U	32 U	33 U	13 U
Methyl tert-butyl ether	µg/kg	4	0	24 U	32 U	33 U	13 U
Methylcyclohexane	µg/kg	4	0	24 U	32 U	33 U	13 U

TABLE C-2
REFERENCE SQT SEDIMENT - SUMMARY OF ORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	PE-SQT-09	PE-SQT-10	PE-SQT-10-DUP	PE-SQT-11
Methylene chloride	µg/kg	4	0	24 U	32 U	33 U	13 U
Styrene	µg/kg	4	0	24 U	32 U	33 U	13 U
Tetrachloroethene	µg/kg	4	0	24 U	32 U	33 U	13 U
Toluene	µg/kg	4	2	24 U	7 J"	7 J"	13 U
trans-1,2-Dichloroethene	µg/kg	4	0	24 U	32 U	33 U	13 U
trans-1,3-Dichloropropene	µg/kg	4	0	24 U	32 U	33 U	13 U
Trichloroethene	µg/kg	4	0	24 U	32 U	33 U	13 U
Trichlorofluoromethane	µg/kg	4	0	24 U	32 U	33 U	13 U
Vinyl chloride	µg/kg	4	0	24 U	32 U	33 U	13 U
Xylenes	µg/kg	4	3	71 U	96	100	39
Semi-Volatile Organic Compounds							
1,1'-Biphenyl	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
2,2'-oxybis(1-Chloropropane)	µg/kg	4	0	310 U	350 U	300 U	200 U
2,4,5-Trichlorophenol	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
2,4,6-Trichlorophenol	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
2,4-Dichlorophenol	µg/kg	4	0	310 U	350 U	300 U	200 U
2,4-Dimethylphenol	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
2,4-Dinitrophenol	µg/kg	4	0	7,900 U	8,800 U	7,600 U	5,200 U
2,4-Dinitrotoluene	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
2,6-Dinitrotoluene	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
2-Chloronaphthalene	µg/kg	4	0	310 U	350 U	300 U	200 U
2-Chlorophenol	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
2-Methylnaphthalene	µg/kg	4	0	310 U	350 U	300 U	200 U
2-Methylphenol	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
2-Nitroaniline	µg/kg	4	0	7,900 U	8,800 U	7,600 U	5,200 U
2-Nitrophenol	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
3,3'-Dichlorobenzidine	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
3-Nitroaniline	µg/kg	4	0	7,900 U	8,800 U	7,600 U	5,200 U
4,6-Dinitro-2-methylphenol	µg/kg	4	0	7,900 U	8,800 U	7,600 U	5,200 U
4-Bromophenyl phenyl ether	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
4-Chloro-3-methylphenol	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
4-Chloroaniline	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
4-Chlorophenyl phenyl ether	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
4-Methylphenol	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
4-Nitroaniline	µg/kg	4	0	7,900 U	8,800 U	7,600 U	5,200 U
4-Nitrophenol	µg/kg	4	0	7,900 U	8,800 U	7,600 U	5,200 U
Acenaphthene	µg/kg	4	0	310 U	350 U	300 U	200 U
Acenaphthylene	µg/kg	4	0	310 U	350 U	300 U	200 U
Acetophenone	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Anthracene	µg/kg	4	0	310 U	350 U	300 U	200 U
Atrazine	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Benzaldehyde	µg/kg	4	1	1,500 U	2,000	1,500 U	1,000 U
Benzo(a)anthracene	µg/kg	4	0	310 U	350 U	300 U	200 U
Benzo(a)pyrene	µg/kg	4	0	310 U	350 U	300 U	200 U
Benzo(b)fluoranthene	µg/kg	4	0	310 U	350 U	300 U	200 U
Benzo(ghi)perylene	µg/kg	4	0	310 U	350 U	300 U	200 U
Benzo(k)fluoranthene	µg/kg	4	0	310 U	350 U	300 U	200 U
bis(2-Chloroethoxy)methane	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
bis(2-Chloroethyl) ether	µg/kg	4	0	310 U	350 U	300 U	200 U
bis(2-Ethylhexyl) phthalate	µg/kg	4	0	3,100 U	3,500 U	3,000 U	2,000 U
Butyl benzyl phthalate	µg/kg	4	1	210 J"	1,700 U	1,500 U	1,000 U
Caprolactam	µg/kg	4	0	7,900 U	8,800 U	7,600 U	5,200 U
Carbazole	µg/kg	4	0	310 U	350 U	300 U	200 U
Chrysene	µg/kg	4	0	310 U	350 U	300 U	200 U
Dibenz(a,h)anthracene	µg/kg	4	0	310 U	350 U	300 U	200 U
Dibenzofuran	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Diethyl phthalate	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Dimethyl phthalate	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Di-n-butyl phthalate	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Di-n-octyl phthalate	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Fluoranthene	µg/kg	4	2	310 U	49 J"	48 J"	200 U

TABLE C-2
REFERENCE SQT SEDIMENT - SUMMARY OF ORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	PE-SQT-09	PE-SQT-10	PE-SQT-10-DUP	PE-SQT-11
Fluorene	µg/kg	4	0	310 U	350 U	300 U	200 U
Hexachlorobenzene	µg/kg	4	0	310 U	350 U	300 U	200 U
Hexachlorobutadiene	µg/kg	4	0	310 U	350 U	300 U	200 U
Hexachlorocyclopentadiene	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Hexachloroethane	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Indeno(1,2,3-cd)pyrene	µg/kg	4	0	310 U	350 U	300 U	200 U
Isophorone	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Naphthalene	µg/kg	4	0	310 U	350 U	300 U	200 U
Nitrobenzene	µg/kg	4	0	3,100 U	3,500 U	3,000 U	2,000 U
N-Nitrosodi-n-propylamine	µg/kg	4	0	310 U	350 U	300 U	200 U
N-Nitrosodiphenylamine	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Pentachlorophenol	µg/kg	4	0	1,500 U	1,700 U	1,500 U	1,000 U
Phenanthrene	µg/kg	4	1	310 U	57 J"	300 U	200 U
Phenol	µg/kg	4	0	310 U	350 U	300 U	200 U
Pyrene	µg/kg	4	2	310 U	58 J"	47 J"	200 U

Notes:

PG" Front and rear chromatography columns display >40% difference

J" Estimated result; less than the RL

U Result is a non-detect < the detection limit

B" Method blank contamination

TABLE C-3
DOWNSTREAM SEDIMENT STATIONS - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Unit	Number of Samples	Number of Detections	PE-DNS-SD-01 (0-1.0)	PE-DNS-SD-01 (1-1.5)	PE-DNS-SD-02 (0-1.0)	PE-DNS-SD-03 (0-1.0)	PE-DNS-SD-04 (0-1.0)	PE-DNS-SD-04 (0-1.0)-DUP
Metals									
Cadmium	mg/kg	6	6	1.9	1	1.7 E'	0.45	0.78	0.69
Copper	mg/kg	6	6	2,020	2,440	1,410	246	179	156
Lead	mg/kg	6	6	77.3	51.4	52.3	25.9	40.6	37
Mercury	mg/kg	6	6	25.5	45.3	25.4	3.4	1.1	1.4
Selenium	mg/kg	6	6	7.7	4.3	5.1 E'	1.3	2	1.9
Zinc	mg/kg	6	6	270	249	226	89.3	185	172
Other Sediment Parameters									
Percent Solids	%	6	6	17.2	40.6	32.4	61	44.2	46.7
Total Organic Carbon	%	6	6	7.14	4.25	7.75	2.08	4.82	3.46

Notes:

U Result is a non-detect < the detection limit (DL)

E' Matrix interference

TABLE C-4
SITE DRAINAGE SEDIMENT SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	Minimum Detection	Maximum Detection	PE-DRN-SD-01 (0.0-0.5)	PE-DRN-SD-01 (0.5-1.0)	PE-DRN-SD-01 (1.0-1.5)	PE-DRN-SD-01 (1.5-2.0)	PE-DRN-SD-01 (0.0-0.5)	PE-DRN-SD-02 (0.0-0.5)
Metals											
Antimony	mg/kg	43	43	0.06	1.50	0.41	0.31	0.26	0.29	0.31	0.57
Arsenic	mg/kg	43	43	1.30	90.40	9.50	8.30	6.90	7.90	7.80	7.40
Barium	mg/kg	43	43	36.30	394.00	96.50	88.20	86.10	94.50	64.20 J'	156.00
Cadmium	mg/kg	43	43	0.17	7.50	2.10	0.51	0.34	0.27	0.74	7.50
Chromium	mg/kg	43	43	5.80	30.40	18.60	19.60	19.00	20.40	14.60 J'	23.20
Cobalt	mg/kg	43	43	3.30	31.50	16.40	15.20	13.90	13.80	15.10 J'	11.10
Copper	mg/kg	43	43	14.50	6940.00	125.00	99.20	72.70	53.10	165.00	794.00
Lead	mg/kg	43	43	16.10	356.00	48.50	40.20	91.30	30.30	48.20 J'	159.00
Mercury	mg/kg	43	43	0.12	114.00	21.50	9.30	5.30	5.50	36.80	5.70
Selenium	mg/kg	43	43	0.49	37.90	2.20	1.40	0.94	0.76	3.30	24.30
Silver	mg/kg	43	43	0.04	27.10	0.05 B'	0.05 B'	0.04 B'	0.04 B'	0.04 B'	0.36
Zinc	mg/kg	43	43	58.80	1770.00	69.90	69.30	65.40	68.30	60.20	156.00
Other Sediment Parameters											
Total organic carbon	mg/kg	43	43	4,130	224,000	16,600	7,600	8,690	5,540	23,400	54,800
Percent Solids	mg/kg	43	43	14.80	92.90	70.10	74.70	74.80	74.80	68.30	45.60

Notes:

U Result is a non-detect < the detection limit (DL)

B' Estimated result; less than the RL

J' Method blank contamination

E' Matrix interference

TABLE C-4
SITE DRAINAGE SEDIMENT SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-DRN-SD-02 (0.5-1.0)	PE-DRN-SD-02 (1.0-1.5)	PE-DRN-SD-02 (1.5-2.0)	PE-DRN-SD-03 (0.0-0.5)	PE-DRN-SD-03 (0.5-1.0)	PE-DRN-SD-03 (1.0-1.5)	PE-DRN-SD-03 (1.5-2.0)	PE-DRN-SD-04 (0.0-0.5)	PE-DRN-SD-04 (0.5-1.0)	PE-DRN-SD-04 (1.0-1.5)
Metals											
Antimony	mg/kg	0.37	0.37	0.13 B'	0.17 E'	0.45	0.38	0.27	0.13 B'	0.11 B'	0.06 B'
Arsenic	mg/kg	6.40	6.40	3.90	5.60	72.60	26.00	12.30	3.10	2.90	2.40
Barium	mg/kg	121.00	196.00	159.00	36.30	79.40	89.40	133.00	161.00	133.00	152.00
Cadmium	mg/kg	3.90	1.00	0.41	0.67	2.20	2.40	1.00	0.41	0.30	0.34
Chromium	mg/kg	16.70	25.70	23.50	5.80 J'	12.40 J'	8.90 J'	19.60 J'	25.80 J'	21.90 J'	22.30 J'
Cobalt	mg/kg	7.60	9.40	8.40	3.30	6.40	5.90	10.30	10.70	9.70	8.80
Copper	mg/kg	582.00	63.90	27.70	89.90	189.00	115.00	213.00	44.20	69.80	23.70
Lead	mg/kg	108.00	47.60	23.10	36.70	51.20	28.00	64.20	21.10	18.40	18.30
Mercury	mg/kg	9.00	1.30	0.39	2.20	2.20	1.00	29.40	1.60	1.90	0.57
Selenium	mg/kg	9.10	3.30	2.20	7.60	29.60	37.90	14.60	2.20	1.90	2.20
Silver	mg/kg	0.19	0.19	0.13	0.62	0.47	0.49	0.36	0.18	0.26	0.16
Zinc	mg/kg	111.00	94.60	67.90	107.00	1770.00	854.00	315.00	103.00	80.70	76.50
Other Sediment Parameters											
Total organic carbon	mg/kg	54,600	31,500	22,200	12,300	28,800	39,400	35,900	32,700	25,500	31,400
Percent Solids	mg/kg	49.20	56.60	62.20	92.90	57.60	55.30	62.30	65.80	64.60	66.40

Notes:

U Result is a non-detect < the detection limit (DL)

B' Estimated result; less than the RL

J' Method blank contamination

E' Matrix interference

TABLE C-4
SITE DRAINAGE SEDIMENT SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-DRN-SD-04 (1.5-2.0)	PE-DRN-SD-05 (0.0-0.5)	PE-DRN-SD-05 (0.0-0.5) DUP	PE-DRN-SD-05 (0.5-1.0)	PE-DRN-SD-05 (1.0-1.5)	PE-DRN-SD-05 (1.5-2.0)	PE-DRN-SD-06 (0.0-0.5)	PE-DRN-SD-06 (0.5-1.0)	PE-DRN-SD-06 (1.0 1.5)	PE-DRN-SD-06 (1.5-2.0)
Metals											
Antimony	mg/kg	0.06 B'	0.59	0.52	0.13 B'	0.10 B'	0.10 B'	0.50	0.66	0.47	0.43
Arsenic	mg/kg	1.50	5.20	5.30	4.00	3.30	2.30	13.10	15.40	13.50	12.20
Barium	mg/kg	140.00	187.00	187.00	165.00	163.00	195.00	166.00	207.00	165.00	150.00
Cadmium	mg/kg	0.26	2.20	2.50	0.60	0.56	0.53	1.90	5.20	2.00	1.50
Chromium	mg/kg	20.00 J'	23.80 J'	23.70 J'	24.60 J'	22.70 J'	24.00 J'	19.00 J'	20.10 J'	17.70 J'	16.10 J'
Cobalt	mg/kg	8.80	10.40	10.20	9.80	9.10	9.40	10.40	12.70	10.60	9.30
Copper	mg/kg	36.90	349.00	345.00	42.50	31.60	35.30	2240.00	4870.00	2700.00	3660.00
Lead	mg/kg	17.90	71.60	70.30	22.90	21.10	21.00	209.00	356.00	212.00	211.00
Mercury	mg/kg	0.25	10.70	12.70	0.81	0.46	0.36	24.20	34.30	31.10	73.60
Selenium	mg/kg	1.10	26.50	25.80	3.30	3.30	3.00	9.30	16.10	9.60	9.30
Silver	mg/kg	0.16	27.10	23.20	0.87	1.10	1.30	0.31	0.56	0.30	0.25
Zinc	mg/kg	73.40	277.00	280.00	118.00	91.10	88.00	1030.00	1410.00	1200.00	874.00
Other Sediment Parameters											
Total organic carbon	mg/kg	13,000	99,600	60,100	31,200	25,400	21,900	36,800	66,700	37,600	49,000
Percent Solids	mg/kg	76.70	37.50	37.50	62.40	66.10	70.10	46.60	50.00	52.20	51.50

Notes:

U Result is a non-detect < the detection limit (DL)

B' Estimated result; less than the RL

J' Method blank contamination

E' Matrix interference

TABLE C-4
SITE DRAINAGE SEDIMENT SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-DRN-SD-07 (0.0-0.5)	PE-DRN-SD-07 (0.5-1.0)	PE-DRN-SD-07 (1.0-1.5)	PE-DRN-SD-07 (1.5-2.0)	PE-DRN-SD-08 (0.0-0.5)	PE-DRN-SD-08 (0.5-1.0)	PE-DRN-SD-08 (1.0-1.5)	PE-DRN-SD-08 (1.5-2.0)	PE-DRN-SD-09 (0.0-0.5)	PE-DRN-SD-09 (0.5-1.0)
Metals											
Antimony	mg/kg	0.50	0.86	1.50	0.44	0.61 E'	1.20	0.67	0.23	0.09 B'	0.12 B'
Arsenic	mg/kg	18.00	15.40	15.50	10.30	46.30	90.40	69.20	7.70	1.30	2.90
Barium	mg/kg	394.00	382.00	307.00	172.00	121.00	167.00	153.00	114.00	101.00	83.20
Cadmium	mg/kg	4.00	4.00	4.10	1.60	2.40	4.60	2.20	0.54	0.21	0.23
Chromium	mg/kg	23.60 J'	22.30 J'	30.40 J'	20.40 J'	20.30 J'	19.90 J'	22.00 J'	22.90 J'	18.20 J'	16.70 J'
Cobalt	mg/kg	12.60	11.40	12.30	8.80	9.40	13.60	19.90	31.50	11.60	10.30
Copper	mg/kg	6660.00	6550.00	5360.00	6940.00 J'	284.00 J'	335.00 J'	309.00 J'	67.50 J'	41.70 J'	48.00 J'
Lead	mg/kg	285.00	232.00	235.00	205.00 J'	185.00 J'	137.00 J'	176.00 J'	38.30 J'	19.00 J'	25.30 J'
Mercury	mg/kg	22.70	18.80	15.40	27.30	4.60	6.10	114.00	6.50	8.00	4.60
Selenium	mg/kg	17.90	12.70	15.70	6.70	9.80	10.50	6.80	1.70	0.63	0.87
Silver	mg/kg	0.85	0.40	0.34	0.30	0.42 E'	0.22 B'	0.11 B'	0.08 B'	0.07	0.07
Zinc	mg/kg	1770.00	1370.00	1120.00	733.00	317.00	571.00	700.00	178.00	65.80	69.70
Other Sediment Parameters											
Total organic carbon	mg/kg	98,400	67,100	59,200	36,400	84,800	224,000	74,600	41,400	5,170	10,900
Percent Solids	mg/kg	23.90	38.20	42.20	59.50	29.30	14.80	40.00	49.80	77.20	74.60

Notes:

U Result is a non-detect < the detection limit (DL)

B' Estimated result; less than the RL

J' Method blank contamination

E' Matrix interference

TABLE C-4
SITE DRAINAGE SEDIMENT SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-DRN-SD-09 (1.0-1.5)	PE-DRN-SD-09 (1.5-2.0)	PE-DRN-SD-10 (0.0-0.5)	PE-DRN-SD-10 (0.0-0.5) DUP	PE-DRN-SD-10 (0.5-1.0)	PE-DRN-SD-10 (1.0-1.5)	PE-DRN-SD-10 (1.5-2.0)
Metals								
Antimony	mg/kg	0.19	0.19	0.12 B'	0.12 B'	0.11 B'	0.15	0.31
Arsenic	mg/kg	5.70	8.40	3.10	2.50	3.30	5.20	7.80
Barium	mg/kg	97.80	82.60	108.00	111.00	104.00	97.20	95.70
Cadmium	mg/kg	0.31	0.27	0.23	0.22	0.17	0.20	0.25
Chromium	mg/kg	19.50 J'	18.60 J'	16.80 J'	17.20 J'	16.70 J'	20.70 J'	22.00 J'
Cobalt	mg/kg	13.20	11.90	8.70	8.80	10.00	12.00	13.90
Copper	mg/kg	35.20 J'	35.40 J'	15.80 J'	16.30 J'	14.50 J'	24.10 J'	26.50 J'
Lead	mg/kg	21.80 J'	21.10 J'	23.80 J'	24.30 J'	17.40 J'	16.10 J'	19.50 J'
Mercury	mg/kg	1.40	1.30	2.80	2.80	0.28	0.12	0.12
Selenium	mg/kg	0.69	0.63	0.99	1.00	0.65	0.49	0.56
Silver	mg/kg	0.07	0.07	0.06 B'	0.06 B'	0.05 B'	0.06 B'	0.07
Zinc	mg/kg	74.60	74.90	75.30	76.30	58.80	72.30	77.50
Other Sediment Parameters								
Total organic carbon	mg/kg	4,400	4,240	13,800	18,000	10,600	5,690	4,130
Percent Solids	mg/kg	72.60	74.90	64.30	64.10	74.40	75.10	75.40

Notes:

U Result is a non-detect < the detection limit (DL)

B' Estimated result; less than the RL

J' Method blank contamination

E' Matrix interference

TABLE C-5
SWMU 1/22 WETLAND COMPLEX SURFACE WATER STATIONS - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Sample Type[1]	Units	Number of Samples	Number of Detections	PE-SW-01	PE-SW-02	PE-SW-03	PE-SW-04	PE-SW-05	PE-SW-06	PE-SW-07	PE-SW-08	PE-SW-09
Metals													
Cadmium	U	µg/L	9	0	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
	F	µg/L	9	0	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Copper	U	µg/L	9	9	3.30	2.40	18.60	3.00	3.70	5.90	0.81 B'	1.30 B'	0.33 B'
	F	µg/L	9	6	2.00	1.90 B'	12.00	2.00	2.60	4.40	0.93 U (2.0)	1.50 U (2.0)	0.68 U (2.0)
Lead	U	µg/L	9	9	0.16 B'	0.15 B'	0.07 B'	0.96 B'	0.58 B'	0.40 B'	0.10 B'	0.46 B'	0.11 B'
	F	µg/L	9	9	0.06 B'	0.19 B'	0.04 B'	0.26 B'	0.25 B'	0.20 B'	0.11 B'	0.18 B'	0.14 B'
Mercury	U	µg/L	9	0	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	F	µg/L	9	0	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Selenium	U	µg/L	9	1	5.00 U	5.00 U	0.49 B'	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
	F	µg/L	9	3	5.00 U	0.86 B'	1.40 B'	0.50 B'	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Zinc	U	µg/L	9	9	3.90 B'	2.70 B'	4.90 B'	7.20	1.70 B'	2.80 B'	2.20 B'	3.70 B'	1.30 B'
	F	µg/L	9	9	4.50 B'	1.90 B'	3.70 B'	2.60 B'	2.30 B'	4.50 B'	3.40 U (5.0)	3.00 U (5.0)	1.30 U (5.0)
Other Water Quality Parameters													
Total Suspended Solids	U	mg/L	9	3	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	2.00 B'	3.60 B'	2.00 B'
Hardness	U	mg/L	9	9	133.00	128.00	156.00	132.00	127.00	133.00	54.70	71.60	80.00

Notes:

1, U, Unfiltered sample; F, Filtered (0.45 µm) sample

U Result is a non-detect < the detection limit (DL)

B' Estimated result; less than the RL

J' Method blank contamination

TABLE C-6
NON-DEPURATED BENTHIC INVERTEBRATE TISSUE SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	Min Detection	Max Detection	PE-SQT-BITIS-01	PE-SQT-BITIS-02	PE-SQT-BITIS-04	PE-SQT-BITIS-05	PE-SQT-BITIS-06	PE-SQT-BITIS-07	PE-SQT-BITIS-07-DUP	PE-SQT-BITIS-08	PE-SQT-BITIS-11
Cadmium	mg/kg, wet weight	9	9	0.03	0.94	0.078	0.043	0.061	0.154	0.944	0.044	0.053	0.171	0.031
Copper	mg/kg, wet weight	9	9	10.30	171.00	15.2	16.9	78.3	64.9	171	14.5	13.01	53.1	10.3
Mercury	ng/g, wet weight	9	9	18.60	270.00	69.9	30.9	70.9	18.6	26.8	64.7	62.27	270	30.2
Methylmercury	ng/g, wet weight	9	9	0.68	47.08	22.1	17.7	17	5.37	0.68	45.7	47.08	17.5	22.8
Lead	mg/kg, wet weight	9	9	0.29	6.65	0.285 [J-M]	1.85 [J-M]	0.446 [J-M]	6.65 [J-M]	3 [J-M]	1.11 [M]	0.58	0.782 [J-M]	0.304 [J-M]
Selenium	mg/kg, wet weight	9	9	0.42	8.51	0.65	2.4	1.04	4.63	8.51	1.76	1.67	2.84	0.42
Zinc	mg/kg, wet weight	9	9	19.38	42.00	20.6	42	25.9	31.8	37.8	22.6	19.38	33	20.3

Notes:

[J-M] Result is estimated; duplicate precision percent difference associated with QC sample was not within acceptance criteria.

[M] Result is estimated; duplicate precision percent difference was not within acceptance criteria.

TABLE C-7
WHOLE BODY FISH TISSUE SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	PE-DNS-FFTIS-01	PE-DNS-FFTIS-02	PE-DNS-FFTIS-03	PE-DNS-FFTIS-04	PE-DNS-FFTIS-05	PE-DNS-PFTIS-01	PE-DNS-PFTIS-02	PE-DNS-PFTIS-03	PE-DNS-PFTIS-04	PE-DNS-PFTIS-05	PE-SITE-FFTIS-01
Cadmium	mg/kg, dry weight	21	19	0.041 B'	0.039 B'	0.049	0.051	0.043	0.155	0.041	0.078	0.077	0.137	0.076
Copper	mg/kg, dry weight	21	21	5.74	7.86	10.5	11.4	12.8	12.2	1.77	5.66	5.06	3.75	13.5
Mercury	ng/g, dry weight	21	21	327.0	575.0	376.0	553.0	409.0	319.0	215.0	349.0	632.0	309.0	440.0
Methylmercury	ng/g, dry weight	21	21	278.0	592.0	338.0	592.0	371.0	295.0	193.0	265.0	526.0	331.0	411.0
Lead	mg/kg, dry weight	21	21	0.094 B'	0.134 B'	0.111 B'	0.359	0.218	0.211	0.059 B'	0.134 B'	0.225	0.088 B'	0.703
Selenium	mg/kg, dry weight	21	21	4.95	4.75	6.3	4.34	5.68	7.15	6.85	8.24	7.25	7.71	3.9
Zinc	mg/kg, dry weight	21	21	158.0	162.0	203.0	203.0	166.0	60.3	45.7	61.9	66.7	68.0	173.0
Total Solids	%	21	21	22.16	20.72	21.16	21.1	24.58	29.99	32.29	21.21	29.68	21.57	21.81

Notes:

U Result is a non-detect < the detection limit (DL)

B' Estimated result; less than the RL

FF, Forage fish tissue sample

PF, Piscivorous fish tissue sample

DNS, Downstream

Site, Site

UPS, Upstream

TABLE C-7
WHOLE BODY FISH TISSUE SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-SITE-FFTIS-02	PE-SITE-FFTIS-03	PE-SITE-FFTIS-04	PE-SITE-FFTIS-05	PE-UPS-FFTIS-01	PE-UPS-FFTIS-02	PE-UPS-FFTIS-03	PE-UPS-FFTIS-04	PE-UPS-FFTIS-05	PE-UPS-PFTIS-01
Cadmium	mg/kg, dry weight	0.023 B'	0.026 B'	0.016 U	0.016 U	0.056	0.016 B'	0.022 B'	0.023 B'	0.032 B'	0.015 B'
Copper	mg/kg, dry weight	10.7	8.59	3.67	6.29	7.98	7.09	10.5	7.17	5.57	6.96
Mercury	ng/g, dry weight	370.0	316.0	407.0	426.0	201.0	269.0	243.0	318.0	275.0	244.0
Methylmercury	ng/g, dry weight	408.0	296.0	387.0	443.0	162.0	252.0	234.0	357.0	326.0	241.0
Lead	mg/kg, dry weight	0.891	0.974	0.22	0.497	0.494	0.135 B'	0.125 B'	0.091 B'	0.076 B'	0.275
Selenium	mg/kg, dry weight	6.77	3.33	3.45	5.71	2.1	2.03	1.97	1.72	1.5	1.58
Zinc	mg/kg, dry weight	265.0	184.0	193.0	284.0	95.5	232.0	214.0	164.0	194.0	207.0
Total Solids	%	19.02	20.16	19.34	18.87	20.3	20.86	20.05	22.96	22.41	20.38

Notes:

U Result is a non-detect < the detection lim

B' Estimated result; less than the RL

FF, Forage fish tissue sample

PF, Piscivorous fish tissue sample

DNS, Downstream

Site, Site

UPS, Upstream

TABLE C-8
NON-DEPURATED EARTHWORM TISSUE SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	PE-N1-EWTIS-COMP-01	PE-N1-EWTIS-COMP-02	PE-N1-EWTIS-COMP-03	PE-N1-EWTIS-COMP-05	PE-N2-EWTIS-COMP-01	PE-N2-EWTIS-COMP-02
Antimony	mg/kg, dry weight	27	7	0.47 [U (2.0)]	0.051 [U (2.0)]	1.1 [U]	0.088 [U (2.0)]	0.99 [U]	1.2 [U]
Arsenic	mg/kg, dry weight	27	27	11.1	5	5.6	4.1	1.3	6.1 [J]
Barium	mg/kg, dry weight	27	27	98.8	11.1	9.5	36	5.7	2.3 [B']
Cadmium	mg/kg, dry weight	27	27	22.6	31.9	64.8	4.4	2.3	8.8
Chromium	mg/kg, dry weight	27	21	13.9 [J]	1.4 [J]	1.3 [J]	1.7 [J]	2 [J]	0.97 [U (2.0)]
Cobalt	mg/kg, dry weight	27	27	5.9	3.2	1.4	1.6	3.6	4.6 [J]
Copper	mg/kg, dry weight	27	27	26.3 [J']	13.9 [J']	15.8 [J']	7.2 [J']	6.2 [J']	5.2 [J]
Lead	mg/kg, dry weight	27	27	107 [J]	13.5 [J]	65.6 [J]	37.2 [J]	1.5 [J]	2.3 [J]
Mercury	mg/kg, dry weight	27	27	1.7 [J]	1.3 [J]	0.46 [J]	1.6 [J]	0.76 [J]	1.2 [J]
Selenium	mg/kg, dry weight	27	27	209	127	147	113	4.5	42.7 [J]
Silver	mg/kg, dry weight	27	21	0.83	1.7	1.2	0.2	0.5 [U]	0.27 [B']
Zinc	mg/kg, dry weight	27	27	334 [J']	546 [J']	266 [J']	155 [J']	123 [J']	534 [J]
Percent Moisture	%	27	27	77	80.9	81.3	50	79.9	82.7

Notes:

[R] Result is considered unusable due to a major quality control anomaly

[J] Result is estimated due to a minor quality control anomaly

[U] Result is a non-detect < the detection limit (DL)

[B'] Estimated result; less than the RL

[J'] Method blank contamination

TABLE C-8
NON-DEPURATED EARTHWORM TISSUE SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-N2-EWTIS-COMP-02 DUP	PE-N2-EWTIS-COMP-05	PE-N3-EWTIS-COMP-01	PE-N3-EWTIS-COMP-02	PE-N3-EWTIS-COMP-03	PE-N3-EWTIS-COMP-04	PE-N3-EWTIS-COMP-05	PE-S1-EWTIS-COMP-01
Antimony	mg/kg, dry weight	0.21 [B']	0.096 [U (2.0)]	0.16 [U (2.0)]	0.26 [U (2.0)]	0.38 [B']	0.073 [B']	0.23 [B']	0.26 [B']
Arsenic	mg/kg, dry weight	3.6 [J]	3.9	4.8	10.1	12.2	8.8	8.3	7.2
Barium	mg/kg, dry weight	2.9 [B']	33.7	23.3	2.6 [B']	8.7	2.4 [B']	7.3	35
Cadmium	mg/kg, dry weight	8.9	3.9	13.6	18.5	34.1	21.8	5.3	7.7
Chromium	mg/kg, dry weight	1.6 [J]	8.8 [J]	4.6 [J]	1.2 [U (2.0)]	5.3 [J]	1.4 [J]	1.9 [J]	9.4 [J]
Cobalt	mg/kg, dry weight	7.1 [J]	6.6	4.8	8.2	10.6	4.2	5.7	4.4
Copper	mg/kg, dry weight	6.5	13.2 [J']	51.5 [J']	17.5 [J']	15.3	11.1	25.4	95.5
Lead	mg/kg, dry weight	1.6	10.8 [J]	206 [J]	183 [J]	188	219	2.9	69.3
Mercury	mg/kg, dry weight	2.2 [R]	0.66 [J]	5.6 [J]	2.8 [J]	3.5 [R]	1.6 [R]	3 [R]	7.9 [R]
Selenium	mg/kg, dry weight	17.1 [J]	16.3	68.2	197	189 [J']	129 [J']	136 [J']	19.9 [J']
Silver	mg/kg, dry weight	0.098 [B']	0.079 [B']	0.019 [B']	0.29 [B']	0.72	0.75	0.14 [B']	0.014 [B']
Zinc	mg/kg, dry weight	368 [J]	291 [J']	656 [J']	260 [J']	404	564	257	428
Percent Moisture	%	82.8	80.7	83.8	85.4	85.7	82.2	80.6	83

Notes:

[R] Result is considered unusable due to a major quality control an

[J] Result is estimated due to a minor quality control anomaly

[U] Result is a non-detect < the detection limit (DL)

[B'] Estimated result; less than the RL

[J'] Method blank contamination

TABLE C-8
NON-DEPURATED EARTHWORM TISSUE SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-S1-EWTIS-COMP-02	PE-S1-EWTIS-COMP-03	PE-S1-EWTIS-COMP-04	PE-S1-EWTIS-COMP-05	PE-S2-EWTIS-COMP-03	PE-S2-EWTIS-COMP-04
Antimony	mg/kg, dry weight	0.06 [B']	0.065 [U (2.0)]	0.33 [U (2.0)]	0.21 [U (2.0)]	0.57 [U (2.0)]	0.21 [U (2.0)]
Arsenic	mg/kg, dry weight	6.8	5.1	9.7	6.9	3.6	3.6
Barium	mg/kg, dry weight	5.5 [B']	2.5 [B']	8.9	3.4 [B']	3.3 [B']	33.2
Cadmium	mg/kg, dry weight	23.7	7.7	8.6	5.5	4	16.1
Chromium	mg/kg, dry weight	1.2 [U (2.0)]	1 [U (2.0)]	2.7 [J]	1.1 [U (2.0)]	0.99 [U (2.0)]	7 [J]
Cobalt	mg/kg, dry weight	1.6	4.4	7.3	5.8	3.9	6.3
Copper	mg/kg, dry weight	7.1	9.7 [J']	8.1 [J']	6.4 [J']	24.6 [J']	22.7 [J']
Lead	mg/kg, dry weight	59.9	9.2 [J]	15.2 [J]	3.7 [J]	4.3 [J]	73 [J]
Mercury	mg/kg, dry weight	3.5 [R]	2.8 [J]	4.2 [J]	3.3 [J]	0.66 [J]	7.2 [J]
Selenium	mg/kg, dry weight	41 [J']	46.9	97.2	57.9	21.2	9.7
Silver	mg/kg, dry weight	1.1	0.62 [U]	0.23 [B']	0.035 [B']	0.57 [U]	0.51 [U]
Zinc	mg/kg, dry weight	767	436 [J']	445 [J']	427 [J']	185 [J']	329 [J']
Percent Moisture	%	85.3	83.9	84.8	83.9	82.5	80.3

Notes:

[R] Result is considered unusable due to a major quality control an

[J] Result is estimated due to a minor quality control anomaly

[U] Result is a non-detect < the detection limit (DL)

[B'] Estimated result; less than the RL

[J'] Method blank contamination

TABLE C-8
NON-DEPURATED EARTHWORM TISSUE SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-S2-EWTIS-COMP-05	PE-S2-EWTIS-COMP-05 DUP	PE-S3-EWTIS-COMP-01	PE-S3-EWTIS-COMP-02	PE-S3-EWTIS-COMP-03	PE-S3-EWTIS-COMP-04	PE-S3-EWTIS-COMP-05
Antimony	mg/kg, dry weight	0.2 [U (2.0)]	0.31 [B']	0.26 [U (2.0)]	0.19 [U (2.0)]	0.2 [U (2.0)]	0.28 [U (2.0)]	0.53 [U (2.0)]
Arsenic	mg/kg, dry weight	4.4	4.8	5.6	5.9	8.9	7.1	8.8
Barium	mg/kg, dry weight	30.1 [J]	3.4 [J]	11.7	3.4 [B']	10.7	19.3	40.6
Cadmium	mg/kg, dry weight	10.2	8.5	4.1	13.1	7	8	6.9
Chromium	mg/kg, dry weight	6.3 [J]	1.4 [J]	5.2 [J]	1.6 [J]	4.8 [J]	7.8 [J]	10.4 [J]
Cobalt	mg/kg, dry weight	4.7 [J]	3 [J]	3.9	5.1	5	4	9.7
Copper	mg/kg, dry weight	74.1 [J]	9.5 [J]	66.3 [J']	7.5 [J']	17.1 [J']	48.6 [J']	91.9 [J']
Lead	mg/kg, dry weight	558 [J]	919 [J]	29 [J]	12.8 [J]	14.7 [J]	34.1 [J]	39.1 [J]
Mercury	mg/kg, dry weight	2.8 [J]	1.7 [R]	6.8 [J]	3.2 [J]	5.7 [J]	9.8 [J]	3.7 [J]
Selenium	mg/kg, dry weight	14.6 [J]	39.2 [J]	38.6	71.1	196	122	66
Silver	mg/kg, dry weight	0.035 [B']	0.66 [U]	0.025 [B']	0.63 [U]	0.053 [B']	0.098 [B']	0.051 [B']
Zinc	mg/kg, dry weight	344 [J']	451	171 [J']	312 [J']	296 [J']	346 [J']	472 [J']
Percent Moisture	%	85.3	84.8	79	84.1	84.2	87	79.6

Notes:

[R] Result is considered unusable due to a major quality control an

[J] Result is estimated due to a minor quality control anomaly

[U] Result is a non-detect < the detection limit (DL)

[B'] Estimated result; less than the RL

[J'] Method blank contamination

TABLE C-9
NON-DEPURATED SMALL MAMMAL WHOLE BODY TISSUE SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	PE-N1-SMTIS-INDV-01	PE-N1-SMTIS-INDV-02	PE-N1-SMTIS-INDV-03	PE-N1-SMTIS-INDV-04	PE-N1-SMTIS-INDV-05	PE-N2-SMTIS-INDV-01	PE-N2-SMTIS-INDV-02	PE-N2-SMTIS-INDV-03	PE-N2-SMTIS-INDV-04	PE-N2-SMTIS-INDV-05	PE-N3-SMTIS-INDV-01	PE-N3-SMTIS-INDV-01 DUP	PE-N3-SMTIS-INDV-02
Antimony	mg/kg, wet weight	16	3	0.18 [U]	0.17 [U]	0.16 [U]	0.19 [U]	0.16 [U]	0.17 [U]	0.18 [U]	0.16 [U]	0.17 [U]	0.04 [B']	0.18 [U]	0.0077 [B']	0.037 [U (0.17)]
Arsenic	mg/kg, wet weight	16	11	0.17	0.32	0.92	0.046 [B']	0.055 [B']	0.087 [U]	0.088 [U]	0.081 [U]	0.087 [U]	0.027 [B']	0.091 [U]	0.026 [B']	0.14
Barium	mg/kg, wet weight	16	16	2.3	6.4	13.2	3.7	4.4	1.7	1.4	0.39 [B']	1.6	3.6	1.2	1.9	2.9
Cadmium	mg/kg, wet weight	16	6	0.023 [B']	0.1 [J]	0.036 [J]	0.056 [J]	0.29 [J]	0.087 [U]	0.088 [U]	0.081 [U]	0.087 [U]	0.086 [U]	0.091 [U]	0.088 [U]	0.084 [U]
Chromium	mg/kg, wet weight	16	16	4.2 [J]	1.7 [J]	6.2 [J']	2.5 [J']	1.5 [J]	2.8 [J']	7.5 [J']	2.2 [J]	2.2 [J]	4.3 [J']	2.8 [J']	1.9 [J]	5.5 [J']
Cobalt	mg/kg, wet weight	16	16	0.046	0.38	0.044	0.043 [B']	0.038 [B']	0.046	0.05	0.02 [B']	0.036 [B']	0.047	0.07	0.064	0.1
Copper	mg/kg, wet weight	16	16	2.4	3.4	4.6	2.6	2.3	2 [J']	2.6	1.9	2	2.3	2 [J']	1.7	2.7 [J']
Lead	mg/kg, wet weight	16	16	0.24	1.6	1.9	0.18	0.073 [B']	0.08 [B']	0.046 [B']	0.98	0.031 [B']	0.08 [B']	0.52	0.52	0.59
Mercury	mg/kg, wet weight	16	3	0.033 [U]	0.032 [U]	0.03 [U]	0.014 [B']	0.03 [U]	0.031 [U]	0.026 [U]	0.03 [U]	0.027 [U]	0.026 [U]	0.029 [U]	0.031 [U]	0.03 [U]
Selenium	mg/kg, wet weight	16	16	5.7 [J]	13.2 [J]	40.2 [J]	2 [J]	0.93 [J]	0.38 [B']	0.45 [J]	0.45 [J]	0.32 [J]	0.77 [J]	0.31 [B']	0.32 [J]	3.6
Silver	mg/kg, wet weight	16	2	0.088 [U]	0.033 [B']	0.081 [U]	0.093 [U]	0.082 [U]	0.087 [U]	0.088 [U]	0.081 [U]	0.087 [U]	0.086 [U]	0.091 [U]	0.088 [U]	0.084 [U]
Zinc	mg/kg,wet weight	16	16	20.1 [J]	19.7 [J]	20.1 [J]	20.7 [J]	22 [J]	25.7 [J]	24.9 [J]	143 [J]	24.4 [J]	33 [J]	57.4 [J]	49.7 [J]	179 [J]
Percent Moisture	%	16	16	82	88.9	84.5	73.8	82.1	77	81.6	85.9	85.4	76.6	85.4	72.2	81.6

Notes:

[J] Result is estimated due to a minor quality control anomaly

[U] Result is a non-detect < the detection limit (DL)

[B'] Estimated result; less than the RL

[J'] Method blank contamination

TABLE C-9
NON-DEPURATED SMALL MAMMAL WHOLE BODY TISSUE SAMPLES - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-N3-SMTIS-INDV-03	PE-N3-SMTIS-INDV-04	PE-N3-SMTIS-INDV-05	PE-S2-SMTIS-INDV-01	PE-S2-SMTIS-INDV-02	PE-S3-SMTIS-INDV-01	PE-S3-SMTIS-INDV-01 DUP	PE-SI-SMTIS-INDV-01	PE-SI-SMTIS-INDV-02	PE-SI-SMTIS-INDV-03	PE-SI-SMTIS-INDV-04
Antimony	mg/kg, wet weight	0.17 ^{U}	0.17 ^{U}	0.17 ^{U}	0.18 ^{U}	0.16 ^{U}	0.17 ^{U}	0.18 ^{U}	0.019 $^{U\,(0.18)}$	0.17 ^{U}	0.2 ^{U}	0.17 ^{U}
Arsenic	mg/kg, wet weight	0.17	0.033 $^{B'}$	0.22	0.088 ^{U}	0.023 $^{B'}$	0.083 ^{U}	0.09 ^{U}	0.086 $^{B'}$	0.084 ^{U}	0.022 $^{B'}$	0.017 $^{B'}$
Barium	mg/kg, wet weight	1.5	1.4	2.9	3.1	1.7	3.2	1.6	2.1	1.7	1	2
Cadmium	mg/kg, wet weight	0.083 ^{U}	0.085 ^{U}	0.086 ^{U}	0.088 ^{U}	0.079 ^{U}	0.015 ^{J}	0.09 ^{U}	0.092 ^{U}	0.084 ^{U}	0.098 ^{U}	0.086 ^{U}
Chromium	mg/kg, wet weight	4.5 $^{J'}$	5.8 $^{J'}$	3.9 $^{J'}$	5.2 $^{J'}$	1.7 ^{J}	1 ^{J}	1.5 ^{J}	12.5 $^{J'}$	7.1 $^{J'}$	1.7 $^{J'}$	11.5 $^{J'}$
Cobalt	mg/kg, wet weight	0.05	0.06	0.051	0.044	0.038 $^{B'}$	0.051	0.037 $^{B'}$	0.075	0.043	0.025 $^{B'}$	0.087
Copper	mg/kg, wet weight	2.3 $^{J'}$	3.8 $^{J'}$	2.2 $^{J'}$	2.5	2	2.3	2	2.6 $^{J'}$	3.3 $^{J'}$	2.2 $^{J'}$	3.1 $^{J'}$
Lead	mg/kg, wet weight	1.5	1.1	5.1	0.069 $^{B'}$	0.15	0.42	0.27	1.3	0.31	0.13	0.17
Mercury	mg/kg, wet weight	0.027 ^{U}	0.014 $^{B'}$	0.013 $^{B'}$	0.025 ^{U}	0.013 $^{B'}$	0.032 ^{U}	0.03 ^{U}	0.047	0.1	0.014 $^{B'}$	0.023 $^{B'}$
Selenium	mg/kg, wet weight	8.3	0.7	9.4	0.35 ^{J}	0.33 ^{J}	0.83 ^{J}	0.83 ^{J}	0.84	0.56	0.38 $^{B'}$	0.28 $^{B'}$
Silver	mg/kg, wet weight	0.083 ^{U}	0.085 ^{U}	0.086 ^{U}	0.088 ^{U}	0.079 ^{U}	0.083 ^{U}	0.09 ^{U}	0.092 ^{U}	0.084 ^{U}	0.098 ^{U}	0.086 ^{U}
Zinc	mg/kg,wet weight	146 ^{J}	70.8 ^{J}	236 ^{J}	22 ^{J}	18.8 ^{J}	25.4 ^{J}	19.8 ^{J}	26.5 ^{J}	27.5 ^{J}	21.1 ^{J}	25.5 ^{J}
Percent Moisture	%	74.1	76.7	89.2	87	77.8	86	88.1	69.2	76.8	80.3	86.2

Notes:

^{J} Result is estimated due to a minor quality control anomaly

^{U} Result is a non-detect < the detection limit (DL)

$^{B'}$ Estimated result; less than the RL

$^{J'}$ Method blank contamination

TABLE C-10
ACTIVE PLANT AREA SOIL SAMPLING - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	PE-N1-SO-COMP-01	PE-N1-SO-COMP-02	PE-N1-SO-COMP-03	PE-N1-SO-COMP-04	PE-N1-SO-COMP-05	PE-N2-SO-COMP-01
Metals									
Antimony	mg/kg	32	32	0.5	0.3	0.3	0.7	0.8	0.3 B'
Arsenic	mg/kg	32	32	13.3	7.2	6.3	7.1	9.5	8.4
Barium	mg/kg	32	32	122	113	112	110	558	58.9
Cadmium	mg/kg	32	32	0.65	0.66	0.8	0.46	0.51	0.16
Chromium	mg/kg	32	32	20.1 J'	20 J'	19.2 J'	18.1 J'	16.2 J'	21.3 J'
Cobalt	mg/kg	32	32	12.5	9.8	9.7	11.4	8.2	11.2
Copper	mg/kg	32	32	41.1	28.0	50.7	20.0	24.7	19.7
Lead	mg/kg	32	32	98.7	83.9	63.4	58.3	676	27
Mercury	mg/kg	32	32	0.16	0.16	0.14	0.59	0.45	0.057
Selenium	mg/kg	32	32	25.0	20.6	6.5	4.3	179.0	0.8
Silver	mg/kg	32	32	0.1 B'	0.1 B'	0.2	0.2	0.1	0.0 B'
Zinc	mg/kg	32	32	75.0	68.4	92.1	92.1	86.7	64.1
Other Soil Parameters									
Percent Solids	%	32	32	85.5	82.1	82.5	80.8	83.4	69.6

Notes:

B' Estimated result; less than the RL

J' Method blank contamination

E' Matrix interference

TABLE C-10
ACTIVE PLANT AREA SOIL SAMPLING - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-N2-SO-COMP-02	PE-N2-SO-COMP-02-DUP	PE-N2-SO-COMP-03	PE-N2-SO-COMP-04	PE-N2-SO-COMP-05	PE-N3-SO-COMP-01	PE-N3-SO-COMP-02	PE-N3-SO-COMP-03	PE-N3-SO-COMP-04
Metals										
Antimony	mg/kg	0.3	0.3 B'	0.2 B'	0.3	0.3	0.4	0.3	0.2 B'	0.2 B'
Arsenic	mg/kg	7.7	6.9	8	6.8	6.2	8.3	10.7	5.6	5.3
Barium	mg/kg	74.8	68.2	66.1	63.4	98.4	62.9	68.4	57.8	55.2
Cadmium	mg/kg	0.24	0.21	0.18	0.23	0.33	0.17	0.17	0.14	0.17
Chromium	mg/kg	21.2 J'	20 J'	21.1 J'	17.4 J'	21.6 J'	20 J'	22.4 J'	20 J'	19.9 J'
Cobalt	mg/kg	12.6	11.8	12.2	10.4	12.2	13.1	15.9	10.7	9.4
Copper	mg/kg	22.6	20.0	24.8	19.1	19.2	172.0	27.7	24.4	28.7
Lead	mg/kg	30.4	27.2	22.2	23.2	35.8	57.4	38.5	29.9	29.1
Mercury	mg/kg	0.14	0.14	0.099	0.099	0.23	1.4	0.26	0.18	0.17
Selenium	mg/kg	1.0	0.9	0.8	0.9	1.2	4.9	1.3	1.1	1.1
Silver	mg/kg	0.1 B'	0.0 B'	0.0 B'	0.1 B'	0.1 B'	0.1 B'	0.1 B'	0.1 B'	0.0 B'
Zinc	mg/kg	76.1	69.1	77.1	69.5	80.5	79.2	79.8	69.3	67.3
Other Soil Parameters										
Percent Solids	%	73.6	75.3	81.5	85.2	71.5	77.5	76.9	77.5	78.4

Notes:

B' Estimated result; less than the RL

J' Method blank contamination

E' Matrix interference

TABLE C-10
ACTIVE PLANT AREA SOIL SAMPLING - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-N3-SO-COMP-05	PE-S1-SO-COMP-01	PE-S1-SO-COMP-02	PE-S1-SO-COMP-03	PE-S1-SO-COMP-04	PE-S1-SO-COMP-05	PE-S2-SO-COMP-01	PE-S2-SO-COMP-02	PE-S2-SO-COMP-03
Metals										
Antimony	mg/kg	0.3	0.4	0.2 B'	0.2 B'	0.2	0.2	0.3	0.3	0.3
Arsenic	mg/kg	9.2 E'	9.8	8.2	4.3	4.5	4.5	6	5.5	6.9
Barium	mg/kg	136	115	74.7	89.4	81.6 J'	96.1 J'	65.2 J'	47.3 J'	72.2 J'
Cadmium	mg/kg	0.31	0.36	0.16	0.15	0.25	0.21	0.17	0.13	0.19
Chromium	mg/kg	25.7 J'	25.8 J'	12.3 J'	17.9 J'	13 J'	14.9 J'	15.9 J'	14.6 J'	17.3 J'
Cobalt	mg/kg	16.9	22.8	6.8	10.4	6.9 J'	9.4 J'	13.3 J'	8.7 J'	14.6 J'
Copper	mg/kg	53.5	282.0	23.5	18.0	13.7	13.0	14.6	16.9	127.0
Lead	mg/kg	42.2	109	33.4	27.9	22.2 J'	21.1 J'	32.9 J'	50.8 J'	28.3 J'
Mercury	mg/kg	0.33	0.83	1.1	0.65	0.44	0.16	0.34	0.33	0.077
Selenium	mg/kg	2.5	1.4	1.2	0.9	0.9	0.9	1.0	1.0	0.9
Silver	mg/kg	0.1 B'	0.0 B'	0.1 B'	0.0 B'	0.1	0.1 B'	0.1 B'	0.0 B'	0.0 B'
Zinc	mg/kg	85.2	227.0	49.4	52.9	44.0	42.8	54.0	46.9	57.4
Other Soil Parameters										
Percent Solids	%	75.4	84.7	75.7	76.8	77.4	77.6	76.1	75.9	80.2

Notes:

B' Estimated result; less than the RL

J' Method blank contamination

E' Matrix interference

TABLE C-10
ACTIVE PLANT AREA SOIL SAMPLING - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	PE-S2-SO-COMP-04	PE-S2-SO-COMP-05	PE-S2-SO-COMP-05-DUP	PE-S3-SO-COMP-01	PE-S3-SO-COMP-02	PE-S3-SO-COMP-03	PE-S3-SO-COMP-04	PE-S3-SO-COMP-05
Metals									
Antimony	mg/kg	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.5
Arsenic	mg/kg	6.6	7	6.6	5.2	6.1	8.2	6.4	5.7
Barium	mg/kg	61.8 J'	67.1 J'	62.4 J'	49.9 J'	47.7 J'	95.8 J'	70.7 J'	68.6 J'
Cadmium	mg/kg	0.14	0.2	0.17	0.15	0.15	0.31	0.2	0.21
Chromium	mg/kg	17 J'	15.3 J'	14.6 J'	14 J'	14.1 J'	16.8 J'	16.3 J'	12.5 J'
Cobalt	mg/kg	12.8 J'	10.2 J'	9.7 J'	9.8 J'	8.9 J'	11.2 J'	11.5 J'	10.7 J'
Copper	mg/kg	23.9	63.0	56.0	281.0	56.4	52.6	170.0	145.0
Lead	mg/kg	55.1 J'	563 J'	497 J'	40.7 J'	31.7 J'	58.6 J'	39.2 J'	45.7 J'
Mercury	mg/kg	0.34	0.33	0.38	0.21	0.27	4.4	0.78	3.2
Selenium	mg/kg	1.1	1.1	1.0	1.2	1.6	6.2	1.1	1.0
Silver	mg/kg	0.1 B'	0.1	0.1	0.0 B'	0.0 B'	0.1 B'	0.1 B'	0.1 B'
Zinc	mg/kg	57.8	65.1	61.0	47.1	46.3	97.0	61.4	54.7
Other Soil Parameters									
Percent Solids	%	57.1	75.1	74.6	75.4	76.5	64.9	75.0	71.5

Notes:

B' Estimated result; less than the RL

J' Method blank contamination

E' Matrix interference

TABLE C-11
SWMU 35 PERIMETER SOIL SAMPLING - SUMMARY OF INORGANIC ANALYTICAL RESULTS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Analyte	Units	Number of Samples	Number of Detections	Minimum Detection	Maximum Detection	PE-35-SO-01	PE-35-SO-02	PE-35-SO-03	PE-35-SO-03 DUP	PE-35-SO-04	PE-35-SO-05
Antimony	mg/kg	6	6	0.13	0.31	0.31 [J]	0.23 [J]	0.16 [J]	0.13 [J]	0.22 [J]	0.16 [J]
Arsenic	mg/kg	6	6	3.90	7.10	5.60 [J]	7.10 [J]	5.20 [J]	3.90 [J]	6.40 [J]	4.50 [J]
Barium	mg/kg	6	6	45.60	286.00	73.90	89.40	49.30	45.60	286.00	87.20
Cadmium	mg/kg	6	6	0.09	11.80	11.80	0.26	0.10	0.09	0.46	0.14
Chromium	mg/kg	6	6	15.50	21.70	16.60 [J']	16.70 [J']	18.30 [J']	15.50 [J']	21.70 [J']	17.00 [J']
Cobalt	mg/kg	6	6	7.80	17.10	10.10	10.30	10.60	7.80	17.10	8.90
Copper	mg/kg	6	6	11.80	40.70	40.70 [J]	22.90 [J]	14.60 [J]	12.20 [J]	17.80 [J]	11.80 [J]
Lead	mg/kg	6	6	12.20	41.20	41.20	21.80	17.80 [J]	12.20 [J]	31.50	22.80 [J']
Mercury	mg/kg	6	6	0.03	0.14	0.09	0.09	0.03	0.03	0.14	0.13
Selenium	mg/kg	6	6	0.33	0.96	0.76	0.53	0.34	0.33 [B']	0.96	0.55
Silver	mg/kg	6	6	0.02	0.15	0.07 [J']	0.07	0.02 [B']	0.02 [B']	0.15	0.06 [B']
Zinc	mg/kg	6	6	47.10	72.70	62.90	61.70	52.60	47.10	72.70	52.10
Percent Solids	%	6	6	72.70	80.70	75.10	80.70	75.90	72.70	78.30	73.50

Notes:

[J] Result is estimated due to a minor quality control anomaly

[U] Result is a non-detect < the detection limit (DL)

[B'] Estimated result; less than the RL

[J'] Method blank contamination

APPENDIX D

Description of Dose Rate Modeling
FWIA Step IIC Investigation Report
Dyno Nobel Port Ewen Site

The purpose of this appendix is to describe the development of dose rate models used to evaluate potential exposures to wildlife receptors identified in the New York State Department of Environmental Conservation (NYSDEC) Fish and Wildlife Impact Analysis (FWIA) of the Dyno Nobel Port Ewen site (Site). Dose rate models were developed based on the ecological conceptual site model (ECSM) to calculate estimated daily doses (EDDs) of metals that select receptor groups potentially experience through exposure to site media. As described in Sections 4.0 and 5.0 of the FWIA Step IIC Report (Report), comprehensive biological tissue, surface water, sediment, and soil data were collected to provide site-specific inputs to dose rate models. Model development and parameterization were reviewed with NYSDEC Division of Fish, Wildlife, and Marine Resources (DFWMR) in a February 23, 2011 meeting and series of subsequent conference calls (March 4, 11, and 18, 2011) during the preparation of the Report.

The following sections provide a detailed description of wildlife exposure areas and the development of the dose rate models, including the selection of species-specific exposure parameters, exposure point concentrations (EPCs), bioaccumulation factors (BAFs), biota sediment accumulation factors (BSAFs), area use factors (AUFs), and wildlife toxicity reference values (TRVs).

Exposure Areas

The following sections define the wildlife exposure areas evaluated for the SWMU 1/22 Wetland Complex and the Active Plant Area.

SWMU 1/22

The wildlife exposure area for SWMU 1/22 Wetland Complex included the area from the plant entrance road to the farthest extent of the downstream sediment characterization sampling (Report Figure 15). The area characterized by the downstream sediment sampling stations was included in the wildlife exposure area because there were elevated concentrations of site-related metals observed in the downstream sediments. Because of the proximity of these drainages to the Wetland Complex, it was assumed that wildlife foraging within the SWMU 1/22 Wetland Complex would also potentially forage downstream of the Site. In addition, at the request of DFWMR, portions of the site drainage ditches to the east of the railroad tracks were conservatively included in the exposure area. Based on these extents, the total exposure area for the SWMU 1/22 Wetland Complex comprises approximately 5.2 hectares and approximately 1.9 linear kilometers (Report Figure 15).

Active Plant Area

The terrestrial exposure evaluation in the Active Plant Area focused on potential risks to wildlife receptors that potentially forage on small mammals and earthworms along the margins of the facility. As described in the Report (Section 5.1.1), small mammal and earthworm tissue collections were spatially- and temporally- matched with the collection of surficial soil samples in six (6) sampling grids designated by DFWMR: three (3) grids near the northern extent of the Active Plant Area and three (3) grids near the southern extent (Report Figure 10). Each sampling grid was approximately one hectare in area. Dose rate models were develop to evaluate terrestrial wildlife exposure for the following scenarios based on the exposure areas:

- Northern sampling grids: maximum area use exposure;
- Southern sampling grids: maximum area use exposure; and
- Northern and Southern sampling grids: maximum area use and adjusted area use exposure for long-ranging receptors (red-tailed hawk and red fox).

The combined data for the northern and southern grids were used to conservatively represent exposure throughout the approximately 42 hectares of the Active Plant Area. The following sections present the modeling approach and specific model parameters.

Modeling Approach

Simplified dose rate models were developed to evaluate wildlife ingestion pathways in the SWMU 1/22 Wetland Complex and the Active Plant Area. EDDs for wildlife receptors were calculated using: (1) EPCs based on site-specific measurements of metals in prey and abiotic media and (2) receptor-specific exposure parameters and food chain model assumptions. EDDs were calculated using EPCs and receptor-specific exposure parameters expressed on a dry weight basis[1]. Receptor doses from diet and incidental substrate ingestion were modeled using dry weight parameters to avoid introducing unnecessary uncertainty into the model associated with converting parameters from dry weight to wet weight based on approximate moisture contents of dietary items. Food ingestion rates, substrate ingestion rates, and substrate-to-biota accumulation rates were expressed on a dry weight basis.

EDDs calculated using dose rate models were compared to TRVs representing no observable adverse effect levels (NOAELs) or low observable adverse effect levels (LOAELs) to evaluate the potential for adverse ecological effects. Potential risks associated with estimated doses to wildlife receptors were expressed as hazard quotients (HQs), which represent the ratio of the calculated EDD to the TRV for wildlife ingestion pathways:

$$HQ = \frac{EDD}{TRV} \tag{1}$$

Potential risk may be characterized based on HQs, as follows:

- HQs greater than 1.0 indicate that exposure exceeds a known threshold of effects, which could represent no adverse effects (e.g., NOAEL) or low adverse effects (e.g., LOAELs).

[1] Wet weight tissue concentrations reported by analytical laboratories were converted to dry weight based on the measured moisture content of tissue samples, with the exception of benthic invertebrate tissue samples. Insufficient sample mass was available to measure percent moisture in benthic invertebrate tissue; therefore, the wet weight to dry weight conversion for benthic invertebrate tissue was based on an assumed 75% moisture content.

- HQs less than 1.0 based on a NOAEL indicate that adverse effects are extremely unlikely because constituent concentrations result in a dose that has been demonstrated to not cause adverse ecological effects.
- HQs less than 1.0 based on a LOAEL indicate that constituent concentrations do not result in an exposure associated with adverse ecological effects to test organisms; HQs less than 1.0 based on a LOAEL are not likely to result in adverse effects to receptor populations.

Based on the dose rate model described above, potential risks to wildlife receptors were evaluated based on two (2) scenarios:

- Maximum Area Use: Scenario conservatively assumes that individual wildlife receptors forage exclusively within the defined exposure area for their entire life span. For this scenario, the AUF input into the dose rate model is 1.0; and
- Area Use Adjusted Exposure: Scenario quantifies exposure based on the proportion of the time that a receptor is likely to forage within the exposure area as a function of its total foraging range. For this scenario, the AUF input into the dose rate model is the ratio of the size of the exposure area to the size of the receptor-specific foraging range as described below.

The following sections present the general dose rate models used to evaluate wildlife exposure in the SWMU 1/22 Wetland Complex and the Active Plant Area.

SWMU 1/22 Wetland Complex

The total dose (EDD_{total}) potentially experienced by select receptors foraging in the SWMU 1/22 Wetland Complex was calculated as the sum of the doses obtained from the primary routes of exposure: the direct ingestion of dietary items, the direct ingestion of surface water, and the incidental ingestion of substrate (i.e., sediment):

$$EDD_{total} = EDD_{diet} + EDD_{water} + EDD_{substrate} \qquad (2)$$

In the model, the dose from each route of exposure was calculated individually as follows:

<u>Dietary Dose:</u>

Receptor-specific exposure parameters were used to estimate the dietary dose based on representative tissue concentrations as follows:

$$EDD_{diet} = \frac{\sum(IR_{diet} \times C_{t\,i} \times DF_i) \times AUF}{BW} \qquad (3)$$

where:

EDD_{diet} = Dietary dose of constituent (mg/kg receptor body weight-day)

IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)

$C_{t\,i}$ = UCL_{95} concentration of constituent in dietary item *i* (mg /kg food item, dry weight)

DF_i = Dietary fraction of item *i* (proportion of dietary item in total diet)

AUF = Area use factor (unitless)

BW = Body weight of the receptor, wet weight (kg)

Water Dose:

The dose associated with the direct ingestion of surface water was calculated based on surface water EPCs and receptor-specific exposure parameters as follows:

$$EDD_{water} = \frac{IR_{water} \times C_{water} \times AUF}{BW} \tag{4}$$

EDD_{water} = Dose of constituent obtained through direct ingestion of surface water (mg/kg receptor body weight-day)

IR_{water} = Drinking water ingestion rate (liters ingested per day)

C_{water} = Maximum constituent concentration in unfiltered surface water (mg/L)

AUF = Area use factor (unitless)

BW = Body weight of the receptor, wet weight (kg)

Substrate Dose:

The dose associated with the incidental ingestion of substrate was calculated based on calculated sediment EPCs and receptor-specific exposure parameters as follows:

$$EDD_{substrate} = \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW} \tag{5}$$

$EDD_{substrate}$ = Dose of constituent obtained through incidental ingestion of substrate (mg/kg receptor body weight-day)

$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)

$C_{substrate}$ = Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

AUF = Area use factor (unitless)

BW = Body weight of the receptor, wet weight (kg).

Input parameters specific to each exposure route for the semi-aquatic wildlife exposure evaluation are discussed in the *Model Parameters* section below.

Active Plant Area

The total dose (EDD_{total}) experienced by select terrestrial wildlife receptors foraging at the margin of the Active Plant Area was calculated as the sum of the doses obtained from the primary routes of exposure: the direct ingestion of dietary items and the incidental ingestion of substrate (i.e., soil):

$$EDD_{total} = EDD_{diet} + EDD_{substrate} \tag{6}$$

The dose from each the dietary route of exposure was calculated using the general form of the Equation 3 presented in the preceding section for the SWMU 1/22 Wetland Complex; the dose associated with incidental substrate ingestion was calculated using the general form of Equation 5. Input parameters specific to each exposure route for the terrestrial wildlife exposure evaluation are discussed in the following section.

Model Parameters

The model includes parameters relating to receptor-specific exposure factors, EPCs, bioaccumulation factors, and area use factors. The following sections describe the estimation of these parameters and the major assumptions of parameterization.

Receptor-Specific Exposure Parameters

The FWIA cannot specifically evaluate the potential for adverse effects to every wildlife species that may be present and potentially exposed in the SWMU 1/22 Wetland Complex and Active Plant Area. As a result, receptors were selected to represent broader groups of organisms and those that are of high ecological value.

Each species selected as a representative receptor reflects an assessment endpoint, which considers trophic category and particular feeding behaviors (e.g., fish-eating birds versus worm-eating birds) that represent different modes of potential exposure to target metals. Consequently, the species chosen for evaluation may represent several similarly exposed species in the area.

The following criteria were used to select potential receptors:

- The receptor utilizes or potentially utilizes habitats present in the study area;
- The receptor is important to either the structure or function of the ecosystem;
- The receptor is statutorily protected (e.g., threatened or endangered species);
- The receptor is reflective and representative of the assessment endpoints for the exposure area; and
- The receptor is known to be either sensitive or highly exposed to target metals present in site exposure media.

Semi-aquatic wildlife receptors selected to quantitatively evaluate exposure from the SWMU 1/22 Wetland Complex include:

- **Omnivorous mammals:** raccoon (*Procyon lotor*);
- **Aerial insectivorous mammals:** Indiana bat (*Myotis sodalis*);
- **Piscivorous mammals:** mink (*Mustela vison*);
- **Invertivorous birds:** mallard duck (*Anas platyrhynchos*);
- **Semi-aquatic insectivorous birds**: tree swallow (*Tachycineta bicolor*); and
- **Piscivorous birds:** great blue heron (*Ardea herodias*).

In the Active Plant Area, ecological receptors were selected to evaluate exposure to wildlife that potentially forage at the margins of the facility. Receptor categories were selected to represent low-level secondary consumers and top-tier predators to provide a range of potential wildlife exposure. Low-level secondary consumers were represented by invertivorous birds and mammals that forage primarily on earthworms:

- **Small invertivorous mammals:** Short-tailed shrew (*Blarina brevicauda*); and
- **Invertivorous birds:** American robin (*Turdus migratorius*).

Top-tier predators were represented by carnivorous birds and mammals that forage primarily on low-level secondary consumers:

- **Carnivorous birds:** Red-tailed hawk (*Buteo jamaicensis*); and
- **Carnivorous mammals:** Red fox (*Vulpes vulpes*).

Exposure parameters used to calculate the EDD for each receptor include body weight (kg, wet weight), food ingestion rate (kg dry weight/day), incidental substrate ingestion rate (kg dry weight/day), dietary composition, and area use factor. Table D-1 summarizes the receptor-specific exposure parameters selected for the dose rate model, as discussed below:

- **Body Weight:** Typical body weights for receptors were obtained from various literature sources, as summarized in Table D-1.
- **Dietary composition:** The composition of dietary items for the dose rate models were generally obtained from literature sources, including USEPA (1993), Sample and Suter (1994), and various receptor-specific sources.
- **Food ingestion rates:** Food ingestion rates were estimated as a function of body weight using allometric regression models developed by Nagy (2001) for various types of mammalian and avian receptors.
- **Water ingestion rates:** Direct ingestion rates of drinking water were estimate from allometric regression formulas presented in Calder and Braun (1983), as cited in Sample and Suter (1994).
- **Incidental substrate ingestion rates:** Estimates of incidental substrate ingestion rates were based on data obtained from Beyer et al. (1994) and Sample and Suter (1994). Beyer et al. (1994) estimated substrate ingestion as a function of dietary intake based on the acid-insoluble ash content measured in the scat of select wildlife species. Because the quantification of substrate ingestion was based on the content of soil or sediment in the scat of consumer, total substrate ingestion rates derived from these data represent the sum of the substrate contained within the gut tract of the prey and substrate incidentally ingested while foraging (i.e., attached to prey items, etc.), as follows:

$$SI_{total} = SI_{prey} + SI_{incidental} \quad (7)$$

where:

SI_{total} = Total substrate ingestion as proportion of total dietary intake;

$SI_{incidental}$ = Substrate incidentally ingested while foraging as a proportion of total dietary intake; and

SI_{prey} = Substrate ingested within the gut tract of prey as a proportion of total dietary intake.

The relative contributions of SI_{prey} and $SI_{incidental}$ to total substrate ingestion were estimated to account for the input of non-depurated tissue data (e.g., earthworms, benthic invertebrates) into dose rate models. Without depurating or purging the gut of prey items prior to analysis, substrate ingested by prey items remained in the gut tract and thus, was included in the measured metal concentration of the whole body sample. As a result, inputting non-depurated tissue results into the dose rate model, without adjusting the estimate of SI_{total}, double-counts the contribution of the substrate contained within the gut tract of the prey (SI_{prey}).

Since the dose of metals associated with the ingestion of substrate contained within the prey is accounted for in the analysis of the non-depurated tissue samples, only the incidentally ingested substrate ($SI_{incidental}$) (i.e., attached to prey items, etc.) was included in the dose rate models. The incidental ingestion of sediment was estimated as difference between the total substrate ingestion rate (SI_{total})[2] and the ingestion of substrate contained in the gut tract of prey (SI_{prey}):

$$SI_{incidental} = SI_{total} - SI_{prey} \tag{8}$$

The ingestion of substrates within the gut tracts of prey items (SI_{prey}) was estimated as a function of total dietary intake based on the relative proportion of the mass of the gut contents to the total body mass of the prey item (S_{gut}) and the proportion of the prey item in the receptor diet (DF):

$$SI_{prey} = S_{gut} \times DF \tag{9}$$

where:

SI_{prey} = Substrate ingested within the gut tract of prey as a proportion of total dietary intake;

S_{gut} = Relative of proportion of the mass of gut contents to total body mass; and

DF = Proportion of the diet represented by the prey item (Table D-1).

A review of available literature indicated that the percentage of soil in the gut contents to the total body weight of earthworms may range from 10[3] to 50 percent (Honda et al., 1984). Based on this range, a conservative estimate of 10 percent (0.1 gut content as a proportion of total body mass) of soil in the gut content of earthworms as a percentage of body weight was used in Equation 9 to estimate SI_{prey} values for vermivorous wildlife.

[2] This “total” substrate rates is equivalent to the incidental substrate ingestion rate provided by Beyer et al. (1994) and Sample and Suter (1994)

[3] http://www.nrri.umn.edu/worms/research/methods_worms_biomass.html

Based on a review of available literature, gut contents were associated with 2 to 19 percent of the total body weight of benthic invertebrates. Neumann et al. (1999) estimated that the gut content of the amphipod *Hyalella azteca* accounted for between 2 and 15 percent of total body weight. Amyot et al. (1996) estimated a similar range (3 to 11 percent) of the relative contribution of the gut content of the amphipod *Gammarus fasciatus*. Gut contents of the mayfly *Hexagenia limbata*, the midge *Chironomus tentans*, and the oligochaete *Lumbriculus variegatus* were associated with 9 to 10 percent of total body weight (Brooke et al., 1996). Additional data for oligochaetes and chironomid larvae estimated that the gut contents contributed 14.9 to 16.8 percent of total body weight, respectively (Chapman, 1985). Cain et al. (1995) reported 5 to 19 percent of the body weight of stonefly nymphs and caddisfly larvae was associated with the contents of the gut.

Based on the range of the estimated contribution of gut content to total body mass, a conservative estimate of 2 percent reported for *Hyalella azteca* (0.02 gut content as a proportion of total body mass) was used in Equation 9 to estimate SI_{prey} values for receptors foraging on benthic invertbrates. The use of *Hyalella* data is appropriate and relevant to the SWMU 1/22 Wetland Complex, given the representation of this taxon in the benthic invertebrate tissue samples collected in the wetland (See Section 4.5.1 of the Report).

Based on the estimations of total substrate ingestion (SI_{total}) provided in the literature (Beyer et al., 1994) and the estimation of substrate ingestion from the gut contents of prey items (SI_{prey}) described above, incidental substrate ingestion as a proportion of dietary ingestion ($SI_{incidental}$) was calculated using Equation 8 above.

Daily incidental substrate ingestion rates ($SIR_{incidental}$) were calculated by multiplying the total daily dietary ingestion rate (DIR) by the proportion of DIR represented by incidental substrate ingestion ($SI_{incidental}$), as follows:

$$SIR_{incidental} = DIR \times SI_{incidental} \tag{10}$$

where:

$SIR_{incidental}$ = Daily incidental ingestion rate of substrate (kg substrate ingested per day, dry weight;

DIR = Daily ingestion rate of dietary items (kg food ingested per day, dry weight); and

$SI_{incidental}$ = Substrate incidentally ingested while foraging as a proportion of total dietary intake.

- **Home range:** Home range data for the selected receptors were compiled from USEPA (1993) and receptor-specific literature sources. Compiled data were evaluated for each receptor based on the relevance of the study to exposure at the Site (Table D-2). Home ranges from representative studies conducted in similar habitat types in similar geographic ranges were selected preferentially. If multiple studies with relevant home range values were identified, the most conservative home range (e.g., smallest in area) was selected for inclusion in the dose rate models. Selected home ranges were reviewed with DFWMR during the development of the dose rate models.

Exposure Point Concentrations

Representative concentrations of target metals in biotic and abiotic exposure media were calculated for use as EPCs in dose rate models. As described in detail in the Report Sections 4.5 and 5.1 for the SWMU 1/22 Wetland Complex and the Active Plant Area, respectively, biological tissue data were collected to provide site-specific inputs to dose rate models. EPCs were primarily calculated as the upper 95 percent confidence limit of the mean concentration (UCL_{95}) measured in biological tissue and physical media collected from the Site. Calculations of UCL_{95} were conducted using USEPA ProUCL 4.00.02 software (ProUCL); UCL_{95} values recommended by ProUCL based on the underlying distributions of the datasets were selected as EPCs for dose rate models (USEPA, 2007a). The following sections describe the calculation of representative EPCs for the two exposure areas.

SWMU 1/22 Wetland Complex

As discussed above, estimated doses to semi-aquatic wildlife exposed to target metals in the SWMU 1/22 Wetland Complex were calculated based on the primary routes of exposure: the direct ingestion of dietary items (e.g., invertebrates and fish), the direct ingestion of surface water, and the incidental ingestion of sediment. The procedure for calculating EPCs to represent target metal concentrations in exposure media in the SWMU 1/22 Wetland Complex is described below:

- **Sediment:** EPCs associated with the incidental ingestion of sediment were calculated based on the UCL_{95} of target metals in sediment from sediment quality triad (SQT) and downstream sampling stations;
- **Surface Water:** The dose associated with the direct ingestion of surface water was conservatively calculated based on maximum unfiltered surface water concentrations; the detection limit was used to represent EPCs for non-detected target metals.
- **Aquatic Life Stage Invertebrates:** Representative EPCs for aquatic life stage invertebrates were based on UCL_{95} concentrations (dry weight) of the site-specific 'market basket' tissue data collected within the SWMU 1/22 Wetland Complex[4] and estimated concentrations of target metals in aquatic life stage invertebrates from the four downstream sampling stations included in the exposure area. Benthic invertebrate tissue data reported in wet weight were converted to dry weight based on an assumed moisture content of 75 percent (Sample and Suter, 1994; Ricciardi and Bourget, 1998); as stated in Section 4.5.1 of the Report, the mass of benthic invertebrate samples submitted to the laboratory was insufficient to quantify the percent moisture.

[4] Explained in Section 4.5 of the Report.

Concentrations in aquatic life stage invertebrates were estimated at stations downstream of the SWMU 1/22 Wetland Complex based on site-specific bioaccumulation relationships established for SQT stations. Concentrations of cadmium, copper, and lead at downstream stations were estimated based on bioaccumulation relationships between measured invertebrate tissue concentrations and corresponding sediment concentrations (Figure D-1; Table D-3).

For total mercury, methylmercury, and zinc, BSAFs were calculated as the ratio of the measured tissue concentration to sediment concentration at each SQT station. BSAFs for methylmercury in tissue were calculated based on total mercury measurements in sediment; methylmercury was not analyzed in sediment samples. Relationships between sediment concentrations and BSAFs were used to calculate station-specific BSAFs for total mercury, methylmercury, and zinc at each downstream station (Figure D-2). Station-specific BSAFs were multiplied by sediment concentrations to estimate concentrations in aquatic life stage invertebrates (Table D-3).

Bioaccumulation relationships between concentrations measured in tissue and sediment were not consistent for selenium. The geometric mean BSAF calculated from station-specific tissue and sediment data was used as a representative BSAF to estimate concentrations of selenium in aquatic life stage invertebrates at downstream stations. The geometric mean BSAF for SQT stations (0.185) was multiplied by the concentration in sediment to estimate concentrations of selenium in aquatic life stage invertebrates (Table D-3).

EPCs of target metals in aquatic life stage invertebrates were calculated as the UCL_{95} concentrations of measured tissue concentrations at SQT stations and estimated tissue concentrations at downstream stations.

- **Emergent Life Stage Invertebrates:** Concentrations of target metals in emergent life stage invertebrates were calculated as a function of the concentrations in aquatic life stage invertebrates and the estimated loss/gain of metal body burden during metamorphosis. As presented in Table D-4, correction factors were derived from literature studies to estimate concentrations of target metals in emergent life stage invertebrates based on aquatic life stage invertebrates. Concentrations of target metals in emergent life stage invertebrates were estimated by multiplying the derived correction factors to EPCs calculated for aquatic life stage invertebrates (Table D-3).
- **Fish Tissue:** EPCs for fish tissue were developed based on site-specific tissue data collected as part of the FWIA. As described in Section 4.5.2 of the Report, fish tissue samples were collected upstream, within, and downstream of the SWMU 1/22 Wetland Complex. Forage fish (golden shiner) were collected in each sampling reach; American eel were collected in the downstream sampling reach, and a single largemouth bass was collected in the upstream reach. Fish tissue results from sampling reaches within and downstream of the SWMU 1/22 Wetland Complex were used to calculate representative EPCs for piscivorous wildlife in dose rate models.

EPCs for piscivorous wildlife were estimated based on UCL_{95} concentrations calculated from fish tissue data representing likely dietary components for each piscivorous receptor:

- **Belted kingfisher:** Fish tissue EPCs for belted kingfisher were based on the UCL_{95} calculated from forage fish tissue data from the Site and downstream sampling reaches; kingfisher typically forage on small fish (e.g., <15 cm) and therefore, are not likely to consume larger fish (e.g., eels) in the downstream reach:
- **Great blue heron, mink and raccoon:** Fish tissue EPCs for larger piscivores were based on the UCL_{95} calculated from forage and piscivorous fish samples collected from the Site and downstream sampling reaches.

Active Plant Area

As discussed above, estimated doses to terrestrial wildlife exposed to target metals at the margins of the Active Plant Area were calculated based on the primary routes of exposure: the direct ingestion of dietary items and the incidental ingestion of substrate (e.g., soil). The procedure for calculating EPCs to represent target metal concentrations in exposure media in the Active Plant Area is described below:

- **Soil:** EPCs associated with the incidental ingestion of soil were calculated based on the UCL_{95} of target metals in soil;
- **Plants:** EPCs for target metals in plant tissues were estimated based on bioaccumulation from soil. Concentrations of select metals in terrestrial plants were estimated consistent with USEPA Eco-SSL guidance (USEPA, 2007b) using the recommended applications of terrestrial plant bioaccumulation models developed by Efroymson et al. (2001) based on data compiled in Bechtel (1998); soil to plant uptake factors developed by Baes et al. (1984) were also included for select metals. UCL_{95} concentrations of estimated plant tissue concentrations were used as representative EPCs.
- **Earthworms:** Representative EPCs for earthworms were based on the UCL_{95} concentrations calculated from the site-specific non-depurated earthworm tissue datasets;
- **Small mammals:** Representative EPCs for small mammal were based on the UCL_{95} concentrations calculated from non-depurated small mammal tissue collected at the Site.

Area Use Factors (AUFs)

AUFs were used to estimate the proportion of time a receptor would actively forage within the two exposure areas evaluated in the FWIA. As previously stated, wildlife exposures to target metals were evaluated based on two exposure scenarios: maximum area use exposure (AUF = 1.0) and adjusted area use exposure.

The adjusted area use exposure evaluation provides a more realistic estimate of risk based on the proportion of time that a receptor is likely to actively forage within a given exposure area. For this estimate, the AUF was calculated for each receptor as the ratio of the size of the exposure area to the area of the receptor home range:

$$AUF = \frac{Exposure\ Area}{Home\ Range\ Area}$$

A default AUF of 1.0 is assumed for receptors with home ranges smaller than the exposure area. AUFs calculated for the adjusted area use exposure scenario are summarized in Table D-5.

Toxicity Reference Values (TRVs)

EDDs calculated for each receptor were evaluated relative to TRVs that represent NOAEL or LOAEL doses derived from toxicological studies. TRVs for the FWIA were primarily derived from toxicological studies accepted by the USEPA for the derivation of Eco-SSLs. The approach for deriving TRVs was established through discussions with DFWMR during the development of the dose rate models, as described below. A summary of the TRVs selected for the FWIA are presented in Table D-6.

The preferred approach for deriving TRVs for the FWIA was based on the evaluation of accepted Eco-SSL feeding studies containing bounded endpoints (i.e., NOAELs and LOAELs) for growth and reproduction. Studies that administered doses through food were selected preferentially for TRV derivation because these studies are more representative of typical wildlife exposure, as compared to other routes of exposure (e.g., gavage, injection, etc.) that are less relevant to natural exposure. TRVs used to evaluate estimated doses in the FWIA were generally calculated as the geometric mean of NOAEL and LOAEL endpoints from feeding studies representing the lowest bounded LOAELs (maximum 10 studies) for each metal. For mammalian exposure to lead, survival endpoints were also included in the subset of lowest bounded LOAEL studies ($n = 5$) to account for mortality observed in some test organisms in the lower range of the LOAEL dataset. A summary of avian studies used in the calculation of TRVs for arsenic, cadmium, chromium, cobalt, copper, lead, and zinc based on this approach is presented in Table D-7; a summary of mammalian studies used to calculate TRVs for arsenic, cadmium, cobalt, copper, lead, and zinc is presented in Table D-8.

If the compilation of Eco-SSL toxicological studies did not have sufficient data from bounded feeding studies to calculate TRVs for target metals based on the above approach, TRVs were calculated based on the geometric mean of NOAELs and LOAELs reported for growth and reproduction endpoints. Table D-6 presents geometric mean values calculated for arsenic and silver based on available NOAEL and LOAEL endpoints for avian growth and reproduction; geometric mean NOAEL and LOAEL values calculated for mammalian exposure to antimony, barium, chromium, and silver are also presented in Table D-6.

TRVs for total mercury, methylmercury, and selenium were calculated based on studies identified in the literature. Eco-SSLs have not been derived for mercury; therefore, available studies regarding total and methylmercury exposure were evaluated to identify TRVs for the FWIA. Studies evaluated as part of the USEPA *Mercury Study Report to Congress* (Report to Congress) were used as the basis for methylmercury TRVs in the

FWIA (USEPA 1997). For the purposes of deriving water quality criteria for methylmercury, the Report to Congress derived NOAEL and LOAEL TRVs for avian receptors based on mallard studies conducted by Heinz (1979) and mammalian TRVs based on mink studies conducted by Woebeser et al. (1976a, 1976b). As summarized Table D-6, the resulting endpoints from these studies were used as the basis for NOAEL and LOAEL TRVs for avian and mammalian receptors in the FWIA.

TRVs for total mercury were based on dietary studies compiled from the literature. Avian TRVs for total mercury were based on reproductive effects reported by Hill and Schaffner (1976) resulting from an administered dose of mercuric chloride to Japanese quail in food. TRVs for mammalian exposure to total mercury were based on a dietary NOAEL of 1.0 mg/kg for reproductive effects in mink reported by Aulerich et al. (1974). A LOAEL of 7.0 mg/kg was based on developmental effects resulting from dietary exposure to rats (Rizzo and Furst, 1972). Considering dietary studies, selected TRVs for mammalian exposure were the lowest doses compiled for feeding studies and therefore, represent conservative endpoints (Table D-9). As previously stated TRVs based on dietary studies are more relevant to wildlife exposure and were selected preferentially over studies with less relevant methods of exposure (e.g., gavage, injection, etc.).

Avian and mammalian TRVs for selenium were based on studies evaluating exposure to mallard and mink, respectively. Heinz et al. (1989) reported reproductive effects to mallards fed diets supplemented with selenium in the form of selenomethionine; the NOAEL and LOAEL from this study were used as avian TRVs for the FWIA (Table D-6). Selenium TRVs for mammalian receptors were based on reproductive effects on rats exposed to potassium selenate (Rosenfeld and Beath, 1954); the NOAEL and LOAEL reported from this study represented the NOAEL and LOAEL used in the FWIA.

No avian data exist for barium in the database compiled for the derivation of Eco-SSLs; therefore, a study by Johnson et al. (1960) was used as the basis for the avian TRVs for barium.

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TABLE D-1
SUMMARY OF EXPOSURE PARAMETERS FOR AVIAN AND MAMMALIAN RECEPTORS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Representative Species			Home Range[a]	Home Range Reference	Body Weight (kg wet weight)	Body Weight Reference (as cited in USEPA 1993)	Dietary Composition							Ingestion Rates						
														Food		Water[j]	Substrate			
Common Name	Scientific Name	Food-web classification					Plant Material	Terrestrial Invertebrates	Small Mammals	Aquatic Invertebrates	Emergent Invertebrates	Fish	References	kg dry weight/day	Reference	Liters / day	SI_{Total} (% of Total Dry Intake)	SI_{Prey} (% of Total Dry Intake)	$SIR_{incidental}$ kg dry wt./day	Reference
Avian Receptors																				
American robin	*Turdus migratorius*	small soil probing invertivore	0.4 ha	Howell (1942), as cited in USEPA (1993)	0.0808	Howell (1942), as cited in USEPA (1993)	60%	40%					Sample and Suter (1994)[b]	0.012	Nagy (2001)[c]	0.011	4.2%	4.00%	0.00002	S_{total}: Beyer et al. (1994) S_{prey}: Honda et al. (1984)
Belted kingfisher	*Ceryle alcyon*	small aquatic piscivore	1.03 km	Brooks and Davis (1987), as cited in USEPA (1993)	0.136	Brooks and Davis (1987), as cited in USEPA (1993)						100%	Sample and Suter (1994)	0.022	Nagy (2001)[b]	0.015	0%	0%	0	Sample and Suter (1994)
Great blue heron	*Ardea herodias*	medium piscivore	3.1 km	Dowd and Flake (1985) as cited in USEPA (1993)	2.2	Dunning (1984), as cited in Sample and Suter (1994)						100%	USEPA (1993)	0.140	Nagy (2001)[b]	0.100	0%	0%	0	Sample and Suter (1994)[f]
Mallard	*Anus platyrhynchos*	aquatic omnivore	111 ha	Dwyer et al. (1979) as cited in USEPA (1993)	1.043	Nelson and Martin (1953), as cited in USEPA (1993)				100%			USEPA (1993)	0.052	Nagy (2001)[c]	0.061	3.3%	2%	0.0007	S_{total}: Beyer et al. (1994) S_{prey}: Neuman et al. (1999)
Red-tailed hawk	*Buteo jamaicensis*	large carnivore	233 ha	USEPA (1993)	1.224	Dunning (1984), as cited in Sample and Suter (1994)			100%				Sample and Suter (1994)	0.095	Nagy (2001)[b]	0.068	0%	0%	0	Sample and Suter (1994)[f]
Tree swallow	*Tachycineta bicolor*	aerial insectivore	0.1 km	McCarty and Winkler (1999)	0.0206	Robertson et al. (1992)					100%		Sibley (2000)	0.0116	Nagy (2001)	0.004	0%	0%	0	Assumption[f]
Mammalian Receptors																				
Indiana bat	*Myotis sodalis*	aerial insectivore (protected)	61.4 ha	Menzel et al. (2005)	0.006	NYSDEC (2011)					100%		NYSDEC (2011)	0.0012	Nagy (2001)[g]	0.001	0%	0%	0	Assumption[i]
Mink	*Mustela vison*	medium semi-aquatic piscivore	1.85 km	Gerell (1970); Sample and Suter (1994)	0.6	Mitchell (1961), as cited in USEPA (1993)						100%	USEPA (1993); Sample and Suter (1994)	0.0256	Nagy (2001)[d]	0.063	0%	0%	0	Sample and Suter (1994)
Raccoon	*Procyon lotor*	medium semi-aquatic omnivore	58 ha	NYSDEC (pers. comm)	3.855	Stuewer (1943), as cited in USEPA (1993)				50%		50%	USEPA (1993)	0.117	Nagy (2001)[e]	0.333	9.4%	2%	0.009	S_{total}: Beyer et al. (1994) S_{prey}: Neuman et al. (1999)
Red fox	*Vulpes vulpes*	medium terrestrial omnivore	72.5 ha	Tullar and Berchielli (1980), as cited in USEPA (1993)	4.5	Storm et al. (1976), as cited in USEPA (1993)	10%		90%				Sample and Suter (1994)	0.146	Nagy (2001)[d]	0.383	2.8%	0%	0.004	Beyer et al. (1994)
Short-tailed shrew	*Blarina brevicauda*	small terrestrial invertivore	0.07	Platt (1976), as cited in USEPA (1993)	0.015	Schlesinger and Potter (1974), as cited in USEPA (1993)		100%					Sample and Suter (1994)	0.002	Nagy (2001)[h]	0.0023	13%	10%	0.00006	S_{total}: Beyer et al. (1994) S_{prey}: Honda et al. (1984)

Notes:
a, km, kilometers; ha, hectares;
b, Estimated food ingestion rate (kg/day dry weight) for carnivorous birds = (0.849[Body Weight in grams] $^{0.663}$)/1000 (Nagy 2001);
c, Estimated food ingestion rate (kg/day dry weight) for omnivorous birds = (0.670[Body Weight in grams] $^{0.627}$)/1000 (Nagy 2001);
d, Estimated food ingestion rate (kg/day dry weight) for Carnivora = (0.102[Body Weight in grams] $^{0.864}$)/1000 (Nagy 2001);
e, Estimated food ingestion rate (kg/day dry weight) for omnivorous mammals = (0.432[Body Weight in grams] $^{0.678}$)/1000 (Nagy 2001);
f, Based on assumption from Sample and Suter 1994 that substrate ingestion is neglible for piscivores;
g, Estimated food ingestion rate (kg/day dry weight) for Chiroptera = (0.365[Body Weight in grams] $^{0.671}$)/1000 (Nagy 2001);
h, Estimated food ingestion rate (kg/day dry weight) for mammalian insectivores = (0.373[Body Weight in grams] $^{0.622}$)/1000 (Nagy 2001);
i, Assumption based on assumption from Sample and Suter 1994 that substrate ingestion is neglible for aerial insectivores;
j, Water ingestion rates estimate from allometric regression formulas presented in Calder and Braun (1983) as cited in Sample and Suter (1994);
k, Estimated food ingestion rate (kg/day dry weight) for insectivorous birds = (0.540[Body Weight in grams] 0.705)/1000 (Nagy 2001);

TABLE D-2
SUMMARY OF HOME RANGE INFORMATION FOR SELECT WILDLIFE RECEPTORS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN

Species	Measurement	Age/Sex/Cond./Seas.	Mean ±SD	Range	Units	Location/habitat	Source	Original Reference[1]
American Robin	Foraging Home Range	A summer feeding: nestlings	0.15±0.021		ha	Ontario deciduous forest	USEPA (1993)	Weatherhead & McRae, 1990
		A summer feeding: fledglings	0.81±0.13		ha	Ontario deciduous forest	USEPA (1993)	Weatherhead & McRae, 1990
		A B summer	***0.4***		***km***	***sc NY/forest***	***USEPA (1993)***	***Howell, 1942***
	Territory Size	A B spring	0.42	0.12-0.84	ha	Tennessee/campus	USEPA (1993)	Pitts, 1984
		A B spring	0.11		ha	NY/dense conifers	USEPA (1993)	Howell, 1942
		A B spring	0.21		ha	NY/unspecified forest	USEPA (1993)	Howell, 1942
		A B spring	0.12	0.04 to 0.24	ha	Wisconsin/parklike	USEPA (1993)	Young 1951
Belted Kingfisher	Territory Size	early summer breeding pairs	2.19±0.56		km shoreline	PA/streams	USEPA (1993)	Brooks & Davis, 1987
		early summer breeding pairs	***1.03 ± 0.28***		***km shoreline***	***Ohio/streams***	***USEPA (1993)***	***Brooks & Davis, 1987***
		late summer non breeding individuals	1.03±0.22		km shoreline	southwest/streams	USEPA (1993)	Davis, 1980
		late summer non breeding individuals	0.39±0.093		km shoreline	southwest ohio/streams	USEPA (1993)	Davis, 1980
		A B breeding summer	1.6	0.8 to 8.0	km	Minnesota/lake, forest	USEPA (1993)	Cornwell 1963
		A B breeding summer	0.8	max 2.4	km	Michigan/lakes	USEPA (1993)	Salyer & Lagler 1946
		A B breeding summer	2.4 to 4.8		km	Michigan/rivers	USEPA (1993)	Salyer & Lagler 1946
		A B breeding summer	14.2		km	Michigan/ponds, marsh	USEPA (1993)	Salyer & Lagler 1946
Great Blue Heron	Size Feeding Territory	A B fall	0.6±0.1		ha	oregon freshwater marsh	USEPA (1993)	Bayer, 1978
		A B winter	8.4±5.4		ha	oregon/estuary	USEPA (1993)	Bayer, 1978
		A M summer	0.98		km	c Minnesota/lakes	USEPA (1993)	Peifer 1979
	Foraging Distance from colony	***A B summer***	***3.1***	***up to 24.4***	***km***	***South Dakota/river and streams***	***USEPA (1993)***	***Dowd & Flake, 1985***
		A B summer	7 to 8		km	North Carolina/coastal	USEPA (1993)	Parnell & Soots, 1978
		A B summer		min 0.4-0.7	km	Idaho/lake, mountain ridge	USEPA (1993)	Collazo 1981
		A B summer	1.8	0 to 4.2	km	Minnesota/Chippewa National Forest	USEPA (1993)	Mathisen & Richards 1978
		A M summer		13.7 to 34.1	km	c Minnesota/lakes, uplands	USEPA (1993)	Peifer 1979
		A B	6.5	max 20.4	km	upper Mississippi River	USEPA (1993)	Thompson 1978
Mallard	Home Range	A F spring - total	468±159	307 to 719	ha	North Dakota/prairie potholes	USEPA (1993)	Dwyer et al. 1979
		A F spring - laying	***111 ± 76***	***38 to 240***	***ha***	***North Dakota/prairie potholes***	***USEPA (1993)***	***Dwyer et al. 1979***
		A F spring	540	40 to 1440	ha	Minnesota/wetlands, river	USEPA (1993)	Kirby et al. 1985
		A M spring	620	70 to 1140	ha	Minnesota/wetlands, river	USEPA (1993)	Kirby et al. 1985
		--	>283		ha	Manitoba Can	USEPA (1993)	Dzubin 1955
		A F spring	210	min 66	ha	Minnesota/upland forest	USEPA (1993)	Gilmer et al. 1975
		A M spring	240			Minnesota/upland forest	USEPA (1993)	Gilmer et al. 1975
		A F spring	135			Minnesota/upland forest	USEPA (1993)	Gilmer et al. 1975
		A F spring	70			Minnesota/upland forest	USEPA (1993)	Gilmer et al. 1975
		A B spring		max 760		Minnesota/upland forest	USEPA (1993)	Gilmer et al. 1975
Red Tailed Hawk	Territory size	A B spring	60 to 160		ha	California/foothills	USEPA (1993)	Fitch et al 1946
		A B winter	697±316		ha	Michigan/fields, woodlots	USEPA (1993)	Craighead & Craighead 1956
		A B summer	229±114	83 to 386	ha	Wyoming/grasslands, forest	USEPA (1993)	Craighead & Craighead 1956
		A B summer	377±146	130 to 557	ha	s Michigan/fields, woodlots	USEPA (1993)	Craighead & Craighead 1956
		I B summer	307	171 to 443	ha	s Michigan/fields, woodlots	USEPA (1993)	Craighead & Craighead 1956
		I summer	150	70 to 230	ha	s Michigan/fields, woodlots	USEPA (1993)	Craighead & Craighead 1956
		I winter	187	75 to 298	ha	s Michigan/fields, woodlots	USEPA (1993)	Craighead & Craighead 1956
		A B fall	1770	957 to 2465	ha	Colorado/upland prairie, woodlands	USEPA (1993)	Andersen & Rongstad, 1989
		A B fall	965	418 to 1747	ha	Colorado/upland prairie, woodlands	USEPA (1993)	Andersen & Rongstad, 1989
		--	***233 ± 90***		***ha***	***Oregon /pasture, wheat fields***	***USEPA (1993)***	***Janes 1984***
		A B winter	165		ha	Wisconsin	USEPA (1993)	Peterson 1979
		A B summer	1500		ha	sw Idaho/canyon, shrubsteppe community	USEPA (1993)	USDI 1979
	Foraging Radius	--	233	1770	ha		USEPA 1993; Janes 1984	
Tree Swallow	Foraging Radius	***--***	***0.1***	***max 0.2***	***km***		***McCarty and Winkler 1999***	***McCarty and Winkler 1999***
Indiana Bat	Home Range	***--***	***61.4***		***ha***	***Illinois***	***Menzel et al. (2005)***	***Menzel et al. (2005)***
Mink	Home Range	--		259 to 380	ha	North Dakota/prairie potholes	USEPA (1993)	Eagle (unpublished)
		A M	770		ha	Manitoba, Canada/prairie potholes	USEPA (1993)	Arnold & Fritzell, 1987
		A M breeding summer		316 to 1626	ha	Manitoba, Canada/prairie potholes	USEPA (1993)	Arnold 1986
		A F		7.8	ha	Montana/riverine heavy vegetation	USEPA (1993)	Mitchell, 1961
		A F		20.4	ha	Montana/riverine sparse vegetation	USEPA (1993)	Mitchell, 1961
		A M	2.63	1.8 to 5.0	km	Sweden/stream	USEPA (1993)	Gerell, 1970
		J M	1.23	1.1 to 1.4	km	Sweden/stream	USEPA (1993)	Gerell, 1970
		A F	***1.85***	***1.0 to 2.8***	***km***	***Sweden/stream***	***USEPA (1993)***	***Gerell, 1970***
		A M	2.5	1.9 to 2.9	km river	England/riverine	USEPA (1993)	Birks & Linn 1982
		A F	2.2	1.5 to 2.9	km river	England/riverine	USEPA (1993)	Birks & Linn 1982
		A B		2.8 to 5.9	km river	England/riverine	USEPA (1993)	Linn & Birks 1981
Raccoon	Home Range	A M spring/summer	2560	670 to 4946	ha	North Dakota/prairie potholes	USEPA (1993)	Fritzell, 1978
		A F spring/summer	806	229 to 1632	ha	North Dakota/prairie potholes	USEPA (1993)	Fritzell, 1978
		Y M spring/summer	1139	277 to 2160	ha	North Dakota/prairie potholes	USEPA (1993)	Fritzell, 1978
		Y F spring/summer	656	222 to 1263	ha	North Dakota/prairie potholes	USEPA (1993)	Fritzell, 1978
		A M	15.8		ha	Ohio/residential woods	USEPA (1993)	Hoffman & Gottschang 1977
		Y M	5.1		ha	Ohio/residential woods	USEPA (1993)	Hoffman & Gottschang 1977
		J M	2.8		ha	Ohio/residential woods	USEPA (1993)	Hoffman & Gottschang 1977
		A F	3.8		ha	Ohio/residential woods	USEPA (1993)	Hoffman & Gottschang 1977
		Y F	4.6		ha	Ohio/residential woods	USEPA (1993)	Hoffman & Gottschang 1977
		J F	2.3		ha	Ohio/residential woods	USEPA (1993)	Hoffman & Gottschang 1977
		A B		80 to 700	ha	US	USEPA (1993)	Kaufmann 1982
		A M May to Dec	204	18.2 to 814	ha	Michigan/riparian	USEPA (1993)	Stuewer, 1943
		A F May to Dec	108	5.3 to 376	ha	Michigan/riparian	USEPA (1993)	Stuewer, 1943
		J M	108	2.0 to 719	ha	Michigan/riparian	USEPA (1993)	Stuewer, 1943
		J F	45	2.0 to 323	ha	Michigan/riparian	USEPA (1993)	Stuewer, 1943
		A M all year	65±18		ha	Georgia/coastal island	USEPA (1993)	Lotze, 1979
		A F all year	39±16		ha	Georgia/coastal island	USEPA (1993)	Lotze, 1979
		A B	38±9		ha	Georgia/coastal island	USEPA (1993)	Lotze, 1979
		A M	51 ±68		ha	Georgia/coastal island	USEPA (1993)	Lotze, 1979
		A F	6±10		ha	Georgia/coastal island	USEPA (1993)	Lotze, 1979
		--	8.31		ha	urban	USEPA (1993)	Cauley & Schinner 1973
		B F	165		ha	Maryland/varied	USEPA (1993)	Sherfy & Chapman 1980
		B M	285		ha	Maryland/varied	USEPA (1993)	Sherfy & Chapman 1980
		F	122		ha	Maryland/varied	USEPA (1993)	Sherfy & Chapman 1980

TABLE D-2
SUMMARY OF HOME RANGE INFORMATION FOR SELECT WILDLIFE RECEPTORS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN

Species	Measurement	Age/Sex/Cond./Seas.	Mean +SD	Range	Units	Location/habitat	Source	Original Reference[1]
Raccoon (cont.)		F	207		ha	Maryland/varied	USEPA (1993)	Sherfy & Chapman 1980
		B B	289		ha	Maryland/varied	USEPA (1993)	Sherfy & Chapman 1980
		B B	433.7		ha	Maryland/coastal plain	USEPA (1993)	Sherfy & Chapman 1980
		B B spring	231		ha	Maryland/Piedmont	USEPA (1993)	Sherfy & Chapman 1980
		B B spring	275		ha	Maryland/Appalachian	USEPA (1993)	Sherfy & Chapman 1980
		B B	37.4		ha	Maryland/urban	USEPA (1993)	Sherfy & Chapman 1980
			58		***ha***	***--***	***NYSDEC (pers. comm)***	
		--	48.4		ha	Lake Erie, Ohio/Sandusky Bay marsh	USEPA (1993)	Urban 1970
Red Fox	Territory Size	A B summer	1611	277 to 3420	ha	nw British Columbia/alpine and subalpine	USEPA (1993)	Jones & Theberge, 1982
		A M summer	1967	514 to 3420	ha	nw British Columbia/alpine and subalpine	USEPA (1993)	Jones & Theberge, 1982
		A F summer	1137	277 to 1870	ha	nw British Columbia/alpine and subalpine	USEPA (1993)	Jones & Theberge, 1982
		--		max 1040	ha	prairie pothole	USEPA (1993)	Johnson, Siniff & Warner (unpubl)
		--		max 1300	ha	prairie pothole	USEPA (1993)	Johnson, Siniff & Warner (unpubl)
		J M	335	90 to 580	ha	nc Minnesota	USEPA (1993)	Kuehn & Berg 1981
		J F	220		ha	nc Minnesota	USEPA (1993)	Kuehn & Berg 1981
		A F	620	330 to 980	ha	nc Minnesota	USEPA (1993)	Kuehn & Berg 1981
		B B	1990		ha	Maine/forest and bogs	USEPA (1993)	Major & Sherburne 1987
		--	1037		ha	Wisconsin	USEPA (1993)	Pils et al. 1981
		A F spring	699+137	596 to 855	ha	ec Minnesota/woods, fields, swamp	USEPA (1993)	Sargeant, 1972
		A B	1190+550	330 to 2140	ha/family	North Dakota/prairie farmland	USEPA (1993)	Sargeant et al. 1987
		--	960		ha/family	--	USEPA (1993)	Storm et al. 1976
		J B summer	***72.5***		***ha***	***sw NY/farm & woods***	***USEPA (1993)***	***Tullar & Berchielli 1980***
		--	900		ha	Ontario Canada/farmland	USEPA (1993)	Voigt & Tinline 1980
		A M all year	717		ha	Wisconsin/diverse	USEPA (1993)	Ables, 1969
		A F all year	96	57 to 170	ha	Wisconsin/diverse	USEPA (1993)	Ables, 1969
		A M	512		ha	Wisconsin/diverse farmland	USEPA (1993)	Ables, 1969
		J M	78		ha	Wisconsin/diverse	USEPA (1993)	Ables, 1969
		Y F	167	142 to 191	ha	Wisconsin/diverse	USEPA (1993)	Ables, 1969
Short-tailed Shrew	Home Range	A F summer		<0.1 to 0.36	ha	s Michigan/bluegrass	USEPA (1993)	Blair, 1940
		A M summer		<0.1 to 1.8	ha	s Michigan/bluegrass	USEPA (1993)	Blair, 1940
		F summer		0.23 to 0.59	ha	Michigan/hardwood forest	USEPA (1993)	Blair, 1940
		M summer		max 0.56	ha	Michigan/hardwood forest	USEPA (1993)	Blair, 1940
		B B all	0.39+0.036		ha	Manitoba/tamarack bog	USEPA (1993)	Buckner, 1966
		B B winter (high prey density)		***0.03 to 0.07***	***ha***	***c NY/old field***	***USEPA (1993)***	***Platt, 1976***
		B B winter (low prey density)		0.10 to 0.22	ha	c NY/old field	USEPA (1993)	Platt, 1976

Notes:
Shaded cells indicate home range values incorprated into dose rate models.
SD - Standard deviation
ha -hectares
km - kilometers

Life stage	**Sex**
J - juvenile	B - both sexes
A - adult	F - female
B - both adults and juveniles	M - male
Y - yearling	
I - incubating	

TABLE D-3
SEDIMENT TO INVERTEBRATE UPTAKE EQUATIONS - SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Constituent	Sediment to Aquatic Stage Invertebrates	Sediment to Emergent Invertebrates
Cadmium	$C_{ai} = 0.1327 \times C_s - 0.0027$	$C_{ei} = C_{ai} \times 0.515$
Copper	$C_{ai} = 0.0319 \times C_s + 66.246$	$C_{ei} = C_{ai} \times 0.299$
Lead	$C_{ai} = 0.0127 \times C_s + 0.6769$	$C_{ei} = C_{ai} \times 0.226$
Mercury	$C_{ai} = (0.1349 \times Cs^{-0.834}) \times C_s$	$C_{ei} = C_{ai} \times 2.2$
Methylmercury	$C_{ai} = (0.082 \times Cs^{-1.221}) \times C_s$	$C_{ei} = C_{ai} \times 2.2$
Selenium	$C_{ai} = 0.185 \times C_s$	$C_{ei} = C_{ai} \times 0.4$
Zinc	$C_{ai} = (72.911 \times Cs^{-0.926}) \times C_s$	$C_{ei} = C_{ai} \times 0.189$

Notes:

C_{ai}, Concentration in aquatic life stage invertebrates

C_{ei}, Concentration in emergent life stage invertebrates

C_s, Concentration in sediment

TABLE D-4
SUMMARY OF CORRECTION FACTORS APPLIED TO AQUATIC LIFE STAGE INVERTEBRATE TISSUE DATA TO ESTIMATE CONCENTRATIONS IN EMERGENT LIFE STAGE INVERTEBRATES
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Target Metal	Relavent Studies	Summary of Data	Basis for Correction Factor	Correction Factor Applied to Aquatic Life Stage Concentration to Estimate Emergent Life Stage Concentration
Cadmium	Groenendijk et al. (1999)	Minimum shedding efficiency of *Chironomus riparius* from metal polluted sites in the River Dommel ranged from 99.5- 99.9% based on analyses of 112-165 imagoes / 100 larvae	Shedding efficiencies identified in the literature ranged from 48.5% (trichoptera) to 99.9% (Chironomus). The most conservative shedding efficiency of 48.5% was used to estimate the proportion of cadmium remaining after metamporphosis (1.0 - 0.485 = 0.515).	0.515
	Currie et al. (1997)	Reported shedding efficiencies for: Ephemeroptera: 55% Trichoptera: 48.5% Odonata: 92%		
Copper	Krantzberg and Stokes (1988)	Ratios of adult:larval copper concentrations (ng/indv) were estimated over a range of surface water pH: <u>pH</u> — <u>[Adult]/[Larvae]</u> 4.4 — 123/136 = 0.904 5.1 — 123/253 = 0.486 5.3-5.5 — 67/91 = 0.736 5.8-6.3 — 23/77 = 0.299	pH in near bottom water in SWMU 1/22 was greater than 6.3 at all stations except SQT-03; therefore, the correction factor was based on the ratio of adult to larval lead concentrations reported for the 5.8 - 6.3 pH range.	0.299
Lead	Krantzberg and Stokes (1988)	Ratios of adult:larval lead concentrations (ng/indv) were estimated over a range of surface water pH: <u>pH</u> — <u>[Adult]/[Larvae]</u> 4.4 — 69/87 = 0.852 5.1 — 52/72 = 0.722 5.3-5.5 — 11/43 = 0.256 5.8-6.3 — 7/31 = 0.226	pH in near bottom water in SWMU 1/22 was greater than 6.3 at all stations except SQT-03; therefore, the correction factor was based on the ratio of adult to larval lead concentrations reported for the 5.8 - 6.3 pH range.	0.226
Mercury/ Methylmercury	Chetelat et al. (2008)	Chetelat et al. (2008) indicates that the mass of mercury remains consistent during metamorphis; the loss of body weight during metamorphosis and subsequent body weight loss during the adult stage of non-feeding insects represent an increase in mercury body burden through metamorphosis	Assumptions: - Mass of mercury does not change through metamorphosis - Approximately 10% body weight lost during metamorphosis - Approximatly 50% body weight lost during the adult stage of a non-feeding invertbrate (ranges from 10 - 50%) 1/(0.1×0.5) = 1/0.45 = 2.2	2.2
Selenium	Reinfelder and Fisher (1994)	Reinfelder and Fisher (1994) found that 59.2% of 75Se was bound to the exoskeleton of copepods. Reinfelder and Fisher (1994) also cite Bertine and Goldberg (1972) who reported that 61% of the selenium in shrimp was due to exoskeleton binding.	Assuming a similar partitioning of selenium in aquatic insects (i.e. 59.2 to 61% associated with the exoskeleton in the final molt), approximately 40% of selenium found in aquatic stage invertebrates would remain in emergent invertebrates following molting.	0.4
Zinc	Groenendijk et al. (1999)	Minimum shedding efficiency of *Chironomus riparius* from metal polluted sites in the River Dommel range from 72.1-89.6% based on analyses of 112-165 imagoes / 100 larvae	Groenendijk et al. (1999) directly measured shedding efficiency of a relevant species (*Chironomus*) to the SWMU 1/22 Wetland Complex; the most conservative shedding efficiency reported in this study (72.1%) was used as the correction factor in dose rate models. (1.0 - 0.721 = 0.189)	0.189
	Krantzberg and Stokes (1988)	Ratios of adult:larval zinc concentrations (ng/indv) were estimated over a range of surface water pH: <u>pH</u> — <u>[Adult]/[Larvae]</u> 5.3-5.5 — 343/442 = 0.776 5.8-6.3 — 315/383 = 0.822		

TABLE D-5
SUMMARY OF AREA USE FACTORS APPLIED TO DOSE RATE MODELS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Common Name	Home Range	Home Range Units	Size of SWMU 1/22 Exposure Area		SWMU 1/22 AUF	Size of Active Plant Exposure Areas (ha)			Active Plant AUFs		
			Length (km)	Area (ha)		Northern Grids	Southern Grids	Northern + Southern Grids	AUF_{North}	AUF_{South}	$AUF_{North+South}$
SWMU 1/22											
Indiana bat	61.4	ha		5.2	0.08	Not Evaluated					
Belted kingfisher	1.03	km	1.94		1						
Great blue heron	3.1	km	1.94		0.63						
Mallard	111	ha		5.2	0.05						
Mink	1.85	km	1.94		1.00						
Raccoon	58	ha		5.2	0.09						
Tree swallow	0.1	km	1.94		1						
Active Plant											
American robin	0.4	ha	Not Evaluated			3	3	42	1.0	1.0	1.0
Red-tailed hawk	233	ha				3	3	42	0.013	0.013	0.180
Short-tailed shrew	0.07	ha				3	3	42	1.0	1.0	1.0
Red fox	72.5	ha				3	3	42	0.041	0.041	0.579

TABLE D-6
SUMMARY OF TOXICITY REFERENCE VALUES FOR AVIAN AND MAMMALIAN RECEPTORS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analytes	Avian Receptors				Mammalian Receptors			
	Chronic NOAEL[a] (mg/kg-bw/d)	Chronic LOAEL[b] (mg/kg-bw/d)	Test Animal	Source	Chronic NOAEL[a] (mg/kg-bw/d)	Chronic LOAEL[b] (mg/kg-bw/d)	Test Animal	Source
Metals								
Antimony	NA	NA	--	--	13.3	NA	geometric mean[c]	USEPA Eco-SSL
Arsenic	2.24	4.51	lowest NOAEL/geometric mean[c] of LOAEL values	USEPA Eco-SSL	3.9	7.8	geometric mean[d]	USEPA Eco-SSL
Barium	20.8	41.7	1-d old chicks	Johnson et al. (1960)	51.8	82.7	geometric mean[c]	USEPA Eco-SSL
Cadmium	1.1	4.9	geometric mean[d]	USEPA Eco-SSL	1.6	5.8	geometric mean[d]	USEPA Eco-SSL
Chromium	4.6	14.5	geometric mean[d]	USEPA Eco-SSL	2.4	58.2	geometric mean[c]	USEPA Eco-SSL
Cobalt	5.6	16.9	geometric mean[d]	USEPA Eco-SSL	5	20	geometric mean[d]	USEPA Eco-SSL
Copper	9.1	16.5	geometric mean[d]	USEPA Eco-SSL	22.3	40.8	geometric mean[d]	USEPA Eco-SSL
Lead	3.8	24.8	geometric mean[d]	USEPA Eco-SSL	30.5	100.5	geometric mean[d]	USEPA Eco-SSL
Mercury	0.45	0.91	japanese quail	Hill and Schaffer (1976)	1	7	mouse/rat	Aulerich et al. (1974) (NOAEL) Rizzo and Faust (1972) (LOAEL)
Methylmercury	0.026	0.078	mallard	Heinz (1979), as cited in USEPA (1997)	0.022	0.18	mink	Wobeser et al. (1976a, 1976b), as cited in USEPA (1997)
Selenium	0.400	0.8	mallard	Heinz et al. (1989)	0.2	0.33	rat	Rosenfeld and Beath (1954)
Silver	2.02	60.5	geometric mean[c]	USEPA Eco-SSL	6.02	119	geometric mean[c]	USEPA Eco-SSL
Zinc	54.5	93.9	geometric mean[d]	USEPA Eco-SSL	116.3	635.9	geometric mean[d]	USEPA Eco-SSL

Notes:
a, NOAEL is no observable adverse effects level.
b, LOAEL is the lowest observable adverse effects level.
c, TRV represents the geometric means of endpoints for growth and reproduction from studies accepted by USEPA for the derivation of Ecological Soil Screening Levels (Eco-SSLs
d, TRV represents the geometric means of endpoints for growth and reproduction from the lowest bounded LOAEL feeding studies (maximum 10 studies) accepted by USEPA for the derivation of Eco-SSLs
-- Appropriate data are not available from published literature to derive NOAEL and LOAEL values.
NA, Toxicity Reference Value not available.

TABLE D-7
SUMMARY OF LOWEST BOUNDED LOAEL FEEDING STUDIES FOR AVIAN TEST ORGANISMS - USEPA ECO-SSL DATABASE
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Metal	Reference[1]	Endpoint	Test Organism	Route of Exposure	Exposure Duration	Duration Units	Age	Age Units	Lifestage	Sex	Effect Type	Effect Measure	Response Site	NOAEL Dose (mg/kg	LOAEL Dose (mg/kg
Cadmium															
	Leach et al, 1978	Reproduction	Chicken (Gallus domesticus)	FD	12	w	8	mo	LB	F	REP	EGPN	WO	0.593	2.37
	Leach et al, 1978	Reproduction	Chicken (Gallus domesticus)	FD	12	mo	6	mo	LB	F	REP	PROG	WO	0.593	2.37
	Bokori et al, 1996	Reproduction	Chicken (Gallus domesticus)	FD	39	w	14	d	IM	M	REP	TEWT	TE	0.799	2.4
	Leach et al, 1978	Growth	Chicken (Gallus domesticus)	FD	6	w	1	d	JV	M	GRO	BDWT	WO	0.826	3.3
	Hill 1979	Growth	Chicken (Gallus domesticus)	FD	2	w	1	d	JV	F	GRO	BDWT	WO	1.72	3.44
	Hill, 1974	Growth	Chicken (Gallus domesticus)	FD	2	w	1	d	JV	B	GRO	BDWT	WO	1.72	3.44
	Bokori et al, 1996	Growth	Chicken (Gallus domesticus)	FD	4	w	14	d	JV	M	GRO	BDWT	WO	1.55	4.66
	Lefevre et al, 1982	Growth	Chicken (Gallus domesticus)	FD	5	w	1	d	JV	NR	GRO	BDWT	WO	0.708	7.08
	White and Finley, 1978	Reproduction	Mallard (Anas platyrhychos)	FD	90	d	1	yr	AD	F	REP	Other	NR	1.53	21.1
	White et al 1978	Reproduction	Mallard (Anas platyrhynchos)	FD	90	d	1	yr	AD	B	REP	TEWT	TE	1.53	21.1
													Geometric Mean:	**1.1**	**4.9**
Chromium															
	Haseltine et al., unpublished	Reproduction	Black duck (Anas rubripes	FD	180-190	d	NR	NR	LB	F	REP	RSUC	WO	0.569	2.78
	Meluzzi et al., 1996	Reproduction	Chicken (Gallus domesticus)	FD	15	d	22	w	LB	F	EGG	ALWT	EG	37.7	75.4
													Geometric Mean:	**4.6**	**14.5**
Cobalt															
	Hill, 1979	Growth	Chicken (Gallus domesticus)	FD	5	w	1	d	JV	F	GRO	BDWT	WO	3.89	7.8
	Ling et al., 1979	Growth	Chicken (Gallus domesticus)	FD	3	w	1	d	JV	M	GRO	BDWT	WO	4.1	8.2
	Hill, 1974	Growth	Chicken (Gallus domesticus)	FD	2	w	1	d	JV	B	GRO	BDWT	WO	4.29	8.59
	Paulov, 1971	Growth	Chicken (Gallus domesticus)	FD	8	d	2	d	JV	NR	GRO	BDWT	WO	14.8	148
													Geometric Mean:	**5.6**	**16.9**
Copper															
	Kashani et al, 1986	Growth	(Melagris gallopavo)	FD	8	w	1	d	JV	M	GRO	BDWT	WO	2.34	4.68
	McGhee et al, 1965	Growth	(Gallus domesticus)	FD	4	w	NR	NR	JV	NR	GRO	BDWT	WO	3.83	7.67
	Ankari et al, 1998	Reproduction	(Gallus domesticus)	FD	84	d	25	w	LB	F	REP	EGPN	WO	4.05	12.1
	Gill et al, 1995	Growth	(Gallus domesticus)	FD	3	w	4	w	JV	M	GRO	BDWT	WO	9.52	19
	Harms and Buresh, 1986	Reproduction	(Gallus domesticus)	FD	6	w	64	w	LB	F	REP	EGPN	WO	13.9	19.5
	Jackson and Stevenson, 1981	Reproduction	(Gallus domesticus)	FD	280	d	18	w	LB	F	EGG	EGWT	EG	15.6	23.3
	Nam et al, 1984	Growth	(Gallus domesticus)	FD	4	w	3	d	JV	NR	GRO	BDWT	WO	12.2	24.3
	Miles et al, 1998	Growth	(Gallus domesticus)	FD	42	d	1	d	JV	B	GRO	BDWT	WO	16.5	24.7
	Jackson and Stevenson, 1981	Reproduction	(Gallus domesticus)	FD	336	d	26	w	LB	F	REP	EGPN	WO	17	25.5
	Funk and Baker, 1991	Growth	(Gallus domesticus)	FD	14	d	8	d	JV	M	GRO	BDWT	WO	15.7	25.8
													Geometric Mean:	**9.1**	**16.5**
Lead															
	Edens and Garlich, 1983	Reproduction	Japanese quail (Coturnix japonica)	FD	5	w	6	w	LB	F	REP	PROG	WO	0.194	1.94
	Edens and Garlich, 1983	Reproduction	Chicken (Gallus domesticus)	FD	4	w	NR	NR	LB	F	REP	PROG	WO	1.63	3.26
	Meluzzi et al., 1996	Reproduction	Chicken (Gallus domesticus)	FD	30	d	22	w	LB	F	EGG	ALWT	EG	2.69	4.04
	Edens and Garlich, 1983	Growth	Japanese quail (Coturnix japonica)	FD	5	w	1	d	JV	F	GRO	BDWT	WO	1.56	15.6
	Edens and Melvin, 1989	Growth	Japanese quail (Coturnix japonica)	FD	4	w	0	d	JV	F	GRO	BDWT	WO	5.93	59.3
	Damron et al, 1969	Growth	Chicken (Gallus domesticus)	FD	4	w	4	w	JV	NR	GRO	BDWT	WO	6.14	61.4
	Morgan et al., 1975	Growth	Japanese quail (Coturnix japonica)	FD	1	w	1	d	JV	NR	GRO	BDWT	WO	13.5	67.4
	Damron et al, 1969	Growth	Chicken (Gallus domesticus)	FD	4	w	4	w	JV	NR	GRO	BDWT	WO	7.1	71
	Edens et al., 1976	Growth	Japanese quail (Coturnix japonica)	FD	12	w	0	d	JV	F	GRO	BDWT	WO	11.1	111
	Edens, 1985	Growth	Japanese quail (Coturnix japonica)	FD	12	w	1	w	JV	F	GRO	BDWT	WO	11.2	112
													Geometric Mean:	**3.8**	**24.8**
Zinc															
	Gibson et al, 1986	Reproduction	Chicken (Gallus domesticus)	FD	10	w	30	w	JV	F	REP	PROG	WO	57.3	66.5
	Stevenson et al, 1987	Reproduction	Chicken (Gallus domesticus)	FD	140	d	28	w	JV	F	REP	PROG	WO	63.9	76.7
	Stevenson et al, 1987	Reproduction	Chicken (Gallus domesticus)	FD	140	d	28	w	LB	F	REP	PROG	WO	67.8	84.8
	Hamilton et al, 1981	Growth	Japanese quail (Coturnix japonica)	FD	14	d	1	d	JV	B	GRO	BDWT	WO	43.3	86.6
	Jensen and Maurice, 1980	Reproduction	Chicken (Gallus domesticus)	FD	6	w	NR	NR	LB	F	REP	PROG	WO	24.7	98.8
	Jackson et al, 1986	Growth	Chicken (Gallus domesticus)	FD	140	d	40	w	SM	F	GRO	BDWT	WO	55	105
	Jackson et al, 1986	Reproduction	Chicken (Gallus domesticus)	FD	140	d	40	w	LB	F	REP	PROG	WO	55	105
	Sandoval et al, 1998	Growth	Chicken (Gallus domesticus)	FD	3	w	1	d	JV	M	GRO	BDWT	WO	70.6	106
	Berg and Martinson, 1972	Growth	Chicken (Gallus domesticus)	FD	2	w	1	d	JV	NR	GRO	BDWT	WO	55.3	111
	Roberson and Schaible, 1960	Growth	Chicken (Gallus domesticus)	FD	4	w	1	d	JV	M	GRO	BDWT	WO	74.3	111
													Geometric Mean:	**54.5**	**93.9**

Notes (From USEPA Eco-SSL guidance):
1, Complete study citations may be found in USEPA Eco-SSL guidance documents (USEPA, 2007); available at http://www.epa.gov/ecotox/ecossl/
AR=adrenal; ATPT = adenosine triphosphate; B = both; BDWT = body weight changes; BL = blood; BLPR = blood pressure; bw = body weight; CHM = chemical; d = days; DR = drinking water; EDMA = edema; ENZ = enzyme; F = female; FCNS = food consumption; FD = food; FDB = feeding behavior; GRO = Growth; GV=gavage; HE= heart; HIS = histology; HTRT = heart rate; JV = juvenile; kg = kilogram; KI = kidney; LI = liver; LOAEL = lowest observed adverse effect level; M = measured; M = male; mg = milligram; mo = months; MOR = effects on survival; MORT = mortality; NOAEL = no observed adverse effect level; NR = not reported; ORW = organ weight changes; ORWT = organ weight; OV = ovary; PHOS = phosphate; PHY = physiology; REP = reproduction; RHIS = reproductive organ histology; Score = Total Data Evaluation Score as described in US EPA (2003; Attachment 4-3); SMIX = organ weight changes relative to body weight; SR = serum; TE = testes; U = unmeasured; UREA = urea; UX = reported as measured but measurements not reported; w = weeks; WCON = water consumption; WO = whole

TABLE D-8
SUMMARY OF LOWEST BOUNDED LOAEL FEEDING STUDIES FOR MAMMALIAN TEST ORGANISMS - USEPA ECO-SSL DATABASE
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Metal	Reference[1]	Endpoint	Test Organism	Route of Exposure	Exposure Duration	Duration Units	Age	Age Units	Lifestage	Sex	Effect Type	Effect Measure	Response Site	NOAEL Dose (mg/kg	LOAEL Dose (mg/kg
Arsenic															
	Neiger and Osweiler 1989	Growth	Dog (Canis familiaris)	FD	8	w	8	mo	JV	F	GRO	BDWT	WO	1.04	1.66
	Byron et al, 1967	Growth	Dog (Canis familiaris)	FD	2	yr	6	mo	JV	B	GRO	BDWT	WO	2.25	5.62
	Byron et al, 1967	Growth	Rat (Rattus norvegicus)	FD	12	w	NR	NR	JV	B	GRO	BDWT	WO	9.84	19.7
	Byron et al, 1967	Growth	Rat (Rattus norvegicus)	FD	12	w	NR	NR	JV	M	GRO	BDWT	WO	10.3	20.6
													Geometric Mean:	**3.9**	**7.8**
Cadmium															
	Doyle et al, 1974	Growth	Sheep (Ovis aires)	FD	163	d	4	mo	JV	M	GRO	BDWT	WO	0.448	0.909
	Cousins et al 1977	Growth	Rat (Rattus norvegicus)	FD	14	w	NR	NR	JV	M	GRO	BDWT	WO	0.268	1.3
	Sawicka-Kapusta et al 1994	Reproduction	Mouse (Mus musculus)	FD	6	d	NR	NR	GE	F	REP	DEYO	WO	1.14	2.28
	Takashima et al 1980	Growth	Rat (Rattus norvegicus)	FD	19	mo	NR	NR	JV	M	MPH	GMPH	BO	1.04	5.2
	Chetty et al, 1980	Growth	Rat (Rattus norvegicus)	FD	4	w	NR	NR	JV	M	GRO	BDWT	WO	4.36	8.71
	Yuyama 1982	Growth	Rat (Rattus norvegicus)	FD	2	w	5	w	JV	M	GRO	BDWT	WO	2.65	10.6
	Bhattacharyya et al, 1988	Growth	Mouse (Mus musculus)	FD	252	d	68	d	GE	F	GRO	BDWT	WO	1.08	10.8
	Cousins et al., 1973	Growth	Pig (Sus scrofa)	FD	6	w	55	d	JV	M	GRO	BDWT	WO	4.05	12.1
	Gustafson and Mercer, 1984	Growth	Rat (Rattus norvegicus)	FD	21	d	NR	NR	JV	M	GRO	BDWT	WO	6.06	15.2
	Mitsumori et al., 1998	Growth	Rat (Rattus norvegicus)	FD	4	d	5	w	JV	F	GRO	BDWT	WO	3.08	15.4
													Geometric Mean:	**1.6**	**5.8**
Cobalt															
	Nation et al., 1983	Reproduction	Rat (R. norvegicus)	FD	69	d	80	d	MA	M	REP	TEWT	TE	5	20
													Geometric Mean:	**5**	**20**
Copper															
	Aulerich et al, 1982	Reproduction	Mink (Mustela vision)	FD	357	d	NR	mo	JV	F	REP	PROG	WO	3.4	6.79
	Allcroft et al, 1961	Growth	Pig (Sus scrofa)	FD	4	w	40400	w	JV	B	GRO	BDWT	WO	5.6	9.34
	Brandt, 1983	Growth	Mink (Mustela vision)	FD	4	mo	90	d	JV	M	GRO	BDWT	WO	10.2	19.6
	Edmonds and Baker, 1986	Growth	Pig (Sus scrofa)	FD	28	d	4	w	JV	NR	GRO	BDWT	WO	10.3	26.9
	Suttle and Mills, 1966	Growth	Pig (Sus scrofa)	FD	14	d	NR	NR	JV	F	GRO	BDWT	WO	16.2	27.6
	Grobner et al, 1986	Growth	Rabbit (Oryctolagus cuniculus)	FD	28	d	28	d	JV	NR	GRO	BDWT	WO	27.7	45.7
	Hebert, 1993	Growth	Rat (Rattus norvegicus)	FD	13	w	6	w	JV	B	GRO	BDWT	WO	49.8	99.6
	Lecyk, 1980	Reproduction	Mouse (Mus musculus)	FD	49	d	NR	NR	GE	B	REP	PROG	WO	90.9	136
	Lecyk, 1980	Reproduction	Mouse (Mus musculus)	FD	49	d	NR	NR	GE	B	REP	PROG	WO	90.9	136
	Hebert, 1993	Growth	Rat (Rattus norvegicus)	FD	15	d	6	w	JV	B	GRO	BDWT	WO	82.5	165
													Geometric Mean:	**22.3**	**40.8**
Lead															
	Azar et al., 1973	Survival	(Rattus norvegicus)	FD	2	yr	NR	NR	NR	M	MOR	MORT	WO	10.9	42.4
	Logner et al., 1984	Survival	(Bos taurus)	FD	10	d	74	d	JV	M	MOR	MORT	WO	16	43
	Jessup and Shott, 1969	Reproduction	(Rattus norvegicus)	FD	92	w	21	d	JV	M	REP	TEWT	TE	7.5	74.9
	Azar et al., 1973	Survival	(Rattus norvegicus)	FD	2	yr	NR	NR	NR	M	MOR	MORT	WO	87.5	163
	Mykkanen et al., 1980	Growth	(Rattus norvegicus)	FD	1	w	NR	NR	LC	F	GRO	BDWT	WO	230	460
													Geometric Mean:	**30.5**	**100.5**
Zinc															
	Miller et al., 1989	Reproduction	Cattle (Bos taurus)	FD	14	w	NR	NR	LC	F	REP	PRWT	WO	37.9	75.9
	Hill et. al., 1983	Reproduction	Pig (Sus scrofa)	FD	12	mo	8-Jul	mo	GE	F	REP	ODVP	WO	8.23	82.3
	Brink et al, 1959	Growth	Pig (Sus scrofa)	FD	42	d	NR	NR	JV	NR	GRO	BDWT	WO	43.5	87.1
	Hill et. al., 1983	Growth	Pig (Sus scrofa)	FD	8	mo	8-Jul	mo	GE	F	GRO	GGRO	WO	10.3	103
	Ketcheson et al, 1969	Reproduction	Rat (Rattus norvegicus)	FD	14	d	NR	NR	LC	F	REP	PRWT	WO	181	452
	Maita et al, 1981	Growth	Rat (Rattus norvegicus)	FD	13	w	5	w	JV	M	GRO	BDWT	WO	234	2514
	Maita et al, 1981	Reproduction	Rat (Rattus norvegicus)	FD	13	w	5	w	JV	M	REP	ORWT	TE	234	2514
	Pettersen, et al, 2002	Growth	Mouse (Mus musculus)	FD	3	w	4	w	JV	B	GRO	BDWT	WO	1419	2838
	Maita et al, 1981	Growth	Mouse (Mus musculus)	FD	13	w	5	w	JV	F	GRO	BDWT	WO	479	4878
	Maita et al, 1981	Reproduction	Mouse (Mus musculus)	FD	13	w	5	w	JV	F	REP	ORWT	OV	479	4878
													Geometric Mean:	**116.255344**	**635.89615**

Notes (From USEPA Eco-SSL guidance):

1, Complete study citations may be found in USEPA Eco-SSL guidance documents (USEPA, 2007); available at http://www.epa.gov/ecotox/ecossl/

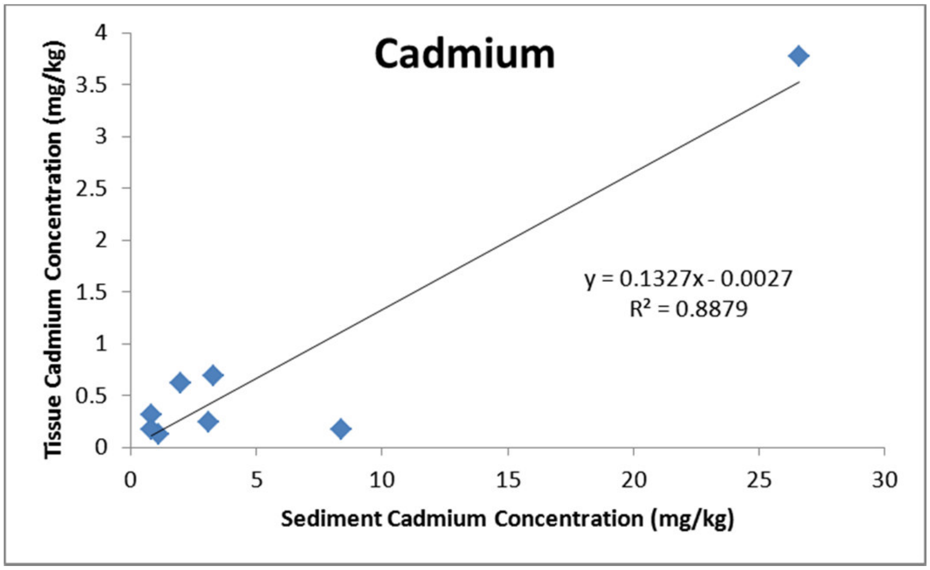
AR=adrenal; ATPT = adenosine triphosphate; B = both; BDWT = body weight changes; BL = blood; BLPR = blood pressure; bw = body weight; CHM = chemical; d = days; DR = drinking water; EDMA = edema; ENZ = enzyme; F = female; FCNS = food consumption; FD = food; FDB = feeding behavior; GRO = Growth; GV=gavage; HE= heart; HIS = histology; HTRT = heart rate; JV = juvenile; kg = kilogram; KI = kidney; LI = liver; LOAEL = lowest observed adverse effect level; M = measured; M = male; mg = milligram; mo = months; MOR = effects on survival; MORT = mortality; NOAEL = no observed adverse effect level; NR = not reported; ORW = organ weight changes; ORWT = organ weight; OV = ovary; PHOS = phosphate; PHY = physiology; REP = reproduction; RHIS = reproductive organ histology; Score = Total Data Evaluation Score as described in US EPA (2003; Attachment 4-3); SMIX = organ weight changes relative to body weight; SR = serum; TE = testes; U = unmeasured; UREA = urea; UX = reported as measured but measurements not reported; w = weeks; WCON = water consumption; WO = whole

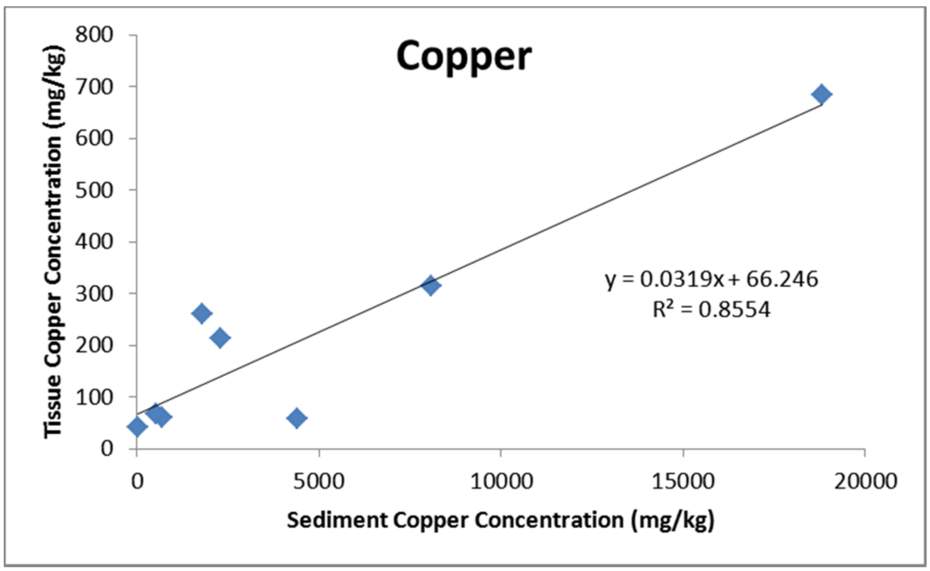
TABLE D-9
SUMMARY OF TOTAL MERCURY STUDIES FOR MAMMALIAN RECEPTORS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Form	Test Organism	NOAEL	LOAEL	Method of exposure	Endpoint	Source	Comments
Mercuric Chloride	Mink	1 mg/kg bw/day		diet	reproduction	Aulerich et al. 1974 (Sample et al. 1996)	
Mercuric Sulfide	Mouse	13.3 mg/kg bw/day		diet	reproduction/survival	Revis et al., 1989 (Sample et al. 1996; used by Opresko et al. 1994 to dervive other TRVs)	
Inorganic	Rat	14 mg/kg bw/day		diet	Reproductive, developmental	Fitzhugh et al., 1950 (USEPA (Great Lakes), 1995)	Great Lakes Water Quality initiative Criteria Documents for the Protection of Wildlife (EPA-820\b-95\008)
Inorganic	Rat		7 mg/kg bw/day	diet	development	Rizzo and Furst 1972 (USEPA (Great Lakes), 1995)	
Mercuric Chloride	Rat		56 mg/kg bw/day	diet	growth	Fitzhugh et al. 1950	
Mercuric Chloride	rat		0.64 mg/kg bw/day	gavage/injection	immune system/kidney	Knoflach et al., 1986; (used by Opresko et al. 1994 to dervive other TRVs)	Mercury chloride was dissolved in tap water and administered through gavage
Mercuric Chloride	rat	0.23 mg/kg bw/day		gavage - de-ionized water	nephropathy	IPCS 2003 (Dieter et al. 1992; NTP 1993)	Study conducted by the National Toxicology Program and summarized in Dieter et al. 1992. Mercuric chloride was administered by de-ionized water through gavage.
Mercuric Chloride	Rat	1.9 mg/kg bw/day	3.7 mg/kg bw/day	gavage - de-ionized water	Resp	Dieter et al. 1992; NTP 1993	
Mercuric Chloride	Rat		0.226 mg/kg bw/day	gavage - de-ionized water	Mortality	Andres 1984	Administered by using an esophageal metallic sound.
Mercuric Chloride	Rat		0.317 mg/kg bw/day	gavage	Autoimmune	Bernaudin et al. 1981	Study described gavage process as only "forcible feeding."
Mercuric Chloride	Rat		0.633 mg/kg bw/day	injection	kidney/neurological	Druet et al. 1978	Used by EPA's mercury workgroup to derive oral RfD with Andres 1984 and Bernaudin et al 1981. despite using injection instead of oral exposure.
Mercuric Chloride	Rat - male		1.9 mg/kg bw/day	gavage - de-ionized water	Mortality	Dieter et al. 1992; NTP 1993	Study conducted by the National Toxicology Program and summarized in Dieter et al. 1992. Mercuric chloride was administered by de-ionized water through gavage.
Mercuric Chloride	Rat - male		1.9 mg/kg bw/day	gavage - de-ionized water	Gastro/Renal/Bd wt	Dieter et al. 1992; NTP 1993	
Mercuric Chloride	Rat		3.7 mg/kg bw/day	gavage - de-ionized water	Cancer	Dieter et al. 1992; NTP 1993	
Mercuric Chloride	Mouse		3.7 mg/kg bw/day	gavage - de-ionized water	Renal	Dieter et al. 1992; NTP 1993	

Notes:
Shaded cells indicate selected mammalian TRVs for inorganic mercury

FIGURE D-1
RELATIONSHIP BETWEEN AQUATIC LIFE STAGE INVERTEBRATE TISSUE AND SEDIMENT CONCENTRATIONS - SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK





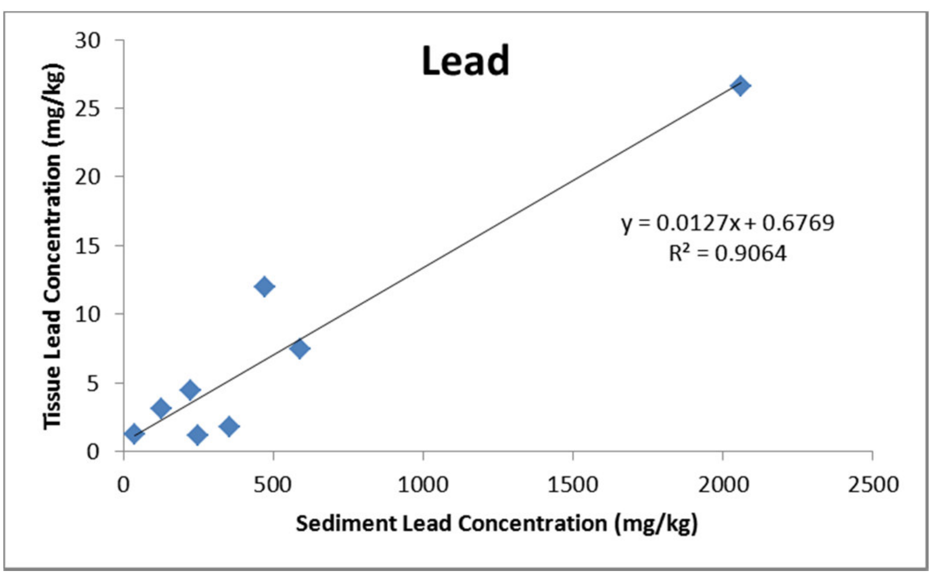
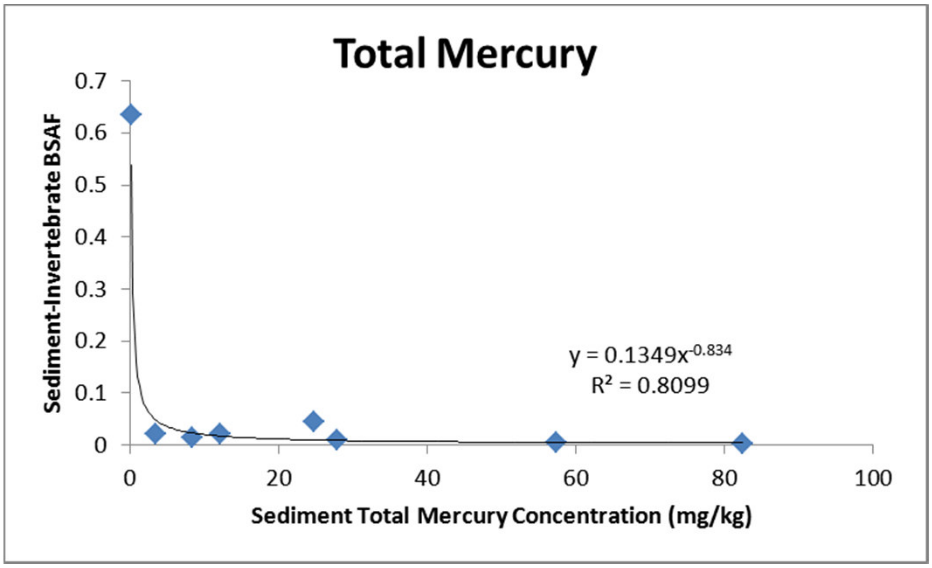
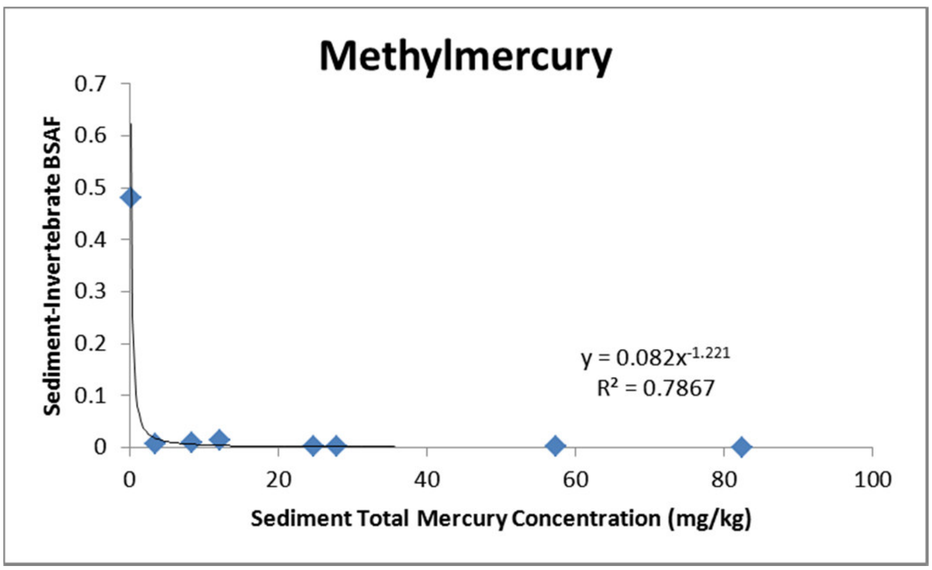
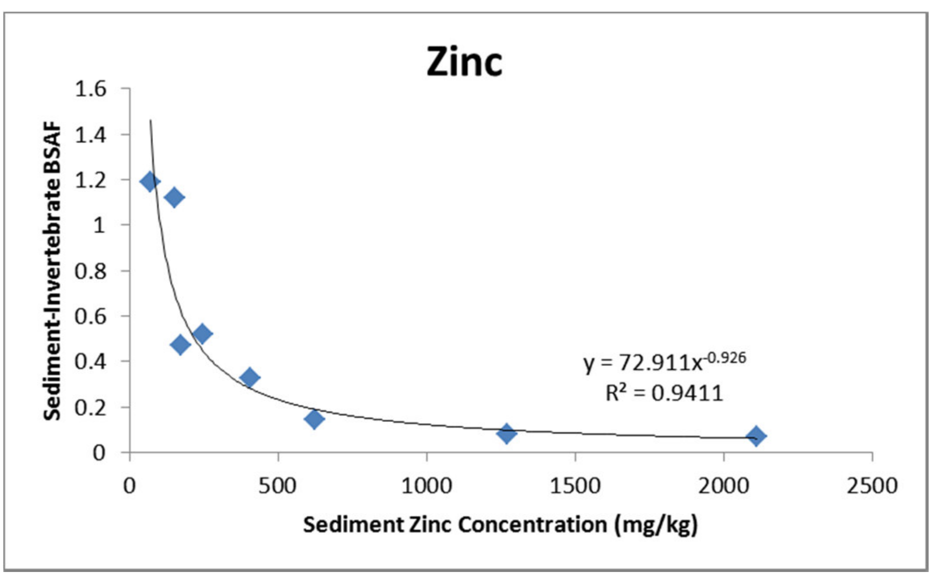


FIGURE D-2
SEDIMENT TO AQUATIC LIFE STAGE INVERTEBRATE BIOTA-SEDIMENT ACCUMULATION FACTORS DERIVED FROM SQT STATIONS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK







APPENDIX E

Dose Rate Model Calculations
FWIA Step IIC Investigation
Dyno Nobel Port Ewen Site

This appendix presents the calculations for dose rate models developed to evaluate wildlife ingestion pathways in the FWIA Step IIC investigation of the Dyno Nobel Port Ewen Site. Model results are provided by exposure area in the order presented in the FWIA Step IIC Report:

SWMU 1/22 Wetland Complex

- Summary of Aquatic Exposure Point Concentrations: Table E-1
- Maximum Area Use Exposure Estimates: Table E-2 to Table E-8
- Adjusted Area Use Exposure Estimates: Table E-9 to Table E-12

Active Plant Area

<u>Northern Grids:</u>

- Summary of Terrestrial Exposure Point Concentrations: Table E-13
- Maximum Area Use Exposure Estimates: Table E-14 to Table E-17

<u>Southern Grids:</u>

- Summary of Terrestrial Exposure Point Concentrations: Table E-18
- Maximum Area Use Exposure Estimates: Table E-19 to Table E-22

<u>Northern and Southern Grids:</u>

- Summary of Terrestrial Exposure Point Concentrations: Table E-23
- Maximum Area Use Exposure Estimates: Table E-24 to Table E-25
- Adjusted Area Use Exposure Estimates: Table E-26 to Table E-27

TABLE E-1
SUMMARY OF AQUATIC EXPOSURE POINT CONCENTRATIONS - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Sediment Exposure Point Concentration (mg/kg, dry weight)	Surface Water Exposure Point Concentration (mg/L)	Exposure Point Concentrations for Dietary Items of Semi-Aquatic Receptors (mg/kg, dry weight)							
			Aquatic Life Stage Invertebrates		Emergent Life Stage Invertebrates		Forage Fish		All Fish	
			Estimated Concentration	Reference	Estimated Concentration[d]	Reference	Estimated Concentration	Reference	Estimated Concentration	Reference
Metals										
Cadmium	8.95	*0.001*	1.26	Measured UCL_{95}[a]	0.648	Measured UCL_{95}[b] x 0.515 (Currie et al. 1999)	0.049	Measured UCL_{95}[c]	0.080	Measured UCL_{95}[c]
Copper	9468	0.0186	309.7	Measured UCL_{95}[a]	92.6	Measured UCL_{95}[b] x 0.299 (Krantzberg and Stokes 1988)	11.0	Measured UCL_{95}[c]	9.7	Measured UCL_{95}[c]
Lead	1085	0.00096	11.2	Measured UCL_{95}[a]	2.53	Measured UCL_{95}[b] x 0.226 (Krantzberg and Stokes 1988)	0.61	Measured UCL_{95}[c]	0.50	Measured UCL_{95}[c]
Mercury	41.29	0.0002	0.455	Measured UCL_{95}[a]	1.00	Measured UCL_{95}[b] x 2.2 (Chetelat et al. 2008)	0.47	Measured UCL_{95}[c]	0.45	Measured UCL_{95}[c]
Methylmercury	NA	NA	0.092	Measured UCL_{95}[a]	0.20	Measured UCL_{95}[b] x 2.2 (Chetelat et al. 2008)	0.47	Measured UCL_{95}[c]	0.44	Measured UCL_{95}[c]
Selenium	118.9	0.005	18.7	Measured UCL_{95}[a]	7.47	Measured UCL_{95} x 0.4 (Reinfelder and Fisher 1994)	5.61	Measured UCL_{95}[c]	6.48	Measured UCL_{95}[c]
Zinc	909	0.0072	130.8	Measured UCL_{95}[a]	24.7	Measured UCL_{95}[b] x 0.189 (Groenendijk et al. 1999)	225.6	Measured UCL_{95}[c]	187.5	Measured UCL_{95}[c]

Notes:

a, 95 percent upper confidence limit of the mean concentration (UCL_{95}) of non-depurated 'market-basket' invertebrate tissues analyzed from SQT stations within SWMU 1/22

b, Assumes equivalent concentration to measured aquatic life stage invertebrates

c, 95 percent upper confidence limit of the mean concentration (UCL_{95}) of non-depurated forage and predatory fish tissues analyzed from within and downstream of SWMU 1/22

d, Estimated concentration in aquatic stage benthic invertebrates multiplied by a correction factor to account for the loss/gain in metal body burden that occurs during metamorphosis (See Appendix D).

TABLE E-2
GREAT BLUE HERON
MAXIMUM AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Great Blue Heron Dose (mg/kg bw-day)							TRV (mg/kg bw-day)			
	Physical		Dietary				Ingestion Rates			Dietary Composition (%)				Diet				Water	Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	All Fish (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish	Area Use Factor	Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.080	2.20	0.1396	0.0	0.1001	0%	0%	100%	1.0	0.0	0.0	0.005	0.005	0.00005	0.0	0.005	1.10	<1	4.90	<1
Copper	9468.0	0.0	309.7	92.6	9.660	2.20	0.1396	0.0	0.1001	0%	0%	100%	1.0	0.0	0.0	0.613	0.613	0.00085	0.0	0.614	9.10	<1	16.50	<1
Lead	1085.0	0.001	11.2	2.5	0.501	2.20	0.1396	0.0	0.1001	0%	0%	100%	1.0	0.0	0.0	0.032	0.032	0.00004	0.0	0.032	3.80	<1	24.80	<1
Mercury	41.29	0.000	0.455	1.001	0.453	2.20	0.1396	0.0	0.1001	0%	0%	100%	1.0	0.0	0.0	0.029	0.029	0.00001	0.0	0.029	0.45	<1	0.91	<1
Methylmercury	NA	NA	0.092	0.202	0.435	2.20	0.1396	0.0	0.1001	0%	0%	100%	1.0	0.0	0.0	0.028	0.028	0.00000	0.0	0.028	0.03	**1.1**	0.08	<1
Selenium	118.9	0.01	18.67	7.47	6.478	2.20	0.1396	0.0	0.1001	0%	0%	100%	1.0	0.0	0.0	0.411	0.411	0.00023	0.0	0.411	0.40	**1.0**	0.80	<1
Zinc	908.7	0.01	130.8	24.7	187.5	2.20	0.1396	0.0	0.1001	0%	0%	100%	1.0	0.0	0.0	11.90	11.90	0.00033	0.0	11.90	54.50	<1	93.90	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum(C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

where:	EDD_{diet}	= Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
	IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
	C_{ti}	= UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
	DF_i	= Dietary fraction of food item *i*
	AUF	= Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
	BW	= Body weight of the receptor, wet weight
	IR_{water}	= Drinking water ingestion rate (liters ingested per day)
	C_{water}	= Maximum constituent concentration in unfiltered surface water (mg/L)
	$SIR_{incidental}$	= Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
	$C_{substrate}$	= Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-3
MALLARD
MAXIMUM AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Mallard Dose (mg/kg bw-day)							TRV (mg/kg bw-day)			
	Physical		Dietary			Body Weight (kg)	Ingestion Rates			Dietary Composition (%)			Area Use Factor	Diet				Water	Substrate	Total Dose	NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	Forage Fish (mg/kg, dw)		Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish		Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$		TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.049	1.04	0.0523	0.0007	0.0607	100%	0%	0%	1.0	0.063	0.0	0.0	0.063	0.00006	0.006	0.069	1.10	<1	4.90	<1
Copper	9468.0	0.0	309.7	92.6	10.970	1.04	0.0523	0.0007	0.0607	100%	0%	0%	1.0	15.53	0.0	0.0	15.53	0.00108	6.172	21.70	9.10	**2.4**	16.50	**1.3**
Lead	1085.0	0.001	11.2	2.5	0.612	1.04	0.0523	0.0007	0.0607	100%	0%	0%	1.0	0.562	0.0	0.0	0.562	0.00006	0.707	1.269	3.80	<1	24.80	<1
Mercury	41.29	0.000	0.455	1.001	0.470	1.04	0.0523	0.0007	0.0607	100%	0%	0%	1.0	0.023	0.0	0.0	0.023	0.00001	0.027	0.050	0.45	<1	0.91	<1
Methylmercury	NA	NA	0.092	0.202	0.474	1.04	0.0523	0.0007	0.0607	100%	0%	0%	1.0	0.005	0.0	0.0	0.005	0.00000	0.0	0.005	0.03	<1	0.08	<1
Selenium	118.9	0.01	18.67	7.47	5.605	1.04	0.0523	0.0007	0.0607	100%	0%	0%	1.0	0.936	0.0	0.0	0.936	0.00029	0.078	1.014	0.40	**2.5**	0.80	**1.3**
Zinc	908.7	0.01	130.8	24.7	225.6	1.04	0.0523	0.0007	0.0607	100%	0%	0%	1.0	6.559	0.0	0.0	6.559	0.00042	0.592	7.152	54.50	<1	93.90	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

- EDD_{diet} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
- IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
- C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
- DF_i = Dietary fraction of food item *i*
- AUF = Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
- BW = Body weight of the receptor, wet weight
- IR_{water} = Drinking water ingestion rate (liters ingested per day)
- C_{water} = Maximum constituent concentration in unfiltered surface water (mg/L)
- $SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
- $C_{substrate}$ = Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-4
BELTED KINGFISHER
MAXIMUM AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Belted Kingfisher Dose (mg/kg bw-day)							TRV (mg/kg bw-day)			
	Physical		Dietary				Ingestion Rates			Dietary Composition (%)				Diet				Water	Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	Forage Fish (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish	Area Use Factor	Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.049	0.14	0.0221	0.0	0.0155	0%	0%	100%	1.0	0.0	0.0	0.008	0.008	0.00011	0.0	0.008	1.10	<1	4.90	<1
Copper	9468.0	0.0	309.7	92.6	10.970	0.14	0.0221	0.0	0.0155	0%	0%	100%	1.0	0.0	0.0	1.779	1.779	0.00212	0.0	1.781	9.10	<1	16.50	<1
Lead	1085.0	0.001	11.2	2.5	0.612	0.14	0.0221	0.0	0.0155	0%	0%	100%	1.0	0.0	0.0	0.099	0.099	0.00011	0.0	0.099	3.80	<1	24.80	<1
Mercury	41.29	0.000	0.455	1.001	0.470	0.14	0.0221	0.0	0.0155	0%	0%	100%	1.0	0.0	0.0	0.076	0.076	0.00002	0.0	0.076	0.45	<1	0.91	<1
Methylmercury	NA	NA	0.092	0.202	0.474	0.14	0.0221	0.0	0.0155	0%	0%	100%	1.0	0.0	0.0	0.077	0.077	0.00000	0.0	0.077	0.03	**3.0**	0.08	<1
Selenium	118.9	0.01	18.67	7.47	5.605	0.14	0.0221	0.0	0.0155	0%	0%	100%	1.0	0.0	0.0	0.909	0.909	0.00057	0.0	0.909	0.40	**2.3**	0.80	**1.1**
Zinc	908.7	0.01	130.8	24.7	225.6	0.14	0.0221	0.0	0.0155	0%	0%	100%	1.0	0.0	0.0	36.58	36.58	0.00082	0.0	36.58	54.50	<1	93.90	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

where:	EDD_{diet}	= Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
	IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
	C_{ti}	= UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
	DF_i	= Dietary fraction of food item *i*
	AUF	= Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
	BW	= Body weight of the receptor, wet weight
	IR_{water}	= Drinking water ingestion rate (liters ingested per day)
	C_{water}	= Maximum constituent concentration in unfiltered surface water (mg/L)
	$SIR_{incidental}$	= Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
	$C_{substrate}$	= Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-5
TREE SWALLOW
MAXIMUM AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Tree Swallow Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical		Dietary			Body Weight (kg)	Ingestion Rates			Dietary Composition (%)			Area Use Factor	Diet				Water	Total Dose	NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	Forage Fish (mg/kg, dw)		Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish		Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$		TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																							
Cadmium	8.95	0.00	1.259	0.648	0.049	0.02	0.0116	0.0	0.0044	0%	100%	0%	1.0	0.0	0.365	0.0	0.365	0.00021	0.365	1.10	<1	4.90	<1
Copper	9468.0	0.0	309.7	92.6	10.970	0.02	0.0116	0.0	0.0044	0%	100%	0%	1.0	0.0	52.1	0.0	52.1	0.00395	52.1	9.10	**5.7**	16.50	**3.2**
Lead	1085.0	0.001	11.2	2.5	0.612	0.02	0.0116	0.0	0.0044	0%	100%	0%	1.0	0.0	1.43	0.0	1.43	0.00020	1.43	3.80	<1	24.80	<1
Mercury	41.29	0.000	0.455	1.001	0.470	0.02	0.0116	0.0	0.0044	0%	100%	0%	1.0	0.0	0.564	0.0	0.564	0.00004	0.564	0.45	**1.3**	0.91	<1
Methylmercury	NA	NA	0.092	0.202	0.474	0.02	0.0116	0.0	0.0044	0%	100%	0%	1.0	0.0	0.113	0.0	0.113	0.00000	0.113	0.03	**4.4**	0.08	**1.5**
Selenium	118.9	0.01	18.67	7.47	5.605	0.02	0.0116	0.0	0.0044	0%	100%	0%	1.0	0.0	4.205	0.0	4.205	0.00106	4.206	0.40	**10.5**	0.80	**5.3**
Zinc	908.7	0.01	130.8	24.7	225.6	0.02	0.0116	0.0	0.0044	0%	100%	0%	1.0	0.0	13.92	0.0	13.92	0.00153	13.92	54.50	<1	93.90	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum(C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

EDD_{diet}	= Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti}	= UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i	= Dietary fraction of food item *i*
AUF	= Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
BW	= Body weight of the receptor, wet weight
IR_{water}	= Drinking water ingestion rate (liters ingested per day)
C_{water}	= Maximum constituent concentration in unfiltered surface water (mg/L)
$SIR_{incidental}$	= Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$	= Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-6
INDIANA BAT
MAXIMUM AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Indiana Bat Dose (mg/kg bw-day)							TRV (mg/kg bw-day)			
	Physical		Dietary			Body Weight (kg)	Ingestion Rates			Dietary Composition (%)			Area Use Factor	Diet				Water	Substrate	Total Dose	NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	Forage Fish (mg/kg, dw)		Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish		Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$		TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.049	0.006	0.0012	0.0	0.0010	0%	100%	0%	1.0	0.0	0.131	0.0	0.131	0.00017	0.0	0.131	1.60	<1	5.80	<1
Copper	9468.0	0.0	309.7	92.6	10.970	0.006	0.0012	0.0	0.0010	0%	100%	0%	1.0	0.0	18.75	0.0	18.75	0.00307	0.0	18.75	22.30	<1	40.80	<1
Lead	1085.0	0.001	11.2	2.5	0.612	0.006	0.0012	0.0	0.0010	0%	100%	0%	1.0	0.0	0.512	0.0	0.512	0.00016	0.0	0.513	30.48	<1	100.47	<1
Mercury	41.29	0.000	0.455	1.001	0.470	0.006	0.0012	0.0	0.0010	0%	100%	0%	1.0	0.0	0.203	0.0	0.203	0.00003	0.0	0.203	1.00	<1	7.00	<1
Methylmercury	NA	NA	0.092	0.202	0.474	0.006	0.0012	0.0	0.0010	0%	100%	0%	1.0	0.0	0.041	0.0	0.041	0.00000	0.0	0.041	0.02	**1.9**	0.18	<1
Selenium	118.9	0.01	18.67	7.47	5.605	0.006	0.0012	0.0	0.0010	0%	100%	0%	1.0	0.0	1.512	0.0	1.512	0.00083	0.0	1.513	0.20	**7.6**	0.33	**4.6**
Zinc	908.7	0.01	130.8	24.7	225.6	0.006	0.0012	0.0	0.0010	0%	100%	0%	1.0	0.0	5.00	0.0	5.00	0.00119	0.0	5.01	116.30	<1	635.90	<1

Notes:

a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

where:	EDD_{diet}	= Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
	IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
	C_{ti}	= UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
	DF_i	= Dietary fraction of food item *i*
	AUF	= Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
	BW	= Body weight of the receptor, wet weight
	IR_{water}	= Drinking water ingestion rate (liters ingested per day)
	C_{water}	= Maximum constituent concentration in unfiltered surface water (mg/L)
	$SIR_{incidental}$	= Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
	$C_{substrate}$	= Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;

--, HQ not calculated because TRV was not availbale

TABLE E-7
RACCOON
MAXIMUM AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Raccoon Dose (mg/kg bw-day)							TRV (mg/kg bw-day)			
	Physical		Dietary				Ingestion Rates			Dietary Composition (%)				Diet				Water	Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	All Fish (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish	Area Use Factor	Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.080	3.86	0.1166	0.0086	0.3335	50%	0%	50%	1.0	0.019	0.0	0.001	0.020	0.00009	0.020	0.040	1.60	<1	5.80	<1
Copper	9468.0	0.0	309.7	92.6	9.660	3.86	0.1166	0.0086	0.3335	50%	0%	50%	1.0	4.685	0.0	0.146	4.831	0.00161	21.197	26.030	22.30	**1.2**	40.80	<1
Lead	1085.0	0.001	11.2	2.5	0.501	3.86	0.1166	0.0086	0.3335	50%	0%	50%	1.0	0.169	0.0	0.008	0.177	0.00008	2.429	2.606	30.48	<1	100.47	<1
Mercury	41.29	0.000	0.455	1.001	0.453	3.86	0.1166	0.0086	0.3335	50%	0%	50%	1.0	0.007	0.0	0.007	0.014	0.00002	0.092	0.106	1.00	<1	7.00	<1
Methylmercury	NA	NA	0.092	0.202	0.435	3.86	0.1166	0.0086	0.3335	50%	0%	50%	1.0	0.001	0.0	0.007	0.008	0.00000	0.000	0.008	0.02	<1	0.18	<1
Selenium	118.9	0.01	18.67	7.47	6.478	3.86	0.1166	0.0086	0.3335	50%	0%	50%	1.0	0.282	0.0	0.098	0.380	0.00043	0.266	0.647	0.20	**3.2**	0.33	**2.0**
Zinc	908.7	0.01	130.8	24.7	187.5	3.86	0.1166	0.0086	0.3335	50%	0%	50%	1.0	1.979	0.0	2.836	4.815	0.00062	2.034	6.850	116.30	<1	635.90	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum(C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

- EDD_{diet} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
- IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
- C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
- DF_i = Dietary fraction of food item *i*
- AUF = Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
- BW = Body weight of the receptor, wet weight
- IR_{water} = Drinking water ingestion rate (liters ingested per day)
- C_{water} = Maximum constituent concentration in unfiltered surface water (mg/L)
- $SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
- $C_{substrate}$ = Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-8
MINK
MAXIMUM AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Mink Dose (mg/kg bw-day)							TRV (mg/kg bw-day)			
	Physical		Dietary				Ingestion Rates			Dietary Composition (%)				Diet				Water	Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	All Fish (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish	Area Use Factor	Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.080	0.60	0.0256	0.0	0.0625	0%	0%	100%	1.0	0.0	0.0	0.003	0.003	0.00010	0.0	0.004	1.60	<1	5.80	<1
Copper	9468.0	0.0	309.7	92.6	9.660	0.60	0.0256	0.0	0.0625	0%	0%	100%	1.0	0.0	0.0	0.413	0.413	0.00194	0.0	0.415	22.30	<1	40.80	<1
Lead	1085.0	0.001	11.2	2.5	0.501	0.60	0.0256	0.0	0.0625	0%	0%	100%	1.0	0.0	0.0	0.021	0.021	0.00010	0.0	0.022	30.48	<1	100.47	<1
Mercury	41.29	0.000	0.455	1.001	0.453	0.60	0.0256	0.0	0.0625	0%	0%	100%	1.0	0.0	0.0	0.019	0.019	0.00002	0.0	0.019	1.00	<1	7.00	<1
Methylmercury	NA	NA	0.092	0.202	0.435	0.60	0.0256	0.0	0.0625	0%	0%	100%	1.0	0.0	0.0	0.019	0.019	0.00000	0.0	0.019	0.02	<1	0.18	<1
Selenium	118.9	0.01	18.67	7.47	6.478	0.60	0.0256	0.0	0.0625	0%	0%	100%	1.0	0.0	0.0	0.277	0.277	0.00052	0.0	0.277	0.20	**1.4**	0.33	<1
Zinc	908.7	0.01	130.8	24.7	187.5	0.60	0.0256	0.0	0.0625	0%	0%	100%	1.0	0.0	0.0	8.013	8.013	0.00075	0.0	8.013	116.30	<1	635.90	<1

a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

EDD_{diet} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
BW = Body weight of the receptor, wet weight
IR_{water} = Drinking water ingestion rate (liters ingested per day)
C_{water} = Maximum constituent concentration in unfiltered surface water (mg/L)
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-9
GREAT BLUE HERON
ADJUSTED AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Great Blue Heron Dose (mg/kg bw-day)							TRV (mg/kg bw-day)			
	Physical		Dietary				Ingestion Rates			Dietary Composition (%)				Diet				Water	Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	All Fish (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish	Area Use Factor	Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.080	2.20	0.1396	0.0	0.1001	0%	0%	100%	0.63	0.0	0.0	0.003	0.003	0.00003	0.0	0.003	1.10	<1	4.90	<1
Copper	9468.0	0.0	309.7	92.6	9.660	2.20	0.1396	0.0	0.1001	0%	0%	100%	0.63	0.0	0.0	0.384	0.384	0.00053	0.0	0.384	9.10	<1	16.50	<1
Lead	1085.0	0.001	11.2	2.5	0.501	2.20	0.1396	0.0	0.1001	0%	0%	100%	0.63	0.0	0.0	0.020	0.020	0.00003	0.0	0.020	3.80	<1	24.80	<1
Mercury	41.29	0.000	0.455	1.001	0.453	2.20	0.1396	0.0	0.1001	0%	0%	100%	0.63	0.0	0.0	0.018	0.018	0.00001	0.0	0.018	0.45	<1	0.91	<1
Methylmercury	NA	NA	0.092	0.202	0.435	2.20	0.1396	0.0	0.1001	0%	0%	100%	0.63	0.0	0.0	0.017	0.017	0.00000	0.0	0.017	0.03	<1	0.08	<1
Selenium	118.9	0.01	18.67	7.47	6.478	2.20	0.1396	0.0	0.1001	0%	0%	100%	0.63	0.0	0.0	0.257	0.257	0.00014	0.0	0.257	0.40	<1	0.80	<1
Zinc	908.7	0.01	130.8	24.7	187.5	2.20	0.1396	0.0	0.1001	0%	0%	100%	0.63	0.0	0.0	7.45	7.45	0.00020	0.0	7.45	54.50	<1	93.90	<1

a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum(C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

EDD_{diet} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
BW = Body weight of the receptor, wet weight
IR_{water} = Drinking water ingestion rate (liters ingested per day)
C_{water} = Maximum constituent concentration in unfiltered surface water (mg/L)
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-10
MALLARD
ADJUSTED AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Mallard Dose (mg/kg bw-day)							TRV (mg/kg bw-day)			
	Physical		Dietary				Ingestion Rates			Dietary Composition (%)				Diet				Water	Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	Forage Fish (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish	Area Use Factor	Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.049	1.04	0.0523	0.0007	0.0607	100%	0%	0%	0.05	0.003	0.0	0.0	0.003	0.000003	0.000	0.003	1.10	<1	4.90	<1
Copper	9468.0	0.0	309.7	92.6	10.970	1.04	0.0523	0.0007	0.0607	100%	0%	0%	0.05	0.73	0.0	0.0	0.73	0.000051	0.289	1.02	9.10	<1	16.50	<1
Lead	1085.0	0.001	11.2	2.5	0.612	1.04	0.0523	0.0007	0.0607	100%	0%	0%	0.05	0.026	0.0	0.0	0.026	0.000003	0.033	0.059	3.80	<1	24.80	<1
Mercury	41.29	0.000	0.455	1.001	0.470	1.04	0.0523	0.0007	0.0607	100%	0%	0%	0.05	0.001	0.0	0.0	0.001	0.000001	0.001	0.002	0.45	<1	0.91	<1
Methylmercury	NA	NA	0.092	0.202	0.474	1.04	0.0523	0.0007	0.0607	100%	0%	0%	0.05	0.000	0.0	0.0	0.000	0.000000	0.0	0.000	0.03	<1	0.08	<1
Selenium	118.9	0.01	18.67	7.47	5.605	1.04	0.0523	0.0007	0.0607	100%	0%	0%	0.05	0.044	0.0	0.0	0.044	0.000014	0.004	0.048	0.40	<1	0.80	<1
Zinc	908.7	0.01	130.8	24.7	225.6	1.04	0.0523	0.0007	0.0607	100%	0%	0%	0.05	0.307	0.0	0.0	0.307	0.000020	0.028	0.335	54.50	<1	93.90	<1

a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

EDD_{diet} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
BW = Body weight of the receptor, wet weight
IR_{water} = Drinking water ingestion rate (liters ingested per day)
C_{water} = Maximum constituent concentration in unfiltered surface water (mg/L)
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-11
INDIANA BAT
ADJUSTED AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Indiana Bat Dose (mg/kg bw-day)								TRV (mg/kg bw-day)			
	Physical		Dietary				Ingestion Rates			Dietary Composition (%)				Diet				Water	Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	Forage Fish (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish	Area Use Factor	Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.049	0.006	0.0012	0.0	0.0010	0%	100%	0%	0.08	0.0	0.011	0.0	0.011	0.000014	0.0	0.011	1.60	<1	5.80	<1
Copper	9468.0	0.0	309.7	92.6	10.970	0.006	0.0012	0.0	0.0010	0%	100%	0%	0.08	0.0	1.59	0.0	1.59	0.000260	0.0	1.59	22.30	<1	40.80	<1
Lead	1085.0	0.001	11.2	2.5	0.612	0.006	0.0012	0.0	0.0010	0%	100%	0%	0.08	0.0	0.043	0.0	0.043	0.000013	0.0	0.043	30.48	<1	100.47	<1
Mercury	41.29	0.000	0.455	1.001	0.470	0.006	0.0012	0.0	0.0010	0%	100%	0%	0.08	0.0	0.017	0.0	0.017	0.000003	0.0	0.017	1.00	<1	7.00	<1
Methylmercury	NA	NA	0.092	0.202	0.474	0.006	0.0012	0.0	0.0010	0%	100%	0%	0.08	0.0	0.003	0.0	0.003	0.000000	0.0	0.003	0.02	<1	0.18	<1
Selenium	118.9	0.01	18.67	7.47	5.605	0.006	0.0012	0.0	0.0010	0%	100%	0%	0.08	0.0	0.128	0.0	0.128	0.000070	0.0	0.128	0.20	<1	0.33	<1
Zinc	908.7	0.01	130.8	24.7	225.6	0.006	0.0012	0.0	0.0010	0%	100%	0%	0.08	0.0	0.42	0.0	0.42	0.000101	0.0	0.42	116.30	<1	635.90	<1

a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

where:	EDD_{diet}	= Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
	IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
	C_{ti}	= UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
	DF_i	= Dietary fraction of food item *i*
	AUF	= Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
	BW	= Body weight of the receptor, wet weight
	IR_{water}	= Drinking water ingestion rate (liters ingested per day)
	C_{water}	= Maximum constituent concentration in unfiltered surface water (mg/L)
	$SIR_{incidental}$	= Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
	$C_{substrate}$	= Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-12
RACCOON
ADJUSTED AREA USE EXPOSURE ESTIMATE - SWMU 1/22 WETLAND COMPLEX
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations					Exposure Parameters								Raccoon Dose (mg/kg bw-day)							TRV (mg/kg bw-day)			
	Physical		Dietary			Body Weight (kg)	Ingestion Rates			Dietary Composition (%)			Area Use Factor	Diet				Water	Substrate	Total Dose	NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Surface Water (mg/L)	Aquatic Invertebrates (mg/kg, dw)	Emergent Invertebrates (mg/kg, dw)	All Fish (mg/kg, dw)		Dietary (kg dw/day)	Substrate (kg dw/day)	Water (L/day)	Aquatic Invertebrates	Emergent Invertebrates	Fish		Aquatic Invertebrates	Emergent Invertebrates	Fish	$Dose_{diet}$	$Dose_{water}$	$Dose_{substrate}$		TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																								
Cadmium	8.95	0.00	1.259	0.648	0.080	3.86	0.1166	0.0086	0.3335	50%	0%	50%	0.09	0.002	0.0	0.000	0.002	0.000008	0.002	0.004	1.60	<1	5.80	<1
Copper	9468.0	0.0	309.7	92.6	9.660	3.86	0.1166	0.0086	0.3335	50%	0%	50%	0.09	0.420	0.0	0.013	0.433	0.000144	1.900	2.334	22.30	<1	40.80	<1
Lead	1085.0	0.001	11.2	2.5	0.501	3.86	0.1166	0.0086	0.3335	50%	0%	50%	0.09	0.015	0.0	0.001	0.016	0.000007	0.218	0.234	30.48	<1	100.47	<1
Mercury	41.29	0.000	0.455	1.001	0.453	3.86	0.1166	0.0086	0.3335	50%	0%	50%	0.09	0.001	0.0	0.001	0.001	0.000002	0.008	0.010	1.00	<1	7.00	<1
Methylmercury	NA	NA	0.092	0.202	0.435	3.86	0.1166	0.0086	0.3335	50%	0%	50%	0.09	0.000	0.0	0.001	0.001	0.000000	0.000	0.001	0.02	<1	0.18	<1
Selenium	118.9	0.01	18.67	7.47	6.478	3.86	0.1166	0.0086	0.3335	50%	0%	50%	0.09	0.025	0.0	0.009	0.034	0.000039	0.024	0.058	0.20	<1	0.33	<1
Zinc	908.7	0.01	130.8	24.7	187.5	3.86	0.1166	0.0086	0.3335	50%	0%	50%	0.09	0.177	0.0	0.254	0.432	0.000056	0.182	0.614	116.30	<1	635.90	<1

a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{IR_{water} \times C_{water} \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

EDD_{diet} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor includes seasonal use rates , area use rates, COPC assimilation rate
BW = Body weight of the receptor, wet weight
IR_{water} = Drinking water ingestion rate (liters ingested per day)
C_{water} = Maximum constituent concentration in unfiltered surface water (mg/L)
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg COPEC/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-13
SUMMARY OF TERRESTRIAL EXPOSURE POINT CONCENTRATIONS - NORTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Soil Exposure Point Concentration (mg/kg, dry weight)	Exposure Point Concentrations for Dietary Items of Terrestrial Receptors (mg/kg, dry weight)						
		Plants			Soil Invertebrates		Small Mammals	
		Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Estimated Concentration	BAF Reference	Estimated Concentration	BAF Reference
Metals								
Antimony	0.42	Regression[a]	0.018	USEPA (2007)	0.293	Measured UCL_{95}[b]	0.200	Measured UCL_{95}[c]
Arsenic	8.93	Regression[a]	0.466	Efroymson et al. (2001)	8.53	Measured UCL_{95}[b]	1.74	Measured UCL_{95}[c]
Barium	257.70	1.56E-01	40.2	USEPA (2007)	39.2	Measured UCL_{95}[b]	31.6	Measured UCL_{95}[c]
Cadmium	0.46	Regression[a]	0.405	Efroymson et al. (2001)	33.2	Measured UCL_{95}[b]	0.497	Measured UCL_{95}[c]
Chromium	21.29	4.10E-02	0.873	USEPA (2005b)	5.55	Measured UCL_{95}[b]	26.5	Measured UCL_{95}[c]
Cobalt	12.81	7.50E-03	0.096	USEPA (2005b)	6.41	Measured UCL_{95}[b]	1.41	Measured UCL_{95}[c]
Copper	81.79	Regression[a]	10.89	Efroymson et al. (2001)	25.1	Measured UCL_{95}[b]	18.52	Measured UCL_{95}[c]
Lead	272.70	Regression[a]	6.11	Efroymson et al. (2001)	198.8	Measured UCL_{95}[b]	14.49	Measured UCL_{95}[c]
Mercury	0.45	Regression[a]	0.240	Efroymson et al. (2001)	3.08	Measured UCL_{95}[b]	0.120	Measured UCL_{95}[c]
Selenium	133.60	Regression[a]	110.4	Bechtel-Jacobs 1998	150.6	Measured UCL_{95}[b]	219.2	Measured UCL_{95}[c]
Silver	0.10	4.00E-01	0.040	Baes et al. (1984)	0.839	Measured UCL_{95}[b]	0.300	Measured UCL_{95}[c]
Zinc	81.51	Regression[a]	57.1	Efroymson et al. (2001)	455.4	Measured UCL_{95}[b]	1083.0	Measured UCL_{95}[c]

Notes:

a, Plant tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows

Metal	BO	B1	Data Source for Model
Antimony	-3.233	0.938	USEPA (2007)
Arsenic	-1.99	0.56	Efroymson et al. (2001)
Cadmium	-0.48	0.55	Efroymson et al. (2001)
Copper	0.67	0.39	Efroymson et al. (2001)
Lead	-1.33	0.56	Efroymson et al. (2001)
Mercury	-1	0.54	Efroymson et al. (2001)
Selenium	-0.68	1.1	Efroymson et al. (2001)
Zinc	1.58	0.56	Efroymson et al. (2001)

b, 95 percent upper confidence limit of the mean concentration (UCl_{95}) of non-depurated earthworm tissues analyzed from grids N1, N2, and N3 of the Active Plant Area

c, 95 percent upper confidence limit of the mean concentration (UCl_{95}) of non-depurated small mammal tissues analyzed from grids N1, N2, and N3 of the Active Plant Area

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TABLE E-14
SHORT-TAILED SHREW
MAXIMUM AREA USE EXPOSURE ESTIMATE - NORTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Short-tailed Shrew Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.423	0.018	0.293	0.200	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.039	0.0	0.039	0.002	0.041	13.30	<1	NA	--
Arsenic	8.926	0.466	8.525	1.741	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	1.142	0.0	1.142	0.036	1.178	3.90	<1	7.8	<1
Barium	257.7	40.20	39.18	31.56	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	5.251	0.0	5.251	1.036	6.287	51.80	<1	82.7	<1
Cadmium	0.462	0.405	33.19	0.497	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	4.448	0.0	4.448	0.002	4.450	1.60	**2.8**	5.8	<1
Chromium	21.29	0.873	5.554	26.53	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.744	0.0	0.744	0.086	0.830	2.40	<1	58.2	<1
Cobalt	12.81	0.096	6.407	1.413	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.859	0.0	0.859	0.052	0.910	5.00	<1	20.0	<1
Copper	81.79	10.89	25.08	18.52	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	3.361	0.0	3.361	0.329	3.690	22.30	<1	40.8	<1
Lead	272.7	6.115	198.8	14.49	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	26.642	0.0	26.64	1.096	27.74	30.48	<1	100.5	<1
Mercury	0.453	0.240	3.082	0.120	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.413	0.0	0.413	0.002	0.415	1.00	<1	7.0	<1
Selenium	133.6	110.4	150.6	219.2	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	20.182	0.0	20.18	0.537	20.72	0.20	**103.6**	0.33	**62.8**
Silver	0.100	0.040	0.839	0.300	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.112	0.0	0.112	0.000	0.113	6.02	<1	119.0	<1
Zinc	81.51	57.08	455.4	1083.0	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	61.029	0.0	61.03	0.328	61.36	116.30	<1	635.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor
BW = Body weight of the receptor, wet weight
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

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TABLE E-15
RED FOX
MAXIMUM AREA USE EXPOSURE ESTIMATE - NORTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Red Fox Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.423	0.018	0.293	0.200	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.0001	0.0	0.006	0.015	0.0004	0.016	13.30	<1	NA	--
Arsenic	8.926	0.466	8.525	1.741	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.0015	0.3	0.051	0.329	0.0081	0.338	3.90	<1	7.8	<1
Barium	257.7	40.20	39.18	31.56	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.1306	1.3	0.923	2.326	0.2344	2.561	51.80	<1	82.7	<1
Cadmium	0.462	0.405	33.19	0.497	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.0013	1.1	0.015	1.094	0.0004	1.095	1.60	<1	5.8	<1
Chromium	21.29	0.873	5.554	26.53	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.0028	0.2	0.776	0.959	0.0194	0.978	2.40	<1	58.2	<1
Cobalt	12.81	0.096	6.407	1.413	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.0003	0.2	0.041	0.250	0.0117	0.261	5.00	<1	20.0	<1
Copper	81.79	10.89	25.08	18.52	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.0354	0.8	0.542	1.392	0.0744	1.466	22.30	<1	40.8	<1
Lead	272.7	6.115	198.8	14.49	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.0199	6.5	0.424	6.90	0.2481	7.15	30.48	<1	100.5	<1
Mercury	0.453	0.240	3.082	0.120	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.0008	0.1	0.004	0.104	0.0004	0.105	1.00	<1	7.0	<1
Selenium	133.6	110.4	150.6	219.2	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.3588	4.9	6.410	11.66	0.1215	11.78	0.20	**58.9**	0.33	**35.7**
Silver	0.100	0.040	0.839	0.300	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.0001	0.0	0.009	0.036	0.0001	0.036	6.02	<1	119.0	<1
Zinc	81.51	57.08	455.4	1083.0	4.500	0.1462	0.00409	10%	100%	90%	1.0	0.1854	14.8	31.669	46.65	0.0742	46.73	116.30	<1	635.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor
BW = Body weight of the receptor, wet weight
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

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TABLE E-16
AMERICAN ROBIN
MAXIMUM AREA USE EXPOSURE ESTIMATE - NORTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							American Robin Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.423	0.018	0.293	0.200	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.0	0.017	0.0	0.019	0.0001	0.019	NA	--	NA	--
Arsenic	8.926	0.466	8.525	1.741	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.0	0.504	0.0	0.545	0.0021	0.547	2.24	<1	4.5	<1
Barium	257.7	40.20	39.18	31.56	0.081	0.0119	0.00002	60%	40%	0%	1.0	3.6	2.316	0.0	5.882	0.0609	5.943	20.80	<1	41.7	<1
Cadmium	0.462	0.405	33.19	0.497	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.0	1.962	0.0	1.998	0.0001	1.998	1.10	**1.8**	4.9	<1
Chromium	21.29	0.873	5.554	26.53	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.1	0.328	0.0	0.406	0.0050	0.411	4.60	<1	14.5	<1
Cobalt	12.81	0.096	6.407	1.413	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.0	0.379	0.0	0.387	0.0030	0.390	5.60	<1	16.9	<1
Copper	81.79	10.89	25.08	18.52	0.081	0.0119	0.00002	60%	40%	0%	1.0	1.0	1.483	0.0	2.448	0.0193	2.468	9.10	<1	16.5	<1
Lead	272.7	6.115	198.8	14.49	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.5	11.754	0.0	12.30	0.0645	12.36	3.80	**3.3**	24.8	<1
Mercury	0.453	0.240	3.082	0.120	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.0	0.182	0.0	0.203	0.0001	0.204	0.45	<1	0.9	<1
Selenium	133.6	110.4	150.6	219.2	0.081	0.0119	0.00002	60%	40%	0%	1.0	9.8	8.904	0.0	18.70	0.0316	18.73	0.40	**46.8**	0.80	**23.4**
Silver	0.100	0.040	0.839	0.300	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.0	0.050	0.0	0.053	0.0000	0.053	2.02	<1	60.5	<1
Zinc	81.51	57.08	455.4	1083.0	0.081	0.0119	0.00002	60%	40%	0%	1.0	5.1	26.925	0.0	31.99	0.0193	32.01	54.50	<1	93.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor
BW = Body weight of the receptor, wet weight
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

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TABLE E-17
RED-TAILED HAWK
MAXIMUM AREA USE EXPOSURE ESTIMATE - NORTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Red-Tailed Hawk Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.423	0.018	0.293	0.200	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	0.0155	0.015	0.0	0.0155	NA	--	NA	--
Arsenic	8.926	0.466	8.525	1.741	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	0.1346	0.135	0.0	0.1346	2.24	<1	4.5	<1
Barium	257.7	40.20	39.18	31.56	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	2.4404	2.440	0.0	2.4404	20.80	<1	41.7	<1
Cadmium	0.462	0.405	33.19	0.497	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	0.0384	0.038	0.0	0.0384	1.10	<1	4.9	<1
Chromium	21.29	0.873	5.554	26.53	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	2.0515	2.051	0.0	2.0515	4.60	<1	14.5	<1
Cobalt	12.81	0.096	6.407	1.413	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	0.1093	0.109	0.0	0.1093	5.60	<1	16.9	<1
Copper	81.79	10.89	25.08	18.52	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	1.4321	1.432	0.0	1.4321	9.10	<1	16.5	<1
Lead	272.7	6.115	198.8	14.49	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	1.1205	1.12	0.0	1.1205	3.80	<1	24.8	<1
Mercury	0.453	0.240	3.082	0.120	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	0.0093	0.009	0.0	0.0093	0.45	<1	0.9	<1
Selenium	133.6	110.4	150.6	219.2	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	16.9499	16.95	0.0	16.9499	0.40	**42.4**	0.80	**21.2**
Silver	0.100	0.040	0.839	0.300	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	0.0232	0.023	0.0	0.0232	2.02	<1	60.5	<1
Zinc	81.51	57.08	455.4	1083.0	1.224	0.0946	0.0	0%	0%	100%	1.0	0.0	0.0	83.7440	83.74	0.0	83.7440	54.50	**1.5**	93.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
- EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
- IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
- C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
- DF_i = Dietary fraction of food item *i*
- AUF = Area use factor
- BW = Body weight of the receptor, wet weight
- $SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
- $C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

DRAFT

TABLE E-18
SUMMARY OF TERRESTRIAL EXPOSURE POINT CONCENTRATIONS - SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Soil Exposure Point Concentration (mg/kg, dry weight)	Exposure Point Concentrations for Dietary Items of Terrestrial Receptors (mg/kg, dry weight)						
		Plants			Soil Invertebrates		Small Mammals	
		Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Estimated Concentration	BAF Reference	Estimated Concentration	BAF Reference
Metals								
Antimony	0.32	Regression[a]	0.014	USEPA (2007)	0.358	Measured UCL_{95}[b]	0.060	Measured UCL_{95}[c]
Arsenic	7.03	Regression[a]	0.407	Efroymson et al. (2001)	7.41	Measured UCL_{95}[b]	0.184	Measured UCL_{95}[c]
Barium	82.34	1.56E-01	12.8	USEPA (2007)	26.58	Measured UCL_{95}[b]	18.41	Measured UCL_{95}[c]
Cadmium	0.23	Regression[a]	0.275	Efroymson et al. (2001)	12.41	Measured UCL_{95}[b]	0.107	Measured UCL_{95}[c]
Chromium	17.32	4.10E-02	0.710	USEPA (2005b)	6.24	Measured UCL_{95}[b]	51.3	Measured UCL_{95}[c]
Cobalt	12.98	7.50E-03	0.097	USEPA (2005b)	6.03	Measured UCL_{95}[b]	0.421	Measured UCL_{95}[c]
Copper	147.70	Regression[a]	13.71	Efroymson et al. (2001)	62.9	Measured UCL_{95}[b]	18.3	Measured UCL_{95}[c]
Lead	230.50	Regression[a]	5.57	Efroymson et al. (2001)	249.6	Measured UCL_{95}[b]	2.70	Measured UCL_{95}[c]
Mercury	1.54	Regression[a]	0.465	Efroymson et al. (2001)	6.00	Measured UCL_{95}[b]	0.245	Measured UCL_{95}[c]
Selenium	2.04	Regression[a]	1.11	Bechtel-Jacobs 1998	96.4	Measured UCL_{95}[b]	4.02	Measured UCL_{95}[c]
Silver	0.06	4.00E-01	0.024	Baes et al. (1984)	0.956	Measured UCL_{95}[b]	0.098	Measured UCL_{95}[c]
Zinc	87.93	Regression[a]	59.6	Efroymson et al. (2001)	455.9	Measured UCL_{95}[b]	165.6	Measured UCL_{95}[c]

Notes:

a, Plant tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows

Metal	BO	B1	Data Source for Model
Antimony	-3.233	0.938	USEPA (2007)
Arsenic	-1.99	0.56	Efroymson et al. (2001)
Cadmium	-0.48	0.55	Efroymson et al. (2001)
Copper	0.67	0.39	Efroymson et al. (2001)
Lead	-1.33	0.56	Efroymson et al. (2001)
Mercury	-1	0.54	Efroymson et al. (2001)
Selenium	-0.68	1.1	Efroymson et al. (2001)
Zinc	1.58	0.56	Efroymson et al. (2001)

b, 95 percent upper confidence limit of the mean concentration (UCl_{95}) of non-depurated earthworm tissues analyzed from grids S1, S2, and S3 of the Active Plant Area

c, 95 percent upper confidence limit of the mean concentration (UCl_{95}) of non-depurated small mammal tissues analyzed from grids S1, S2, and S3 of the Active Plant Area

TABLE E-19
SHORT-TAILED SHREW
MAXIMUM AREA USE EXPOSURE ESTIMATE - SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Short-tailed Shrew Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary			Body Weight (kg)	Ingestion Rates		Dietary Composition (%)			Area Use Factor	Diet				Substrate	Total Dose	NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)		Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$		TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.324	0.014	0.358	0.060	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.048	0.0	0.048	0.001	0.049	13.30	<1	NA	--
Arsenic	7.027	0.407	7.413	0.184	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.993	0.0	0.993	0.028	1.022	3.90	<1	7.8	<1
Barium	82.3	12.85	26.58	18.41	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	3.562	0.0	3.562	0.331	3.893	51.80	<1	82.7	<1
Cadmium	0.229	0.275	12.41	0.107	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	1.663	0.0	1.663	0.001	1.664	1.60	**1.0**	5.8	<1
Chromium	17.32	0.710	6.243	51.31	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.837	0.0	0.837	0.070	0.906	2.40	<1	58.2	<1
Cobalt	12.98	0.097	6.034	0.421	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.809	0.0	0.809	0.052	0.861	5.00	<1	20.0	<1
Copper	147.70	13.71	62.93	18.30	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	8.433	0.0	8.433	0.594	9.027	22.30	<1	40.8	<1
Lead	230.5	5.565	249.6	2.70	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	33.450	0.0	33.45	0.927	34.38	30.48	**1.1**	100.5	<1
Mercury	1.542	0.465	5.998	0.245	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.804	0.0	0.804	0.006	0.810	1.00	<1	7.0	<1
Selenium	2.0	1.1	96.4	4.0	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	12.913	0.0	12.91	0.008	12.92	0.20	**64.6**	0.33	**39.2**
Silver	0.060	0.024	0.956	0.098	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	0.128	0.0	0.128	0.000	0.128	6.02	<1	119.0	<1
Zinc	87.93	59.55	455.9	165.6	0.015	0.0020	0.00006	0%	100%	0%	1.0	0.0	61.096	0.0	61.10	0.354	61.45	116.30	<1	635.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor
BW = Body weight of the receptor, wet weight
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-20
RED FOX
MAXIMUM AREA USE EXPOSURE ESTIMATE - SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Red Fox Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.324	0.014	0.358	0.060	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.00004	0.0	0.002	0.002	0.0003	0.0021	13.30	<1	NA	--
Arsenic	7.027	0.407	7.413	0.184	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.00132	0.0	0.005	0.007	0.0064	0.0131	3.90	<1	7.8	<1
Barium	82.3	12.85	26.58	18.41	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.04173	0.0	0.538	0.580	0.0749	0.6550	51.80	<1	82.7	<1
Cadmium	0.229	0.275	12.41	0.107	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.00089	0.0	0.003	0.004	0.0002	0.0042	1.60	<1	5.8	<1
Chromium	17.32	0.710	6.243	51.31	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.00231	0.0	1.500	1.503	0.0158	1.5185	2.40	<1	58.2	<1
Cobalt	12.98	0.097	6.034	0.421	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.00032	0.0	0.012	0.013	0.0118	0.0244	5.00	<1	20.0	<1
Copper	147.70	13.71	62.93	18.30	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.04455	0.0	0.535	0.580	0.1344	0.7140	22.30	<1	40.8	<1
Lead	230.5	5.565	249.6	2.70	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.01808	0.0	0.079	0.10	0.2097	0.3067	30.48	<1	100.5	<1
Mercury	1.542	0.465	5.998	0.245	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.00151	0.0	0.007	0.009	0.0014	0.0101	1.00	<1	7.0	<1
Selenium	2.0	1.1	96.4	4.0	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.00360	0.0	0.118	0.12	0.0019	0.1230	0.20	<1	0.33	<1
Silver	0.060	0.024	0.956	0.098	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.00008	0.0	0.003	0.003	0.0001	0.0030	6.02	<1	119.0	<1
Zinc	87.93	59.55	455.9	165.6	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.19349	0.0	4.842	5.04	0.0800	5.1159	116.30	<1	635.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
- EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
- IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
- C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
- DF_i = Dietary fraction of food item *i*
- AUF = Area use factor
- BW = Body weight of the receptor, wet weight
- $SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
- $C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-21
AMERICAN ROBIN
MAXIMUM AREA USE EXPOSURE ESTIMATE - SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							American Robin Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.324	0.014	0.358	0.060	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.001	0.021	0.0	0.022	0.0001	0.022	NA	--	NA	--
Arsenic	7.027	0.407	7.413	0.184	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.036	0.438	0.0	0.474	0.0017	0.476	2.24	<1	4.5	<1
Barium	82.3	12.85	26.58	18.41	0.081	0.0119	0.00002	60%	40%	0%	1.0	1.139	1.572	0.0	2.711	0.0195	2.730	20.80	<1	41.7	<1
Cadmium	0.229	0.275	12.41	0.107	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.024	0.734	0.0	0.758	0.0001	0.758	1.10	<1	4.9	<1
Chromium	17.32	0.710	6.243	51.31	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.063	0.369	0.0	0.432	0.0041	0.436	4.60	<1	14.5	<1
Cobalt	12.98	0.097	6.034	0.421	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.009	0.357	0.0	0.365	0.0031	0.368	5.60	<1	16.9	<1
Copper	147.70	13.71	62.93	18.30	0.081	0.0119	0.00002	60%	40%	0%	1.0	1.216	3.721	0.0	4.937	0.0349	4.972	9.10	<1	16.5	<1
Lead	230.5	5.565	249.6	2.70	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.494	14.757	0.0	15.25	0.0545	15.31	3.80	**4.0**	24.8	<1
Mercury	1.542	0.465	5.998	0.245	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.041	0.355	0.0	0.396	0.0004	0.396	0.45	<1	0.9	<1
Selenium	2.0	1.1	96.4	4.0	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.098	5.697	0.0	5.80	0.0005	5.80	0.40	**14.5**	0.80	**7.2**
Silver	0.060	0.024	0.956	0.098	0.081	0.0119	0.00002	60%	40%	0%	1.0	0.002	0.057	0.0	0.059	0.0000	0.059	2.02	<1	60.5	<1
Zinc	87.93	59.55	455.9	165.6	0.081	0.0119	0.00002	60%	40%	0%	1.0	5.282	26.955	0.0	32.24	0.0208	32.26	54.50	<1	93.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
- EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
- IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
- C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
- DF_i = Dietary fraction of food item *i*
- AUF = Area use factor
- BW = Body weight of the receptor, wet weight
- $SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
- $C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-22
RED-TAILED HAWK
MAXIMUM AREA USE EXPOSURE ESTIMATE - SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Red-Tailed Hawk Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.32	0.014	0.358	0.060	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	0.0046	0.0046	0.0	0.0046	NA	--	NA	--
Arsenic	7.027	0.407	7.413	0.184	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	0.0142	0.0142	0.0	0.0142	2.24	<1	4.5	<1
Barium	82.3	12.85	26.58	18.41	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	1.4236	1.4236	0.0	1.4236	20.80	<1	41.7	<1
Cadmium	0.229	0.275	12.41	0.107	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	0.0083	0.0083	0.0	0.0083	1.10	<1	4.9	<1
Chromium	17.32	0.710	6.243	51.31	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	3.9676	3.9676	0.0	3.9676	4.60	<1	14.5	<1
Cobalt	12.98	0.097	6.034	0.421	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	0.0326	0.0326	0.0	0.0326	5.60	<1	16.9	<1
Copper	147.70	13.71	62.93	18.30	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	1.4151	1.4151	0.0	1.4151	9.10	<1	16.5	<1
Lead	230.5	5.565	249.6	2.70	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	0.2087	0.2087	0.0	0.2087	3.80	<1	24.8	<1
Mercury	1.542	0.465	5.998	0.245	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	0.0189	0.0189	0.0	0.0189	0.45	<1	0.9	<1
Selenium	2.0	1.1	96.4	4.0	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	0.3109	0.3109	0.0	0.3109	0.40	<1	0.80	<1
Silver	0.060	0.024	0.956	0.098	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	0.0076	0.0076	0.0	0.0076	2.02	<1	60.5	<1
Zinc	87.93	59.55	455.9	165.6	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.000	12.8052	12.8052	0.0	12.8052	54.50	<1	93.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor
BW = Body weight of the receptor, wet weight
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-23
SUMMARY OF TERRESTRIAL EXPOSURE POINT CONCENTRATIONS - NORTHERN AND SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Soil Exposure Point Concentration (mg/kg, dry weight)	Exposure Point Concentrations for Dietary Items of Terrestrial Receptors (mg/kg, dry weight)						
		Plants			Soil Invertebrates		Small Mammals	
		Bioaccumulation Factor (BAF)	Estimated Concentration	BAF Reference	Estimated Concentration	BAF Reference	Estimated Concentration	BAF Reference
Metals								
Antimony	0.36	Regression[a]	0.015	USEPA (2007)	0.289	Measured UCL_{95}[b]	0.094	Measured UCL_{95}[c]
Arsenic	7.77	Regression[a]	0.431	Efroymson et al. (2001)	7.52	Measured UCL_{95}[b]	1.21	Measured UCL_{95}[c]
Barium	125.90	1.56E-01	19.64	USEPA (2007)	26.11	Measured UCL_{95}[b]	24.58	Measured UCL_{95}[c]
Cadmium	0.41	Regression[a]	0.379	Efroymson et al. (2001)	19.04	Measured UCL_{95}[b]	0.363	Measured UCL_{95}[c]
Chromium	19.17	4.10E-02	0.786	USEPA (2005b)	7.32	Measured UCL_{95}[b]	31.85	Measured UCL_{95}[c]
Cobalt	12.44	7.50E-03	0.093	USEPA (2005b)	5.83	Measured UCL_{95}[b]	1.06	Measured UCL_{95}[c]
Copper	122.10	Regression[a]	12.73	Efroymson et al. (2001)	38.11	Measured UCL_{95}[b]	17.39	Measured UCL_{95}[c]
Lead	200.60	Regression[a]	5.15	Efroymson et al. (2001)	129.80	Measured UCL_{95}[b]	9.03	Measured UCL_{95}[c]
Mercury	0.87	Regression[a]	0.342	Efroymson et al. (2001)	4.65	Measured UCL_{95}[b]	0.117	Measured UCL_{95}[c]
Selenium	35.00	Regression[a]	25.30	Bechtel-Jacobs 1998	120.10	Measured UCL_{95}[b]	82.86	Measured UCL_{95}[c]
Silver	0.08	4.00E-01	0.031	Baes et al. (1984)	0.864	Measured UCL_{95}[b]	0.300	Measured UCL_{95}[c]
Zinc	80.98	Regression[a]	56.87	Efroymson et al. (2001)	428.2	Measured UCL_{95}[b]	797.4	Measured UCL_{95}[c]

Notes:

a, Plant tissue concentrations (mg/kg dry weight) calculated based on regression models, where ln([tissue]) = B0 + B1(ln[soil]). Slopes (B1) and intercepts (B0) are as follows

Metal	BO	B1	Data Source for Model
Antimony	-3.233	0.938	USEPA (2007)
Arsenic	-1.99	0.56	Efroymson et al. (2001)
Cadmium	-0.48	0.55	Efroymson et al. (2001)
Copper	0.67	0.39	Efroymson et al. (2001)
Lead	-1.33	0.56	Efroymson et al. (2001)
Mercury	-1	0.54	Efroymson et al. (2001)
Selenium	-0.68	1.1	Efroymson et al. (2001)
Zinc	1.58	0.56	Efroymson et al. (2001)

b, 95 percent upper confidence limit of the mean concentration (UCl_{95}) of non-depurated earthworm tissues analyzed from grids N1, N2, N3, S1, S2, and S3 of the Active Plant Area

c, 95 percent upper confidence limit of the mean concentration (UCl_{95}) of non-depurated small mammal tissues analyzed from grids N1, N2, N3, S1, S2, and S3 of the Active Plant Area

TABLE E-24
RED FOX
MAXIMUM AREA USE EXPOSURE ESTIMATE - NORTHERN AND SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Red Fox Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.358	0.015	0.289	0.094	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0000	0.0	0.0027	0.0028	0.0003	0.0031	13.30	<1	NA	--
Arsenic	7.768	0.431	7.517	1.206	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0014	0.0	0.0353	0.0367	0.0071	0.0437	3.90	<1	7.8	<1
Barium	125.9	19.64	26.11	24.58	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0638	0.0	0.7188	0.7826	0.1145	0.8971	51.80	<1	82.7	<1
Cadmium	0.411	0.379	19.04	0.363	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0012	0.0	0.0106	0.0118	0.0004	0.0122	1.60	<1	5.8	<1
Chromium	19.17	0.786	7.320	31.85	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0026	0.0	0.9314	0.9339	0.0174	0.9513	2.40	<1	58.2	<1
Cobalt	12.44	0.093	5.829	1.062	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0003	0.0	0.0311	0.0314	0.0113	0.0427	5.00	<1	20.0	<1
Copper	122.10	12.73	38.11	17.39	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0414	0.0	0.5085	0.5499	0.1111	0.6610	22.30	<1	40.8	<1
Lead	200.6	5.149	129.8	9.03	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0167	0.0	0.2641	0.2808	0.1825	0.4633	30.48	<1	100.5	<1
Mercury	0.872	0.342	4.648	0.117	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0011	0.0	0.0034	0.0045	0.0008	0.0053	1.00	<1	10.0	<1
Selenium	35.0	25.3	120.1	82.9	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0822	0.0	2.4230	2.5052	0.0318	2.5370	0.20	**12.7**	0.33	**7.7**
Silver	0.078	0.031	0.864	0.300	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.0001	0.0	0.0088	0.0089	0.0001	0.0089	6.02	<1	119.0	<1
Zinc	80.98	56.87	428.2	797.4	4.500	0.1462	0.00409	10%	0%	90%	1.0	0.1848	0.0	23.3175	23.5023	0.0737	23.5759	116.30	<1	635.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor
BW = Body weight of the receptor, wet weight
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-25
RED-TAILED HAWK
MAXIMUM AREA USE EXPOSURE ESTIMATE - NORTHERN AND SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Red-Tailed Hawk Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.36	0.015	0.289	0.094	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	0.0073	0.0073	0.0	0.0073	NA	--	NA	--
Arsenic	7.768	0.431	7.517	1.206	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	0.0933	0.0933	0.0	0.0933	2.24	<1	4.5	<1
Barium	125.9	19.64	26.11	24.58	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	1.9007	1.9007	0.0	1.9007	20.80	<1	41.7	<1
Cadmium	0.411	0.379	19.04	0.363	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	0.0281	0.0281	0.0	0.0281	1.10	<1	4.9	<1
Chromium	19.17	0.786	7.320	31.85	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	2.4628	2.4628	0.0	2.4628	4.60	<1	14.5	<1
Cobalt	12.44	0.093	5.829	1.062	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	0.0821	0.0821	0.0	0.0821	5.60	<1	16.9	<1
Copper	122.10	12.73	38.11	17.39	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	1.3447	1.3447	0.0	1.3447	9.10	<1	16.5	<1
Lead	200.6	5.149	129.8	9.03	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	0.6984	0.6984	0.0	0.6984	4.10	<1	27.7	<1
Mercury	0.872	0.342	4.648	0.117	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	0.0090	0.0090	0.0	0.0090	0.45	<1	0.9	<1
Selenium	35.0	25.3	120.1	82.9	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	6.4072	6.4072	0.0	6.4072	0.40	**16.0**	0.80	**8.0**
Silver	0.078	0.031	0.864	0.300	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	0.0232	0.0232	0.0	0.0232	2.02	<1	60.5	<1
Zinc	80.98	56.87	428.2	797.4	1.224	0.0946	0.00000	0%	0%	100%	1.0	0.0	0.0	61.6597	61.6597	0.0	61.6597	54.50	**1.1**	93.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:
EDD_{total} = Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
IR_{diet} = Ingestion rate of food (kg food ingested per day, dry weight)
C_{ti} = UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
DF_i = Dietary fraction of food item *i*
AUF = Area use factor
BW = Body weight of the receptor, wet weight
$SIR_{incidental}$ = Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
$C_{substrate}$ = Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-26
RED FOX
ADJUSTED AREA USE EXPOSURE ESTIMATE - NORTHERN AND SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Red Fox Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary			Body Weight (kg)	Ingestion Rates		Dietary Composition (%)			Area Use Factor	Diet				Substrate	Total Dose	NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)		Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals		Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$		TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.358	0.015	0.289	0.094	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0000	0.0	0.0016	0.0016	0.0002	0.0018	13.30	<1	NA	--
Arsenic	7.768	0.431	7.517	1.206	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0008	0.0	0.0204	0.0212	0.0041	0.0253	3.90	<1	7.8	<1
Barium	125.9	19.64	26.11	24.58	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0370	0.0	0.4164	0.4534	0.0664	0.5197	51.80	<1	82.7	<1
Cadmium	0.411	0.379	19.04	0.363	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0007	0.0	0.0061	0.0069	0.0002	0.0071	1.60	<1	5.8	<1
Chromium	19.17	0.786	7.320	31.85	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0015	0.0	0.5395	0.5410	0.0101	0.5511	2.40	<1	58.2	<1
Cobalt	12.44	0.093	5.829	1.062	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0002	0.0	0.0180	0.0182	0.0066	0.0247	5.00	<1	20.0	<1
Copper	122.10	12.73	38.11	17.39	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0240	0.0	0.2946	0.3185	0.0643	0.3829	22.30	<1	40.8	<1
Lead	200.6	5.149	129.8	9.03	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0097	0.0	0.1530	0.1627	0.1057	0.2684	30.48	<1	100.5	<1
Mercury	0.872	0.342	4.648	0.117	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0006	0.0	0.0020	0.0026	0.0005	0.0031	1.00	<1	10.0	<1
Selenium	35.0	25.3	120.1	82.9	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0476	0.0	1.4037	1.4513	0.0184	1.4697	0.20	**7.3**	0.33	**4.5**
Silver	0.078	0.031	0.864	0.300	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.0001	0.0	0.0051	0.0051	0.0000	0.0052	6.02	<1	119.0	<1
Zinc	80.98	56.87	428.2	797.4	4.500	0.1462	0.00409	10%	0%	90%	0.58	0.1070	0.0	13.5081	13.6151	0.0427	13.6578	116.30	<1	635.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

where:	EDD_{total}	= Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
	IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
	C_{ti}	= UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
	DF_i	= Dietary fraction of food item *i*
	AUF	= Area use factor
	BW	= Body weight of the receptor, wet weight
	$SIR_{incidental}$	= Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
	$C_{substrate}$	= Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

TABLE E-27
RED-TAILED HAWK
ADJUSTED AREA USE EXPOSURE ESTIMATE - NORTHERN AND SOUTHERN PLANT GRIDS
FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN
PORT EWEN, NEW YORK

Analyte	Exposure Point Concentrations				Exposure Parameters							Red-Tailed Hawk Dose (mg/kg bw-day)						TRV (mg/kg bw-day)			
	Physical	Dietary				Ingestion Rates		Dietary Composition (%)				Diet				Substrate		NOAEL		LOAEL	
	Sediment/Soil (mg/kg)	Plant Material (mg/kg, dw)	Terrestrial Invertebrates (mg/kg, dw)	Small Mammal (mg/kg, dw)	Body Weight (kg)	Dietary (kg dw/day)	Substrate (kg dw/day)	Plant Material	Terrestrial Invertebrates	Small Mammals	Area Use Factor	Plant Material	Invertebrates	Small Mammals	$Dose_{diet}$	$Dose_{substrate}$	Total Dose	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
Metals																					
Antimony	0.358	0.015	0.289	0.094	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.0013	0.0013	0.0000	0.0013	NA	--	NA	--
Arsenic	7.768	0.431	7.517	1.206	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.0168	0.0168	0.0000	0.0168	2.24	<1	4.5	<1
Barium	125.9	19.64	26.11	24.58	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.3426	0.3426	0.0000	0.3426	20.80	<1	41.7	<1
Cadmium	0.411	0.379	19.04	0.363	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.0051	0.0051	0.0000	0.0051	1.10	<1	4.9	<1
Chromium	19.17	0.786	7.320	31.85	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.4439	0.4439	0.0000	0.4439	4.60	<1	14.5	<1
Cobalt	12.44	0.093	5.829	1.062	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.0148	0.0148	0.0000	0.0148	5.60	<1	16.9	<1
Copper	122.10	12.73	38.11	17.39	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.2424	0.2424	0.0000	0.2424	9.10	<1	16.5	<1
Lead	200.6	5.149	129.8	9.03	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.1259	0.1259	0.0000	0.1259	4.10	<1	27.7	<1
Mercury	0.872	0.342	4.648	0.117	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.0016	0.0016	0.0000	0.0016	0.45	<1	0.9	<1
Selenium	35.0	25.3	120.1	82.9	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	1.1550	1.1550	0.0000	1.1550	0.40	**2.9**	0.80	**1.4**
Silver	0.078	0.031	0.864	0.300	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	0.0042	0.0042	0.0000	0.0042	2.02	<1	60.5	<1
Zinc	80.98	56.87	428.2	797.4	1.224	0.0946	0.00000	0%	0%	100%	0.18	0.0	0.0	11.1146	11.1146	0.0000	11.1146	54.50	<1	93.9	<1

Notes:
a, Total dose calculated as:

$$EDD_{total} = \frac{IR_{diet} \times \sum (C_{ti} \times DF_i) \times AUF}{BW} + \frac{SIR_{incidental} \times C_{substrate} \times AUF}{BW}$$

where:

where:	EDD_{total}	= Total dose of target obtained from the primary routes of exposure (mg metals/kg receptor body weight-day)
	IR_{diet}	= Ingestion rate of food (kg food ingested per day, dry weight)
	C_{ti}	= UCL95 concentration of constituent in dietary item i (mg /kg food item, dry weight)
	DF_i	= Dietary fraction of food item *i*
	AUF	= Area use factor
	BW	= Body weight of the receptor, wet weight
	$SIR_{incidental}$	= Incidental substrate ingestion rate (kg substrate ingested per day, dry weight)
	$C_{substrate}$	= Constituent concentration in substrate (mg metal/kg substrate, dry weight)

NA, Not Available;
--, HQ not calculated because TRV was not availbale

APPENDIX F

URS

DATA VALIDATION REPORT

<u>Date:</u> December 2, 2010

<u>Data Reviewer:</u> Emily Strake (URS Philadelphia Office)

<u>To:</u> Gary Long (URS Philadelphia Office)

<u>Subject:</u> Ashland Inc. – Port Ewen, NY
FWIA Step IIC Sampling – June 2010

<u>Laboratory:</u> Test America Laboratories, Inc., Pittsburgh, PA

<u>SDG:</u> C0F180512 Surface Water and SQT Sediment

Methodology

Data were analyzed by the following methods:

Select Total Metals by USEPA SW-846 Method 6020 and 7470A/7471A.

Total Hardness by SM18 2340B.

Total Suspended Solids (TSS) by SM20 2540D.

Total Organic Solids (TOC) by SM20 5310B.

Target Compound List (TLC) Volatile Organic Compounds (VOCs) SW-846 8260B.

TCL Sem-Volatile Organic Compounds (SVOCs) SW-846 8270C.

TCL Pesticides SW-846 8081A.

Percent Solids by SM20 2540G.

Acid Volatile Sulfide/Simultaneously Extracted Metals (AVS/SEM) by USEPA AVS and USEPA SEM.

Table 1 summarizes sample numbers, sampling dates, and requested analytical parameters:

Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F180512-001	PE-SW-07	6/16/2010	Metals, Hardness, TSS
C0F180512-002	PE-SW-07-DIS	6/16/2010	Metals
C0F180512-003	PE-SW-08	6/16/2010	Metals, Hardness, TSS
C0F180512-004	PE-SW-08-DIS	6/16/2010	Metals
C0F180512-005	PE-SW-09	6/16/2010	Metals, Hardness, TSS
C0F180512-006	PE-SW-09-DIS	6/16/2010	Metals
C0F180512-007	PE-SW-FBLK-02-DIS	6/16/2010	Metals

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Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F180512-008	PE-SED-FBLK-02	6/15/2010	Metals
C0F180512-009	PE-SED-FBLK-03	6/16/2010	Metals, TOC, VOCs, SVOCs, Pesticides
C0F180512-010	TRIP BLANK	---	VOCs
C0F180512-011	PE-SQT-08	6/17/2010	AVS/SEM, % Solids
C0F180512-012	PE-SQT-07	6/17/2010	AVS/SEM, % Solids
C0F180512-013	PE-SQT-04	6/17/2010	AVS/SEM, % Solids
C0F180512-014	PE-SQT-SD-03	6/17/2010	VOCs, SVOCs, Sulfate, Sulfide
C0F180512-015	PE-SED-FBLK-04	6/17/2010	VOCs, SVOCs, Metals, TOC

Validation Overview

Data have been validated using the specifics of the analytical methods listed above. Data qualifiers have been applied using the requirements as specified in *USEPA Region 2 Standard Operating Procedure (SOP) #HW-2:* Validation of Metals for the CLP based on SOW ILM05.3 (September 2006), *SOP #HW-22:* Validation of Semi-Volatile Organic Compounds by GC/MS, (October 2006), *SOP #HW-24:* Validation of Volatile Organic Compounds by GC/MS, (October 2006), *SOP #HW-44:* Validation of Pesticide Compounds by GC, (October 2006), and the QAPP.

The following qualifiers may be applied as a result of data validation:

- **R –** Result is considered unusable due to a major quality control anomaly.
- **U –** Result is non-detect to due to the presence of blank contamination.
- **J –** Result is estimated due to a minor quality control anomaly.
- **UJ –** Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

Validation qualifiers will supersede the laboratory-applied qualifiers.

Qualification Summary

Table 2 represents all validator applied data qualification:

Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-SED-FBLK-03	6/16/2010	VOCs	Acetone	**J**
PE-SED-FBLK-03	6/16/2010	VOCs	Bromomethane	**UJ**
PE-SED-FBLK-03	6/16/2010	SVOCs	4,6-Dinitro-2-methylphenol	**UJ**
PE-SED-FBLK-03	6/16/2010	Pesticides	delta-BHC	**R**
PE-SED-FBLK-03	6/16/2010	Pesticides	Endrin aldehyde	**UJ**

Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-SED-FBLK-04	6/17/2010	VOCs	Acetone	**J**
PE-SED-FBLK-04	6/17/2010	VOCs	Bromomethane	**UJ**
PE-SED-FBLK-04	6/17/2010	SVOCs	4,6-Dinitro-2-methylphenol	**UJ**
TRIP BLANK	---	VOCs	Bromomethane	**UJ**
PE-SW-07-DIS	6/16/2010	Dissolved Metals	Copper	**U (2.0)**
PE-SW-07-DIS	6/16/2010	Dissolved Metals	Zinc	**U (5.0)**
PE-SW-08-DIS	6/16/2010	Dissolved Metals	Copper	**U (2.0)**
PE-SW-08-DIS	6/16/2010	Dissolved Metals	Zinc	**U (5.0)**
PE-SW-09-DIS	6/16/2010	Dissolved Metals	Copper	**U (2.0)**
PE-SW-09-DIS	6/16/2010	Dissolved Metals	Zinc	**U (5.0)**
PE-SED-FBLK-02	6/15/2010	Total Metals	Calcium	**U (100)**
PE-SQT-08	6/17/2010	SEM	Cadmium	**J**
PE-SQT-08	6/17/2010	SEM	Nickel	**J**
PE-SQT-08	6/17/2010	SEM	Lead	**J**
PE-SQT-08	6/17/2010	SEM	Zinc	**J**
PE-SQT-07	6/17/2010	SEM	Cadmium	**J**
PE-SQT-07	6/17/2010	SEM	Nickel	**J**
PE-SQT-07	6/17/2010	SEM	Lead	**J**
PE-SQT-07	6/17/2010	SEM	Zinc	**J**
PE-SQT-04	6/17/2010	SEM	Cadmium	**J**
PE-SQT-04	6/17/2010	SEM	Nickel	**J**
PE-SQT-04	6/17/2010	SEM	Lead	**J**
PE-SQT-04	6/17/2010	SEM	Zinc	**J**
PE-SED-FBLK-04	6/17/2010	Total Metals	Calcium	**U (100)**

Major Deficiencies: *Pesticides by SW-846 Method 8081A:*

Sample PE-SED-FBLK-03 displayed dual column imprecision greater than the control limit (i.e., 25%) for delta-BHC at 1,083%. The associated positive detection was qualified as "R", for rejected.

Minor Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

Field blank sample PE-SW-FBLK-02-DIS displayed positive detections for copper and zinc at 0.26 μg/L and 0.99 μg/L, respectively. Associated positive detections less than the RL were qualified as "U".

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The method blank sample analyzed in conjunction with preparation batch 0171016 displayed a positive detection for calcium at 31.5 μg/L. Associated positive detections less than the RL were qualified as "U".

Simultaneously Extracted Metals by USEPA SEM:

The serial dilution relative percent difference (RPD) associated with sample batch 0176024 was greater than the control limit (i.e., 10%) for cadmium, lead, nickel, and zinc at 10.3%, 12.8%, 13.9%, and 13.7%, respectively. The associated sample results were positive detections and were qualified as "J".

VOCs by SW-846 Method 8260B:

The continuing calibration analyzed on 6/22/2010 at 14:32 displayed percent deviations (%Ds) greater than the control limit with negative biases for bromomethane at 22.7% and acetone at 25.7%. The associated positive detections were qualified as "J" and non-detects were qualified "UJ".

The continuing calibration analyzed on 6/22/2010 at 17:07 displayed a %D greater than the control limit with a negative bias for bromomethane at 22.4%. The associated sample results were non-detect and were qualified as "UJ". In addition, the %D for acetone was greater than the control limit with a positive bias at 22.0%. The associated positive detections were qualified as "J".

SVOCs by SW-846 Method 8270C:

The continuing calibration analyzed on 6/24/2010 at 09:56 displayed a %D greater than the control limit (i.e., 20%) with a negative bias for 4,6-dinitro-2-methylphenol at 22.0%. The associated sample results were non-detect and were qualified as "UJ".

Pesticides by SW-846 Method 8081A:

The continuing calibration analyzed on 6/23/2010 at 01:26 displayed %Ds greater than the control limit (i.e., 20%) with negative biases on the front and rear chromatography columns for endrin aldehyde at 27.2% and 20.8%, respectively. The associated sample result was non-detect and was qualified as "UJ".

Other Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

Field blank sample PE-SED-FBLK-03 displayed a positive detection for mercury at 0.040 μg/L. There were no sediment samples collected on 6/16/2010 reported with this SDG; no qualification was required.

Field blank sample PE-SED-FBLK-02 displayed positive detections for calcium, copper, magnesium, lead, and zinc at 27.7 μg/L, 0.34 μg/L, 7.8 μg/L, 0.12 μg/L, and 2.3 μg/L, respectively.. There were no sediment samples collected on 6/15/2010 reported with this SDG; no qualification was required.

Field blank sample PE-SED-FBLK-04 displayed positive detections for calcium, copper, magnesium, lead, and zinc at 22.3 μg/L, 0.64 μg/L, 3.6 μg/L, 0.10 μg/L, and 2.1 μg/L, respectively. There were no sediment samples collected on 6/17/2010 that were analyzed for total metals; no qualification was required.

The method blank analyzed in conjunction with preparation batch 0173173 displayed a positive detection for mercury at 0.039 μg/L. The associated sample results were non-detect; no qualification was required.

Simultaneously Extracted Metals by USEPA SEM:

Spiked sample PE-SQT-08 displayed a matrix spike recovery less than the lower control limit (i.e., 75%) for lead at 58%. In addition, the matrix spike/spike duplicate relative percent difference was greater than the control limit (i.e., 20%) at 21%. The sample results were previously qualified on the basis of serial dilution anomalies; no further action was required.

The method blank sample associated with preparation batch 0176024 displayed positive detections for copper, nickel, and zinc at 0.00088 umoles/gm, 0.0030 umoles/gm, and 0.023 umoles/gm. The associated sample results were greater than 10X the blank concentrations; no qualification was required.

VOCs by SW-846 Method 8260B:

The trip blank sample displayed a positive detection for carbon disulfide at 0.43 μg/L. The associated investigative samples were not reported with this SDG; no qualification was required.

Field blank samples PE-SED-FBLK-03 and PE-SED-FBLK-04 displayed positive detections for acetone at 4.8 μg/L and 7.0 μg/L, respectively; carbon disulfide at 0.32 μg/L and 0.34 μg/L, respectively; and toluene at 0.78 μg/L and 0.46 μg/L, respectively. The associated investigative samples were not reported with this SDG; no qualification was required.

SVOCs by SW-846 Method 8270C:

The matrix spike duplicate associated with sample batch 0173110 displayed recoveries less than the lower control limits for pyrene and 4-bromophenyl phenyl ether at 34% and 37%, respectively. Data are not qualified on the basis of matrix spike duplicate recoveries alone.

Pesticides by SW-846 Method 8081A:

The continuing calibrations analyzed on 6/23/2010 at 07:42 displayed a %D greater than the control limit with a negative bias for endrin aldehyde at 20.9%. Sample results were previously qualified on the basis of continuing calibration anomalies; no further action was required.

Field blank sample PE-SED-FBLK-03 displayed a positive detection for delta-BHC at 0.22 µg/L. The associated investigative samples were not reported with this SDG; no qualification was required.

Comments: Sulfide and sulfate results were not reported with this SDG.

On the basis of this evaluation, the laboratory appears to have followed the specified analytical method according to the provisions of the guidelines, with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that fraction.

Signed:

Emily Strake

Emily Strake

URS

DATA VALIDATION REPORT

Date: November 29, 2010

Data Reviewer: Emily Strake (URS Philadelphia Office)

To: Gary Long (URS Philadelphia Office)

Subject: Ashland Inc. – Port Ewen, NY
FWIA Step IIC Sampling – June 2010

Laboratory: Test America Laboratories, Inc., Pittsburgh, PA

SDG: C0F190477 SWMU 35 Soils

Methodology

Data were analyzed by the following methods:

Select Total Metals by USEPA SW-846 Method 6020 and 7471A.

Percent Moisture (%M) by SM20 2540G.

Table 1 summarizes sample numbers, sampling dates, and requested analytical parameters:

Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F190477-001	PE-35-SO-01	6/18/2010	Metals, %M
C0F190477-002	PE-35-SO-02	6/18/2010	Metals, %M
C0F190477-003	PE-35-SO-03	6/18/2010	Metals, %M
C0F190477-004	PE-35-SO-03 DUP	6/18/2010	Metals, %M
C0F190477-005	PE-35-SO-04	6/18/2010	Metals, %M
C0F190477-006	PE-35-SO-05	6/18/2010	Metals, %M
C0F190477-007	PE-SO-FBLK-01	6/18/2010	Metals, %M

Validation Overview

Data have been validated using the specifics of the analytical methods listed above. Data qualifiers have been applied using the requirements as specified in *USEPA Region 2 Standard Operating Procedure #HW-2:* Validation of Metals for the CLP based on SOW ILM05.3 (September 2006), and the QAPP.

The following qualifiers may be applied as a result of data validation:

R – Result is considered unusable due to a major quality control anomaly.
U – Result is non-detect to due to the presence of blank contamination.

J – Result is estimated due to a minor quality control anomaly.
UJ – Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

Validation qualifiers will supersede the laboratory-applied qualifiers.

Qualification Summary

Table 2 represents all validator applied data qualification:

Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-35-SO-01	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-01	6/18/2010	Metals	Copper	**J**
PE-35-SO-01	6/18/2010	Metals	Antimony	**J**
PE-35-SO-02	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-02	6/18/2010	Metals	Copper	**J**
PE-35-SO-02	6/18/2010	Metals	Antimony	**J**
PE-35-SO-03	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-03	6/18/2010	Metals	Copper	**J**
PE-35-SO-03	6/18/2010	Metals	Lead	**J**
PE-35-SO-03	6/18/2010	Metals	Antimony	**J**
PE-35-SO-03 DUP	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-03 DUP	6/18/2010	Metals	Copper	**J**
PE-35-SO-03 DUP	6/18/2010	Metals	Lead	**J**
PE-35-SO-03 DUP	6/18/2010	Metals	Antimony	**J**
PE-35-SO-04	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-04	6/18/2010	Metals	Copper	**J**
PE-35-SO-04	6/18/2010	Metals	Antimony	**J**
PE-35-SO-05	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-05	6/18/2010	Metals	Copper	**J**
PE-35-SO-05	6/18/2010	Metals	Antimony	**J**
PE-SO-FBLK-01	6/18/2010	Metals	Antimony	**U (2.0)**

Major Deficiencies: No major deficiencies were identified.

Minor Deficiencies: <u>*Metals by USEPA SW-846 Method 6020 and 7471A:*</u>

The method blank analyzed in conjunction with preparation batch 0173368 displayed a positive detection greater than the MDL but less than the RL for antimony at 0.34 mg/kg. Associated positive detections less than the RL were qualified as “U”.

URS

The method blank analyzed in conjunction with preparation batch 0173375 displayed positive detections greater than the MDL but less than the RL for antimony at 0.020 mg/kg and chromium at 0.016 mg/kg. Associated positive detections greater than the RL but less than 10X the blank concentration were qualified as "J".

Matrix spike/spike duplicate (MS/SD) sample PE-35-SO-02 displayed recoveries less than the lower control limit (i.e., 75%) for antimony at 36% and 38%, respectively; arsenic at 57% and 72%, respectively; and for copper at 63% and 68%, respectively. The associated sample results were positive detections and were qualified as "J".

Field duplicate and parent sample pair PE-35-SO-03 and PE-35-SO-03 DUP displayed a relative percent difference greater than the control limit (i.e., 35%) for lead at 37.3%. The associated positive detections were qualified as "J".

Other Deficiencies: *<u>Metals by USEPA SW-846 Method 6020 and 7471A:</u>*

The SD recovery for barium associated with spiked sample PE-35-SO-02 was greater than the upper control limit at 130%. The MS was within control; no qualification was required.

The MS recovery for cobalt associated with spiked sample PE-35-SO-02 was less than the lower control limit at 70%. The SD was within control; no qualification was required.

The field blank sample displayed positive detections for barium, cobalt, chromium, copper, lead, antimony, and zinc. The associated investigative sample results were greater than 10X the blank concentrations or non-detect; no qualification was required.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified analytical method according to the provisions of the guidelines, with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that fraction.

Signed:

Emily Strake

Emily Strake

URS

DATA VALIDATION REPORT

Date: November 29, 2010

Data Reviewer: Emily Strake (URS Philadelphia Office)

To: Gary Long (URS Philadelphia Office)

Subject: Ashland Inc. – Port Ewen, NY
FWIA Step IIC Sampling – June 2010

Laboratory: Test America Laboratories, Inc., Pittsburgh, PA

SDG: C0F300551 Small Mammal Tissue

Methodology

Data were analyzed by the following methods:

Select Total Metals by USEPA SW-846 Method 6020 and 7471A.

Percent Moisture (%M) by SM20 2540G.

Table 1 summarizes sample numbers, sampling dates, and requested analytical parameters:

Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F300551-001	PE-S1-SMTIS-INDV-01	6/22/2010	Metals, %M
C0F300551-002	PE-S1-SMTIS-INDV-02	6/22/2010	Metals, %M
C0F300551-003	PE-S1-SMTIS-INDV-03	6/23/2010	Metals, %M
C0F300551-004	PE-S1-SMTIS-INDV-04	6/24/2010	Metals, %M
C0F300551-005	PE-N3-SMTIS-INDV-01	6/23/2010	Metals, %M
C0F300551-006	PE-N3-SMTIS-INDV-02	6/23/2010	Metals, %M
C0F300551-007	PE-N3-SMTIS-INDV-03	6/24/2010	Metals, %M
C0F300551-008	PE-N3-SMTIS-INDV-04	6/24/2010	Metals, %M
C0F300551-009	PE-N3-SMTIS-INDV-05	6/24/2010	Metals, %M
C0F300551-010	PE-N2-SMTIS-INDV-01	6/22/2010	Metals, %M
C0F300551-011	PE-N2-SMTIS-INDV-02	6/22/2010	Metals, %M
C0F300551-012	PE-N2-SMTIS-INDV-03	6/22/2010	Metals, %M
C0F300551-013	PE-N2-SMTIS-INDV-04	6/23/2010	Metals, %M
C0F300551-014	PE-N2-SMTIS-INDV-05	6/24/2010	Metals, %M
C0F300551-015	PE-S2-SMTIS-INDV-01	6/24/2010	Metals, %M
C0F300551-016	PE-S2-SMTIS-INDV-02	6/24/2010	Metals, %M
C0F300551-017	PE-S3-SMTIS-INDV-01	6/24/2010	Metals, %M
C0F300551-018	PE-N1-SMTIS-INDV-01	6/22/2010	Metals, %M
C0F300551-019	PE-N1-SMTIS-INDV-02	6/22/2010	Metals, %M
C0F300551-020	PE-N1-SMTIS-INDV-03	6/22/2010	Metals, %M
C0F300551-021	PE-N1-SMTIS-INDV-04	6/22/2010	Metals, %M

Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F300551-022	PE-N1-SMTIS-INDV-05	6/22/2010	Metals, %M
C0F300551-025	PE-N3-SMTIS-INDV-01 DUP	6/23/2010	Metals, %M
C0F300551-026	PE-S3-SMTIS-INDV-01 DUP	6/24/2010	Metals, %M
C0F300551-027	Equipment Blank	8/12/2010	Metals, %M

Validation Overview

Data have been validated using the specifics of the analytical methods listed above. Data qualifiers have been applied using the requirements as specified in *USEPA Region 2 Standard Operating Procedure #HW-2:* Validation of Metals for the CLP based on SOW ILM05.3 (September 2006), and the QAPP.

The following qualifiers may be applied as a result of data validation:

R – Result is considered unusable due to a major quality control anomaly.
U – Result is non-detect to due to the presence of blank contamination.
J – Result is estimated due to a minor quality control anomaly.
UJ – Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

Validation qualifiers will supersede the laboratory-applied qualifiers.

Qualification Summary

Table 2 represents all validator applied data qualification:

Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-S1-SMTIS-INDV-01	6/22/2010	Metals	Antimony	**U (0.18)**
PE-S1-SMTIS-INDV-01	6/22/2010	Metals	Zinc	**J**
PE-S1-SMTIS-INDV-02	6/22/2010	Metals	Zinc	**J**
PE-S1-SMTIS-INDV-03	6/23/2010	Metals	Zinc	**J**
PE-S1-SMTIS-INDV-04	6/24/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-01	6/23/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-02	6/23/2010	Metals	Antimony	**U (0.17)**
PE-N3-SMTIS-INDV-02	6/23/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-03	6/24/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-04	6/24/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-05	6/24/2010	Metals	Zinc	**J**
PE-N2-SMTIS-INDV-01	6/22/2010	Metals	Zinc	**J**
PE-N2-SMTIS-INDV-02	6/22/2010	Metals	Selenium	**J**
PE-N2-SMTIS-INDV-02	6/22/2010	Metals	Zinc	**J**
PE-N2-SMTIS-INDV-03	6/22/2010	Metals	Chromium	**J**

Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-N2-SMTIS-INDV-03	6/22/2010	Metals	Selenium	**J**
PE-N2-SMTIS-INDV-03	6/22/2010	Metals	Zinc	**J**
PE-N2-SMTIS-INDV-04	6/23/2010	Metals	Chromium	**J**
PE-N2-SMTIS-INDV-04	6/23/2010	Metals	Selenium	**J**
PE-N2-SMTIS-INDV-04	6/23/2010	Metals	Zinc	**J**
PE-N2-SMTIS-INDV-05	6/24/2010	Metals	Selenium	**J**
PE-N2-SMTIS-INDV-05	6/24/2010	Metals	Zinc	**J**
PE-S2-SMTIS-INDV-01	6/24/2010	Metals	Selenium	**J**
PE-S2-SMTIS-INDV-01	6/24/2010	Metals	Zinc	**J**
PE-S2-SMTIS-INDV-02	6/24/2010	Metals	Chromium	**J**
PE-S2-SMTIS-INDV-02	6/24/2010	Metals	Selenium	**J**
PE-S2-SMTIS-INDV-02	6/24/2010	Metals	Zinc	**J**
PE-S3-SMTIS-INDV-01	6/24/2010	Metals	Cadmium	**J**
PE-S3-SMTIS-INDV-01	6/24/2010	Metals	Chromium	**J**
PE-S3-SMTIS-INDV-01	6/24/2010	Metals	Selenium	**J**
PE-S3-SMTIS-INDV-01	6/24/2010	Metals	Zinc	**J**
PE-N1-SMTIS-INDV-01	6/22/2010	Metals	Chromium	**J**
PE-N1-SMTIS-INDV-01	6/22/2010	Metals	Selenium	**J**
PE-N1-SMTIS-INDV-01	6/22/2010	Metals	Zinc	**J**
PE-N1-SMTIS-INDV-02	6/22/2010	Metals	Cadmium	**J**
PE-N1-SMTIS-INDV-02	6/22/2010	Metals	Chromium	**J**
PE-N1-SMTIS-INDV-02	6/22/2010	Metals	Selenium	**J**
PE-N1-SMTIS-INDV-02	6/22/2010	Metals	Zinc	**J**
PE-N1-SMTIS-INDV-03	6/22/2010	Metals	Cadmium	**J**
PE-N1-SMTIS-INDV-03	6/22/2010	Metals	Selenium	**J**
PE-N1-SMTIS-INDV-03	6/22/2010	Metals	Zinc	**J**
PE-N1-SMTIS-INDV-04	6/22/2010	Metals	Cadmium	**J**
PE-N1-SMTIS-INDV-04	6/22/2010	Metals	Selenium	**J**
PE-N1-SMTIS-INDV-04	6/22/2010	Metals	Zinc	**J**
PE-N1-SMTIS-INDV-05	6/22/2010	Metals	Cadmium	**J**
PE-N1-SMTIS-INDV-05	6/22/2010	Metals	Chromium	**J**
PE-N1-SMTIS-INDV-05	6/22/2010	Metals	Selenium	**J**
PE-N1-SMTIS-INDV-05	6/22/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-01 DUP	6/23/2010	Metals	Chromium	**J**
PE-N3-SMTIS-INDV-01 DUP	6/23/2010	Metals	Selenium	**J**
PE-N3-SMTIS-INDV-01 DUP	6/23/2010	Metals	Zinc	**J**
PE-S3-SMTIS-INDV-01 DUP	6/24/2010	Metals	Chromium	**J**
PE-S3-SMTIS-INDV-01 DUP	6/24/2010	Metals	Selenium	**J**
PE-S3-SMTIS-INDV-01 DUP	6/24/2010	Metals	Zinc	**J**
Equipment Blank	8/12/2010	Metals	Selenium	**J**
Equipment Blank	8/12/2010	Metals	Zinc	**J**

Major Deficiencies: No major deficiencies were identified.

Minor Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The method blank analyzed in conjunction with preparation batch 0238055 displayed positive detections greater than the MDL but less than the RL for antimony at 0.009 mg/kg, chromium at 0.027 mg/kg, copper at 0.0085 mg/kg, and silver at 0.0027 mg/kg. Associated positive detections less than the RL were qualified as “U” and detections greater than the RL but less than 10X the blank concentration were qualified as “J”.

The method blank analyzed in conjunction with preparation batch 0238057 displayed a positive detection greater than the MDL but less than the RL for chromium at 0.024 mg/kg. Associated positive detections greater than the RL but less than 10X the blank concentration were qualified as “J”.

The matrix spike/spike duplicate (MS/SD) relative percent difference (RPD) associated with spiked sample PE-S1-SMTIS-COMP-04 was greater than the control limit (i.e., 20%) for zinc at 22%. The associated sample results were positive detections and were qualified as “J”.

The MS/SD RPD associated with spiked sample PE-N1-SMTIS-INDV-05 was greater than the control limit for selenium and zinc at 26% and 22%, respectively. The associated sample results were positive detections and were qualified as “J”.

The serial dilution percent differences (%Ds) for cadmium and zinc associated with sample batch 0238057 were greater than the control limit (i.e., 10%) at 24.9% and 11.0%, respectively. The associated positive detections were qualified as “J”.

Field duplicate and parent sample pair PE-N3-SMTIS-INDV-02 and PE-N3-SMTIS-INDV-02 DUP displayed a RPD greater than the control limit (i.e., 35%) for chromium at 38.3%. The associated positive detections were qualified as “J”.

Field duplicate and parent sample pair PE-S3-SMTIS-INDV-01 and PE-S3-SMTIS-INDV-01 DUP displayed a RPD greater than the control limit for chromium at 40%. The associated positive detections were qualified as “J”.

The equipment blank sample displayed positive detections for chromium, copper, selenium, and zinc at 0.38 mg/kg, 0.17 mg/kg, 0.094 mg/kg, and 0.65 mg/kg, respectively. Positive sample results less than 10X the blank concentration were qualified as “J”.

Other Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The MS recovery for chromium associated with spiked sample PE-S1-SMTIS-INDV-04 was less than the lower control limit at 73%. The SD was within control; no qualification was required.

The MS recovery for selenium associated with spiked sample PE-N1-SMTIS-INDV-05 was less than the lower control limit at 63%. The SD was within control; no qualification was required.

The continuing calibration blank analyzed on 8/26/2010 at 09:21 displayed a negative detection for mercury at -0.1 μg/L. The associated sample results were greater than 10X the blank concentration; no qualification was required.

Comments: Small mammal tissue samples were sent to Aquatec Biological Services, Inc. in Willston, VT for homogenization and were returned to Test America on 8/20/2010 and 8/25/2010. Upon arrival at Test America, the sample coolers were determined to be at ambient temperature. On the basis of professional judgment, sample quality for metal analytes was not impacted by temperature.

On the basis of this evaluation, the laboratory appears to have followed the specified analytical method according to the provisions of the guidelines, with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that fraction.

Signed:

Emily Strake

URS

DATA VALIDATION REPORT

Date: November 29, 2010

Data Reviewer: Emily Strake (URS Philadelphia Office)

To: Gary Long (URS Philadelphia Office)

Subject: Ashland Inc. – Port Ewen, NY
FWIA Step IIC Sampling – June 2010

Laboratory: Test America Laboratories, Inc., Pittsburgh, PA

SDG: C0F300566r Earthworm Composite Tissue

Methodology

Data were analyzed by the following methods:

Select Total Metals by USEPA SW-846 Method 6020 and 7471A.

Percent Moisture (%M) by SM20 2540G.

Table 1 summarizes sample numbers, sampling dates, and requested analytical parameters:

Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F300566-001	PE-S3-EWTIS-COMP-01	6/25/2010	Metals, %M
C0F300566-002	PE-S3-EWTIS-COMP-02	6/25/2010	Metals, %M
C0F300566-003	PE-S3-EWTIS-COMP-03	6/25/2010	Metals, %M
C0F300566-004	PE-S3-EWTIS-COMP-04	6/25/2010	Metals, %M
C0F300566-005	PE-S3-EWTIS-COMP-05	6/25/2010	Metals, %M
C0F300566-006	PE-N2-EWTIS-COMP-01	6/24/2010	Metals, %M
C0F300566-007	PE-N2-EWTIS-COMP-02	6/24/2010	Metals, %M
C0F300566-008	PE-N2-EWTIS-COMP-05	6/24/2010	Metals, %M
C0F300566-009	PE-N1-EWTIS-COMP-01	6/24/2010	Metals, %M
C0F300566-010	PE-N1-EWTIS-COMP-02	6/24/2010	Metals, %M
C0F300566-011	PE-N1-EWTIS-COMP-03	6/24/2010	Metals, %M
C0F300566-012	PE-N1-EWTIS-COMP-05	6/25/2010	Metals, %M
C0F300566-013	PE-S1-EWTIS-COMP-03	6/25/2010	Metals, %M
C0F300566-014	PE-S1-EWTIS-COMP-04	6/25/2010	Metals, %M
C0F300566-015	PE-S1-EWTIS-COMP-05	6/25/2010	Metals, %M
C0F300566-016	PE-S2-EWTIS-COMP-03	6/25/2010	Metals, %M
C0F300566-017	PE-S2-EWTIS-COMP-04	6/25/2010	Metals, %M
C0F300566-018	PE-S2-EWTIS-COMP-05	6/25/2010	Metals, %M
C0F300566-019	PE-N3-EWTIS-COMP-01	6/24/2010	Metals, %M
C0F300566-020	PE-N3-EWTIS-COMP-02	6/24/2010	Metals, %M
C0F300566-021	PE-N3-EWTIS-COMP-03	6/24/2010	Metals, %M

Lab Sample ID	Client Project Sample ID	Sample Date	Analyses Requested
C0F300566-022	PE-N3-EWTIS-COMP-04	6/24/2010	Metals, %M
C0F300566-023	PE-N3-EWTIS-COMP-05	6/24/2010	Metals, %M
C0F300566-024	PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals, %M
C0F300566-025	PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals, %M
C0F300566-026	PE-S1-EWTIS-COMP-02	6/25/2010	Metals, %M
C0F300566-027	PE-S1-EWTIS-COMP-01	6/25/2010	Metals, %M

Validation Overview

Data have been validated using the specifics of the analytical methods listed above. Data qualifiers have been applied using the requirements as specified in *USEPA Region 2 Standard Operating Procedure #HW-2:* Validation of Metals for the CLP based on SOW ILM05.3 (September 2006), and the QAPP.

The following qualifiers may be applied as a result of data validation:

R – Result is considered unusable due to a major quality control anomaly.
U – Result is non-detect to due to the presence of blank contamination.
J – Result is estimated due to a minor quality control anomaly.
UJ – Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

Validation qualifiers will supersede the laboratory-applied qualifiers.

Qualification Summary

Table 2 represents all validator applied data qualification:

Sample	Sample Date	Analysis	Analyte	Qualification
				Validator Flag (final flag)
PE-S3-EWTIS-COMP-01	6/25/2010	Metals	Chromium	**J**
PE-S3-EWTIS-COMP-01	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-01	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-01	6/25/2010	Metals	Mercury	**J**
PE-S3-EWTIS-COMP-02	6/25/2010	Metals	Chromium	**J**
PE-S3-EWTIS-COMP-02	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-02	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-02	6/25/2010	Metals	Mercury	**J**
PE-S3-EWTIS-COMP-03	6/25/2010	Metals	Chromium	**J**
PE-S3-EWTIS-COMP-03	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-03	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-03	6/25/2010	Metals	Mercury	**J**
PE-S3-EWTIS-COMP-04	6/25/2010	Metals	Chromium	**J**

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Sample	Sample Date	Analysis	Analyte	Qualification
				Validator Flag (final flag)
PE-S3-EWTIS-COMP-04	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-04	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-04	6/25/2010	Metals	Mercury	**J**
PE-S3-EWTIS-COMP-05	6/25/2010	Metals	Chromium	**J**
PE-S3-EWTIS-COMP-05	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-05	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-05	6/25/2010	Metals	Mercury	**J**
PE-N2-EWTIS-COMP-01	6/24/2010	Metals	Chromium	**J**
PE-N2-EWTIS-COMP-01	6/24/2010	Metals	Lead	**J**
PE-N2-EWTIS-COMP-01	6/24/2010	Metals	Mercury	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Arsenic	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Cobalt	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Chromium	**U (0.20)**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Copper	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Lead	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Selenium	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Zinc	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Mercury	**J**
PE-N2-EWTIS-COMP-05	6/24/2010	Metals	Chromium	**J**
PE-N2-EWTIS-COMP-05	6/24/2010	Metals	Lead	**J**
PE-N2-EWTIS-COMP-05	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N2-EWTIS-COMP-05	6/24/2010	Metals	Mercury	**J**
PE-N1-EWTIS-COMP-01	6/24/2010	Metals	Chromium	**J**
PE-N1-EWTIS-COMP-01	6/24/2010	Metals	Lead	**J**
PE-N1-EWTIS-COMP-01	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N1-EWTIS-COMP-01	6/24/2010	Metals	Mercury	**J**
PE-N1-EWTIS-COMP-02	6/24/2010	Metals	Chromium	**J**
PE-N1-EWTIS-COMP-02	6/24/2010	Metals	Lead	**J**
PE-N1-EWTIS-COMP-02	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N1-EWTIS-COMP-02	6/24/2010	Metals	Mercury	**J**
PE-N1-EWTIS-COMP-03	6/24/2010	Metals	Chromium	**J**
PE-N1-EWTIS-COMP-03	6/24/2010	Metals	Lead	**J**
PE-N1-EWTIS-COMP-03	6/24/2010	Metals	Mercury	**J**
PE-N1-EWTIS-COMP-05	6/25/2010	Metals	Chromium	**J**
PE-N1-EWTIS-COMP-05	6/25/2010	Metals	Lead	**J**
PE-N1-EWTIS-COMP-05	6/25/2010	Metals	Antimony	**U (0.20)**
PE-N1-EWTIS-COMP-05	6/25/2010	Metals	Mercury	**J**
PE-S1-EWTIS-COMP-03	6/25/2010	Metals	Chromium	**U (0.20)**
PE-S1-EWTIS-COMP-03	6/25/2010	Metals	Lead	**J**
PE-S1-EWTIS-COMP-03	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S1-EWTIS-COMP-03	6/25/2010	Metals	Mercury	**J**
PE-S1-EWTIS-COMP-04	6/25/2010	Metals	Chromium	**J**
PE-S1-EWTIS-COMP-04	6/25/2010	Metals	Lead	**J**
PE-S1-EWTIS-COMP-04	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S1-EWTIS-COMP-04	6/25/2010	Metals	Mercury	**J**
PE-S1-EWTIS-COMP-05	6/25/2010	Metals	Chromium	**U (0.20)**

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Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-S1-EWTIS-COMP-05	6/25/2010	Metals	Lead	**J**
PE-S1-EWTIS-COMP-05	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S1-EWTIS-COMP-05	6/25/2010	Metals	Mercury	**J**
PE-S2-EWTIS-COMP-03	6/25/2010	Metals	Chromium	**U (0.20)**
PE-S2-EWTIS-COMP-03	6/25/2010	Metals	Lead	**J**
PE-S2-EWTIS-COMP-03	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S2-EWTIS-COMP-03	6/25/2010	Metals	Mercury	**J**
PE-S2-EWTIS-COMP-04	6/25/2010	Metals	Chromium	**J**
PE-S2-EWTIS-COMP-04	6/25/2010	Metals	Lead	**J**
PE-S2-EWTIS-COMP-04	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S2-EWTIS-COMP-04	6/25/2010	Metals	Mercury	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Barium	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Cobalt	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Chromium	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Copper	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Lead	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Selenium	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Mercury	**J**
PE-N3-EWTIS-COMP-01	6/24/2010	Metals	Chromium	**J**
PE-N3-EWTIS-COMP-01	6/24/2010	Metals	Lead	**J**
PE-N3-EWTIS-COMP-01	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N3-EWTIS-COMP-01	6/24/2010	Metals	Mercury	**J**
PE-N3-EWTIS-COMP-02	6/24/2010	Metals	Chromium	**U (0.20)**
PE-N3-EWTIS-COMP-02	6/24/2010	Metals	Lead	**J**
PE-N3-EWTIS-COMP-02	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N3-EWTIS-COMP-02	6/24/2010	Metals	Mercury	**J**
PE-N3-EWTIS-COMP-03	6/24/2010	Metals	Chromium	**J**
PE-N3-EWTIS-COMP-03	6/24/2010	Metals	Mercury	**R**
PE-N3-EWTIS-COMP-04	6/24/2010	Metals	Chromium	**J**
PE-N3-EWTIS-COMP-04	6/24/2010	Metals	Mercury	**R**
PE-N3-EWTIS-COMP-05	6/24/2010	Metals	Chromium	**J**
PE-N3-EWTIS-COMP-05	6/24/2010	Metals	Mercury	**R**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Arsenic	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Cobalt	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Chromium	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Selenium	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Zinc	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Mercury	**R**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Barium	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Cobalt	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Chromium	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Copper	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Lead	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Selenium	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Mercury	**R**

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Sample	Sample Date	Analysis	Analyte	Qualification
				Validator Flag (final flag)
PE-S1-EWTIS-COMP-02	6/25/2010	Metals	Chromium	**U (0.20)**
PE-S1-EWTIS-COMP-02	6/25/2010	Metals	Mercury	**R**
PE-S1-EWTIS-COMP-01	6/25/2010	Metals	Chromium	**J**
PE-S1-EWTIS-COMP-01	6/25/2010	Metals	Mercury	**R**

Major Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

Matrix spike/spike duplicate (MS/SD) sample PE-N3-EWTIS-COMP-05 did not recover (i.e., 0%) for mercury. The associated sample results were qualified as "R", for rejected.

Minor Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The method blank analyzed in conjunction with preparation batch 191035 displayed positive detections greater than the MDL but less than the RL for antimony at 0.026 mg/kg, chromium at 0.058 mg/kg, copper at 0.046 mg/kg, lead at 0.0036 mg/kg, and zinc at 0.029 mg/kg. Associated positive detections less than the RL were qualified as "U" and detections greater than the RL but less than 10X the blank concentration were qualified as "J".

The method blank analyzed in conjunction with preparation batch 191036 displayed positive detections greater than the MDL but less than the RL for chromium at 0.019 mg/kg and selenium at 0.070 mg/kg. Associated positive detections less than the RL were qualified as "U" and detections greater than the RL but less than 10X the blank concentration were qualified as "J".

The MS/SD relative percent difference (RPD) associated with spiked sample PE-S1-EWTIS-COMP-04 was greater than the control limit (i.e., 20%) for lead at 48%. The associated sample results were positive detections and were qualified as "J".

The MS/SD recoveries for mercury associated with spiked sample PE-S1-EWTIS-COMP-04 were less than the lower control limit (i.e., 75%) for mercury at 49% and 27%, respectively. The associated sample results were positive detections and were qualified as "J".

The serial dilution percent differences (%Ds) for chromium associated with sample batches 0191035 and 0191036 were greater than the control limit (i.e., 10%) at 45.3% and 11.8%, respectively. The associated positive detections were qualified as "J", unless previously qualified "U" for blank contamination.

Field duplicate and parent sample pair PE-N2-EWTIS-COMP-02 and PE-N2-EWTIS-COMP-02 DUP displayed RPDs greater than the control limit (i.e., 35%) for arsenic, cobalt, selenium, zinc, and mercury at 46.9%, 41.2%, 87.4%, 37.2%, and 60%, respectively. The associated positive detections were qualified as "J".

Field duplicate and parent sample pair PE-S2-EWTIS-COMP-05 and PE-S2-EWTIS-COMP-05 DUP displayed RPDs greater than the control limit for cobalt, copper, lead, and mercury at 40%, 154.5%, 52.5%, and 47.1%, respectively. The associated positive detections were qualified as "J". In addition, the absolute difference for barium, chromium, and selenium was greater than the control limit (i.e., 2X the RL) at 3.89 mg/kg, 0.71 mg/kg, and 3.9 mg/kg, respectively. The associated sample results were positive detections and were qualified as "J".

Other Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The SD recovery for lead associated with spiked sample PE-S1-EWTIS-COMP-04 was less than the lower control limit at 8.2%. The MS was within control; no qualification was required.

The MS recovery for zinc associated with spiked sample PE-S1-EWTIS-COMP-04 was less than the lower control limit at 65%. The SD was within control; no qualification was required.

The MS recovery for arsenic associated with spiked sample PE-N3-EWTIS-COMP-05 was less than the lower control limit at 72%. The SD was within control; no qualification was required.

The MS recovery for zinc associated with spiked sample PE-N3-EWTIS-COMP-05 was greater than the upper control limit at 141%. The SD was within control; no qualification was required.

The continuing calibration blank analyzed on 7/12/2010 at 09:18 displayed a negative detection for mercury at -0.1 μg/L. The associated sample results were greater than 10X the blank concentration; no qualification was required.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified analytical method according to the provisions of the guidelines, with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that fraction.

Signed:

Emily Strake

DATA VALIDATION REPORT

Date: December 2, 2010

Data Reviewer: Emily Strake (URS Philadelphia Office)

To: Gary Long (URS Philadelphia Office)

Subject: Ashland Inc. – Port Ewen, NY
FWIA Step IIC Sampling – June 2010

Laboratory: Test America Laboratories, Inc., Pittsburgh, PA

SDG: C0F180512 Surface Water and SQT Sediment

Methodology

Data were analyzed by the following methods:

Select Total Metals by USEPA SW-846 Method 6020 and 7470A/7471A.

Total Hardness by SM18 2340B.

Total Suspended Solids (TSS) by SM20 2540D.

Total Organic Solids (TOC) by SM20 5310B.

Target Compound List (TLC) Volatile Organic Compounds (VOCs) SW-846 8260B.

TCL Sem-Volatile Organic Compounds (SVOCs) SW-846 8270C.

TCL Pesticides SW-846 8081A.

Percent Solids by SM20 2540G.

Acid Volatile Sulfide/Simultaneously Extracted Metals (AVS/SEM) by USEPA AVS and USEPA SEM.

Table 1 summarizes sample numbers, sampling dates, and requested analytical parameters:

Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F180512-001	PE-SW-07	6/16/2010	Metals, Hardness, TSS
C0F180512-002	PE-SW-07-DIS	6/16/2010	Metals
C0F180512-003	PE-SW-08	6/16/2010	Metals, Hardness, TSS
C0F180512-004	PE-SW-08-DIS	6/16/2010	Metals
C0F180512-005	PE-SW-09	6/16/2010	Metals, Hardness, TSS
C0F180512-006	PE-SW-09-DIS	6/16/2010	Metals
C0F180512-007	PE-SW-FBLK-02-DIS	6/16/2010	Metals

Lab Sample ID	Client Project Sample ID	Sample Date	Analyses Requested
C0F180512-008	PE-SED-FBLK-02	6/15/2010	Metals
C0F180512-009	PE-SED-FBLK-03	6/16/2010	Metals, TOC, VOCs, SVOCs, Pesticides
C0F180512-010	TRIP BLANK	---	VOCs
C0F180512-011	PE-SQT-08	6/17/2010	AVS/SEM, % Solids
C0F180512-012	PE-SQT-07	6/17/2010	AVS/SEM, % Solids
C0F180512-013	PE-SQT-04	6/17/2010	AVS/SEM, % Solids
C0F180512-014	PE-SQT-SD-03	6/17/2010	VOCs, SVOCs, Sulfate, Sulfide
C0F180512-015	PE-SED-FBLK-04	6/17/2010	VOCs, SVOCs, Metals, TOC

Validation Overview

Data have been validated using the specifics of the analytical methods listed above. Data qualifiers have been applied using the requirements as specified in *USEPA Region 2 Standard Operating Procedure (SOP) #HW-2:* Validation of Metals for the CLP based on SOW ILM05.3 (September 2006), *SOP #HW-22:* Validation of Semi-Volatile Organic Compounds by GC/MS, (October 2006), *SOP #HW-24:* Validation of Volatile Organic Compounds by GC/MS, (October 2006), *SOP #HW-44:* Validation of Pesticide Compounds by GC, (October 2006), and the QAPP.

The following qualifiers may be applied as a result of data validation:

- **R –** Result is considered unusable due to a major quality control anomaly.
- **U –** Result is non-detect to due to the presence of blank contamination.
- **J –** Result is estimated due to a minor quality control anomaly.
- **UJ –** Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

Validation qualifiers will supersede the laboratory-applied qualifiers.

Qualification Summary

Table 2 represents all validator applied data qualification:

Sample	Sample Date	Analysis	Analyte	Qualification Validator Flag (final flag)
PE-SED-FBLK-03	6/16/2010	VOCs	Acetone	**J**
PE-SED-FBLK-03	6/16/2010	VOCs	Bromomethane	**UJ**
PE-SED-FBLK-03	6/16/2010	SVOCs	4,6-Dinitro-2-methylphenol	**UJ**
PE-SED-FBLK-03	6/16/2010	Pesticides	delta-BHC	**R**
PE-SED-FBLK-03	6/16/2010	Pesticides	Endrin aldehyde	**UJ**

Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-SED-FBLK-04	6/17/2010	VOCs	Acetone	**J**
PE-SED-FBLK-04	6/17/2010	VOCs	Bromomethane	**UJ**
PE-SED-FBLK-04	6/17/2010	SVOCs	4,6-Dinitro-2-methylphenol	**UJ**
TRIP BLANK	---	VOCs	Bromomethane	**UJ**
PE-SW-07-DIS	6/16/2010	Dissolved Metals	Copper	**U (2.0)**
PE-SW-07-DIS	6/16/2010	Dissolved Metals	Zinc	**U (5.0)**
PE-SW-08-DIS	6/16/2010	Dissolved Metals	Copper	**U (2.0)**
PE-SW-08-DIS	6/16/2010	Dissolved Metals	Zinc	**U (5.0)**
PE-SW-09-DIS	6/16/2010	Dissolved Metals	Copper	**U (2.0)**
PE-SW-09-DIS	6/16/2010	Dissolved Metals	Zinc	**U (5.0)**
PE-SED-FBLK-02	6/15/2010	Total Metals	Calcium	**U (100)**
PE-SQT-08	6/17/2010	SEM	Cadmium	**J**
PE-SQT-08	6/17/2010	SEM	Nickel	**J**
PE-SQT-08	6/17/2010	SEM	Lead	**J**
PE-SQT-08	6/17/2010	SEM	Zinc	**J**
PE-SQT-07	6/17/2010	SEM	Cadmium	**J**
PE-SQT-07	6/17/2010	SEM	Nickel	**J**
PE-SQT-07	6/17/2010	SEM	Lead	**J**
PE-SQT-07	6/17/2010	SEM	Zinc	**J**
PE-SQT-04	6/17/2010	SEM	Cadmium	**J**
PE-SQT-04	6/17/2010	SEM	Nickel	**J**
PE-SQT-04	6/17/2010	SEM	Lead	**J**
PE-SQT-04	6/17/2010	SEM	Zinc	**J**
PE-SED-FBLK-04	6/17/2010	Total Metals	Calcium	**U (100)**

Major Deficiencies: *Pesticides by SW-846 Method 8081A:*

Sample PE-SED-FBLK-03 displayed dual column imprecision greater than the control limit (i.e., 25%) for delta-BHC at 1,083%. The associated positive detection was qualified as "R", for rejected.

Minor Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

Field blank sample PE-SW-FBLK-02-DIS displayed positive detections for copper and zinc at 0.26 μg/L and 0.99 μg/L, respectively. Associated positive detections less than the RL were qualified as "U".

The method blank sample analyzed in conjunction with preparation batch 0171016 displayed a positive detection for calcium at 31.5 μg/L. Associated positive detections less than the RL were qualified as “U”.

Simultaneously Extracted Metals by USEPA SEM:

The serial dilution relative percent difference (RPD) associated with sample batch 0176024 was greater than the control limit (i.e., 10%) for cadmium, lead, nickel, and zinc at 10.3%, 12.8%, 13.9%, and 13.7%, respectively. The associated sample results were positive detections and were qualified as “J”.

VOCs by SW-846 Method 8260B:

The continuing calibration analyzed on 6/22/2010 at 14:32 displayed percent deviations (%Ds) greater than the control limit with negative biases for bromomethane at 22.7% and acetone at 25.7%. The associated positive detections were qualified as “J” and non-detects were qualified “UJ”.

The continuing calibration analyzed on 6/22/2010 at 17:07 displayed a %D greater than the control limit with a negative bias for bromomethane at 22.4%. The associated sample results were non-detect and were qualified as “UJ”. In addition, the %D for acetone was greater than the control limit with a positive bias at 22.0%. The associated positive detections were qualified as “J”.

SVOCs by SW-846 Method 8270C:

The continuing calibration analyzed on 6/24/2010 at 09:56 displayed a %D greater than the control limit (i.e., 20%) with a negative bias for 4,6-dinitro-2-methylphenol at 22.0%. The associated sample results were non-detect and were qualified as “UJ”.

Pesticides by SW-846 Method 8081A:

The continuing calibration analyzed on 6/23/2010 at 01:26 displayed %Ds greater than the control limit (i.e., 20%) with negative biases on the front and rear chromatography columns for endrin aldehyde at 27.2% and 20.8%, respectively. The associated sample result was non-detect and was qualified as “UJ”.

Other Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

Field blank sample PE-SED-FBLK-03 displayed a positive detection for mercury at 0.040 μg/L. There were no sediment samples collected on 6/16/2010 reported with this SDG; no qualification was required.

Field blank sample PE-SED-FBLK-02 displayed positive detections for calcium, copper, magnesium, lead, and zinc at 27.7 μg/L, 0.34 μg/L, 7.8 μg/L, 0.12 μg/L, and 2.3 μg/L, respectively.. There were no sediment samples collected on 6/15/2010 reported with this SDG; no qualification was required.

Field blank sample PE-SED-FBLK-04 displayed positive detections for calcium, copper, magnesium, lead, and zinc at 22.3 μg/L, 0.64 μg/L, 3.6 μg/L, 0.10 μg/L, and 2.1 μg/L, respectively. There were no sediment samples collected on 6/17/2010 that were analyzed for total metals; no qualification was required.

The method blank analyzed in conjunction with preparation batch 0173173 displayed a positive detection for mercury at 0.039 μg/L. The associated sample results were non-detect; no qualification was required.

Simultaneously Extracted Metals by USEPA SEM:

Spiked sample PE-SQT-08 displayed a matrix spike recovery less than the lower control limit (i.e., 75%) for lead at 58%. In addition, the matrix spike/spike duplicate relative percent difference was greater than the control limit (i.e., 20%) at 21%. The sample results were previously qualified on the basis of serial dilution anomalies; no further action was required.

The method blank sample associated with preparation batch 0176024 displayed positive detections for copper, nickel, and zinc at 0.00088 umoles/gm, 0.0030 umoles/gm, and 0.023 umoles/gm. The associated sample results were greater than 10X the blank concentrations; no qualification was required.

VOCs by SW-846 Method 8260B:

The trip blank sample displayed a positive detection for carbon disulfide at 0.43 μg/L. The associated investigative samples were not reported with this SDG; no qualification was required.

Field blank samples PE-SED-FBLK-03 and PE-SED-FBLK-04 displayed positive detections for acetone at 4.8 μg/L and 7.0 μg/L, respectively; carbon disulfide at 0.32 μg/L and 0.34 μg/L, respectively; and toluene at 0.78 μg/L and 0.46 μg/L, respectively. The associated investigative samples were not reported with this SDG; no qualification was required.

SVOCs by SW-846 Method 8270C:

The matrix spike duplicate associated with sample batch 0173110 displayed recoveries less than the lower control limits for pyrene and 4-bromophenyl phenyl ether at 34% and 37%, respectively. Data are not qualified on the basis of matrix spike duplicate recoveries alone.

Pesticides by SW-846 Method 8081A:

The continuing calibrations analyzed on 6/23/2010 at 07:42 displayed a %D greater than the control limit with a negative bias for endrin aldehyde at 20.9%. Sample results were previously qualified on the basis of continuing calibration anomalies; no further action was required.

Field blank sample PE-SED-FBLK-03 displayed a positive detection for delta-BHC at 0.22 μg/L. The associated investigative samples were not reported with this SDG; no qualification was required.

Comments: Sulfide and sulfate results were not reported with this SDG.

On the basis of this evaluation, the laboratory appears to have followed the specified analytical method according to the provisions of the guidelines, with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that fraction.

Signed:

Emily Strake

Emily Strake

URS

DATA VALIDATION REPORT

<u>Date:</u> November 29, 2010

<u>Data Reviewer:</u> Emily Strake (URS Philadelphia Office)

<u>To:</u> Gary Long (URS Philadelphia Office)

<u>Subject:</u> Ashland Inc. – Port Ewen, NY
FWIA Step IIC Sampling – June 2010

<u>Laboratory:</u> Test America Laboratories, Inc., Pittsburgh, PA

<u>SDG:</u> C0F190477 SWMU 35 Soils

Methodology

Data were analyzed by the following methods:

Select Total Metals by USEPA SW-846 Method 6020 and 7471A.

Percent Moisture (%M) by SM20 2540G.

Table 1 summarizes sample numbers, sampling dates, and requested analytical parameters:

Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F190477-001	PE-35-SO-01	6/18/2010	Metals, %M
C0F190477-002	PE-35-SO-02	6/18/2010	Metals, %M
C0F190477-003	PE-35-SO-03	6/18/2010	Metals, %M
C0F190477-004	PE-35-SO-03 DUP	6/18/2010	Metals, %M
C0F190477-005	PE-35-SO-04	6/18/2010	Metals, %M
C0F190477-006	PE-35-SO-05	6/18/2010	Metals, %M
C0F190477-007	PE-SO-FBLK-01	6/18/2010	Metals, %M

Validation Overview

Data have been validated using the specifics of the analytical methods listed above. Data qualifiers have been applied using the requirements as specified in *USEPA Region 2 Standard Operating Procedure #HW-2:* <u>Validation of Metals for the CLP based on SOW ILM05.3</u> (September 2006), and the QAPP.

The following qualifiers may be applied as a result of data validation:

R – Result is considered unusable due to a major quality control anomaly.
U – Result is non-detect to due to the presence of blank contamination.

J – Result is estimated due to a minor quality control anomaly.

UJ – Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

Validation qualifiers will supersede the laboratory-applied qualifiers.

Qualification Summary

Table 2 represents all validator applied data qualification:

Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-35-SO-01	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-01	6/18/2010	Metals	Copper	**J**
PE-35-SO-01	6/18/2010	Metals	Antimony	**J**
PE-35-SO-02	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-02	6/18/2010	Metals	Copper	**J**
PE-35-SO-02	6/18/2010	Metals	Antimony	**J**
PE-35-SO-03	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-03	6/18/2010	Metals	Copper	**J**
PE-35-SO-03	6/18/2010	Metals	Lead	**J**
PE-35-SO-03	6/18/2010	Metals	Antimony	**J**
PE-35-SO-03 DUP	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-03 DUP	6/18/2010	Metals	Copper	**J**
PE-35-SO-03 DUP	6/18/2010	Metals	Lead	**J**
PE-35-SO-03 DUP	6/18/2010	Metals	Antimony	**J**
PE-35-SO-04	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-04	6/18/2010	Metals	Copper	**J**
PE-35-SO-04	6/18/2010	Metals	Antimony	**J**
PE-35-SO-05	6/18/2010	Metals	Arsenic	**J**
PE-35-SO-05	6/18/2010	Metals	Copper	**J**
PE-35-SO-05	6/18/2010	Metals	Antimony	**J**
PE-SO-FBLK-01	6/18/2010	Metals	Antimony	**U (2.0)**

Major Deficiencies: No major deficiencies were identified.

Minor Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The method blank analyzed in conjunction with preparation batch 0173368 displayed a positive detection greater than the MDL but less than the RL for antimony at 0.34 mg/kg. Associated positive detections less than the RL were qualified as "U".

The method blank analyzed in conjunction with preparation batch 0173375 displayed positive detections greater than the MDL but less than the RL for antimony at 0.020 mg/kg and chromium at 0.016 mg/kg. Associated positive detections greater than the RL but less than 10X the blank concentration were qualified as “J”.

Matrix spike/spike duplicate (MS/SD) sample PE-35-SO-02 displayed recoveries less than the lower control limit (i.e., 75%) for antimony at 36% and 38%, respectively; arsenic at 57% and 72%, respectively; and for copper at 63% and 68%, respectively. The associated sample results were positive detections and were qualified as “J”.

Field duplicate and parent sample pair PE-35-SO-03 and PE-35-SO-03 DUP displayed a relative percent difference greater than the control limit (i.e., 35%) for lead at 37.3%. The associated positive detections were qualified as “J”.

Other Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The SD recovery for barium associated with spiked sample PE-35-SO-02 was greater than the upper control limit at 130%. The MS was within control; no qualification was required.

The MS recovery for cobalt associated with spiked sample PE-35-SO-02 was less than the lower control limit at 70%. The SD was within control; no qualification was required.

The field blank sample displayed positive detections for barium, cobalt, chromium, copper, lead, antimony, and zinc. The associated investigative sample results were greater than 10X the blank concentrations or non-detect; no qualification was required.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified analytical method according to the provisions of the guidelines, with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that fraction.

Signed:

Emily Strake

URS

DATA VALIDATION REPORT

Date: November 29, 2010

Data Reviewer: Emily Strake (URS Philadelphia Office)

To: Gary Long (URS Philadelphia Office)

Subject: Ashland Inc. – Port Ewen, NY
FWIA Step IIC Sampling – June 2010

Laboratory: Test America Laboratories, Inc., Pittsburgh, PA

SDG: C0F300551 Small Mammal Tissue

Methodology

Data were analyzed by the following methods:

Select Total Metals by USEPA SW-846 Method 6020 and 7471A.

Percent Moisture (%M) by SM20 2540G.

Table 1 summarizes sample numbers, sampling dates, and requested analytical parameters:

Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F300551-001	PE-S1-SMTIS-INDV-01	6/22/2010	Metals, %M
C0F300551-002	PE-S1-SMTIS-INDV-02	6/22/2010	Metals, %M
C0F300551-003	PE-S1-SMTIS-INDV-03	6/23/2010	Metals, %M
C0F300551-004	PE-S1-SMTIS-INDV-04	6/24/2010	Metals, %M
C0F300551-005	PE-N3-SMTIS-INDV-01	6/23/2010	Metals, %M
C0F300551-006	PE-N3-SMTIS-INDV-02	6/23/2010	Metals, %M
C0F300551-007	PE-N3-SMTIS-INDV-03	6/24/2010	Metals, %M
C0F300551-008	PE-N3-SMTIS-INDV-04	6/24/2010	Metals, %M
C0F300551-009	PE-N3-SMTIS-INDV-05	6/24/2010	Metals, %M
C0F300551-010	PE-N2-SMTIS-INDV-01	6/22/2010	Metals, %M
C0F300551-011	PE-N2-SMTIS-INDV-02	6/22/2010	Metals, %M
C0F300551-012	PE-N2-SMTIS-INDV-03	6/22/2010	Metals, %M
C0F300551-013	PE-N2-SMTIS-INDV-04	6/23/2010	Metals, %M
C0F300551-014	PE-N2-SMTIS-INDV-05	6/24/2010	Metals, %M
C0F300551-015	PE-S2-SMTIS-INDV-01	6/24/2010	Metals, %M
C0F300551-016	PE-S2-SMTIS-INDV-02	6/24/2010	Metals, %M
C0F300551-017	PE-S3-SMTIS-INDV-01	6/24/2010	Metals, %M
C0F300551-018	PE-N1-SMTIS-INDV-01	6/22/2010	Metals, %M
C0F300551-019	PE-N1-SMTIS-INDV-02	6/22/2010	Metals, %M
C0F300551-020	PE-N1-SMTIS-INDV-03	6/22/2010	Metals, %M
C0F300551-021	PE-N1-SMTIS-INDV-04	6/22/2010	Metals, %M

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Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F300551-022	PE-N1-SMTIS-INDV-05	6/22/2010	Metals, %M
C0F300551-025	PE-N3-SMTIS-INDV-01 DUP	6/23/2010	Metals, %M
C0F300551-026	PE-S3-SMTIS-INDV-01 DUP	6/24/2010	Metals, %M
C0F300551-027	Equipment Blank	8/12/2010	Metals, %M

Validation Overview

Data have been validated using the specifics of the analytical methods listed above. Data qualifiers have been applied using the requirements as specified in *USEPA Region 2 Standard Operating Procedure #HW-2:* Validation of Metals for the CLP based on SOW ILM05.3 (September 2006), and the QAPP.

The following qualifiers may be applied as a result of data validation:

- **R –** Result is considered unusable due to a major quality control anomaly.
- **U –** Result is non-detect to due to the presence of blank contamination.
- **J –** Result is estimated due to a minor quality control anomaly.
- **UJ –** Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

Validation qualifiers will supersede the laboratory-applied qualifiers.

Qualification Summary

Table 2 represents all validator applied data qualification:

Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-S1-SMTIS-INDV-01	6/22/2010	Metals	Antimony	**U (0.18)**
PE-S1-SMTIS-INDV-01	6/22/2010	Metals	Zinc	**J**
PE-S1-SMTIS-INDV-02	6/22/2010	Metals	Zinc	**J**
PE-S1-SMTIS-INDV-03	6/23/2010	Metals	Zinc	**J**
PE-S1-SMTIS-INDV-04	6/24/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-01	6/23/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-02	6/23/2010	Metals	Antimony	**U (0.17)**
PE-N3-SMTIS-INDV-02	6/23/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-03	6/24/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-04	6/24/2010	Metals	Zinc	**J**
PE-N3-SMTIS-INDV-05	6/24/2010	Metals	Zinc	**J**
PE-N2-SMTIS-INDV-01	6/22/2010	Metals	Zinc	**J**
PE-N2-SMTIS-INDV-02	6/22/2010	Metals	Selenium	**J**
PE-N2-SMTIS-INDV-02	6/22/2010	Metals	Zinc	**J**
PE-N2-SMTIS-INDV-03	6/22/2010	Metals	Chromium	**J**

Sample	Sample Date	Analysis	Analyte	Qualification
				Validator Flag (final flag)
PE-N2-SMTIS-INDV-03	6/22/2010	Metals	Selenium	J
PE-N2-SMTIS-INDV-03	6/22/2010	Metals	Zinc	J
PE-N2-SMTIS-INDV-04	6/23/2010	Metals	Chromium	J
PE-N2-SMTIS-INDV-04	6/23/2010	Metals	Selenium	J
PE-N2-SMTIS-INDV-04	6/23/2010	Metals	Zinc	J
PE-N2-SMTIS-INDV-05	6/24/2010	Metals	Selenium	J
PE-N2-SMTIS-INDV-05	6/24/2010	Metals	Zinc	J
PE-S2-SMTIS-INDV-01	6/24/2010	Metals	Selenium	J
PE-S2-SMTIS-INDV-01	6/24/2010	Metals	Zinc	J
PE-S2-SMTIS-INDV-02	6/24/2010	Metals	Chromium	J
PE-S2-SMTIS-INDV-02	6/24/2010	Metals	Selenium	J
PE-S2-SMTIS-INDV-02	6/24/2010	Metals	Zinc	J
PE-S3-SMTIS-INDV-01	6/24/2010	Metals	Cadmium	J
PE-S3-SMTIS-INDV-01	6/24/2010	Metals	Chromium	J
PE-S3-SMTIS-INDV-01	6/24/2010	Metals	Selenium	J
PE-S3-SMTIS-INDV-01	6/24/2010	Metals	Zinc	J
PE-N1-SMTIS-INDV-01	6/22/2010	Metals	Chromium	J
PE-N1-SMTIS-INDV-01	6/22/2010	Metals	Selenium	J
PE-N1-SMTIS-INDV-01	6/22/2010	Metals	Zinc	J
PE-N1-SMTIS-INDV-02	6/22/2010	Metals	Cadmium	J
PE-N1-SMTIS-INDV-02	6/22/2010	Metals	Chromium	J
PE-N1-SMTIS-INDV-02	6/22/2010	Metals	Selenium	J
PE-N1-SMTIS-INDV-02	6/22/2010	Metals	Zinc	J
PE-N1-SMTIS-INDV-03	6/22/2010	Metals	Cadmium	J
PE-N1-SMTIS-INDV-03	6/22/2010	Metals	Selenium	J
PE-N1-SMTIS-INDV-03	6/22/2010	Metals	Zinc	J
PE-N1-SMTIS-INDV-04	6/22/2010	Metals	Cadmium	J
PE-N1-SMTIS-INDV-04	6/22/2010	Metals	Selenium	J
PE-N1-SMTIS-INDV-04	6/22/2010	Metals	Zinc	J
PE-N1-SMTIS-INDV-05	6/22/2010	Metals	Cadmium	J
PE-N1-SMTIS-INDV-05	6/22/2010	Metals	Chromium	J
PE-N1-SMTIS-INDV-05	6/22/2010	Metals	Selenium	J
PE-N1-SMTIS-INDV-05	6/22/2010	Metals	Zinc	J
PE-N3-SMTIS-INDV-01 DUP	6/23/2010	Metals	Chromium	J
PE-N3-SMTIS-INDV-01 DUP	6/23/2010	Metals	Selenium	J
PE-N3-SMTIS-INDV-01 DUP	6/23/2010	Metals	Zinc	J
PE-S3-SMTIS-INDV-01 DUP	6/24/2010	Metals	Chromium	J
PE-S3-SMTIS-INDV-01 DUP	6/24/2010	Metals	Selenium	J
PE-S3-SMTIS-INDV-01 DUP	6/24/2010	Metals	Zinc	J
Equipment Blank	8/12/2010	Metals	Selenium	J
Equipment Blank	8/12/2010	Metals	Zinc	J

Major Deficiencies: No major deficiencies were identified.

Minor Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The method blank analyzed in conjunction with preparation batch 0238055 displayed positive detections greater than the MDL but less than the RL for antimony at 0.009 mg/kg, chromium at 0.027 mg/kg, copper at 0.0085 mg/kg, and silver at 0.0027 mg/kg. Associated positive detections less than the RL were qualified as “U” and detections greater than the RL but less than 10X the blank concentration were qualified as “J”.

The method blank analyzed in conjunction with preparation batch 0238057 displayed a positive detection greater than the MDL but less than the RL for chromium at 0.024 mg/kg. Associated positive detections greater than the RL but less than 10X the blank concentration were qualified as “J”.

The matrix spike/spike duplicate (MS/SD) relative percent difference (RPD) associated with spiked sample PE-S1-SMTIS-COMP-04 was greater than the control limit (i.e., 20%) for zinc at 22%. The associated sample results were positive detections and were qualified as “J”.

The MS/SD RPD associated with spiked sample PE-N1-SMTIS-INDV-05 was greater than the control limit for selenium and zinc at 26% and 22%, respectively. The associated sample results were positive detections and were qualified as “J”.

The serial dilution percent differences (%Ds) for cadmium and zinc associated with sample batch 0238057 were greater than the control limit (i.e., 10%) at 24.9% and 11.0%, respectively. The associated positive detections were qualified as “J”.

Field duplicate and parent sample pair PE-N3-SMTIS-INDV-02 and PE-N3-SMTIS-INDV-02 DUP displayed a RPD greater than the control limit (i.e., 35%) for chromium at 38.3%. The associated positive detections were qualified as “J”.

Field duplicate and parent sample pair PE-S3-SMTIS-INDV-01 and PE-S3-SMTIS-INDV-01 DUP displayed a RPD greater than the control limit for chromium at 40%. The associated positive detections were qualified as “J”.

The equipment blank sample displayed positive detections for chromium, copper, selenium, and zinc at 0.38 mg/kg, 0.17 mg/kg, 0.094 mg/kg, and 0.65 mg/kg, respectively. Positive sample results less than 10X the blank concentration were qualified as “J”.

Other Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The MS recovery for chromium associated with spiked sample PE-S1-SMTIS-INDV-04 was less than the lower control limit at 73%. The SD was within

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control; no qualification was required.

The MS recovery for selenium associated with spiked sample PE-N1-SMTIS-INDV-05 was less than the lower control limit at 63%. The SD was within control; no qualification was required.

The continuing calibration blank analyzed on 8/26/2010 at 09:21 displayed a negative detection for mercury at -0.1 µg/L. The associated sample results were greater than 10X the blank concentration; no qualification was required.

Comments: Small mammal tissue samples were sent to Aquatec Biological Services, Inc. in Willston, VT for homogenization and were returned to Test America on 8/20/2010 and 8/25/2010. Upon arrival at Test America, the sample coolers were determined to be at ambient temperature. On the basis of professional judgment, sample quality for metal analytes was not impacted by temperature.

On the basis of this evaluation, the laboratory appears to have followed the specified analytical method according to the provisions of the guidelines, with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that fraction.

Signed:

Emily Strake

Emily Strake

URS

DATA VALIDATION REPORT

Date: November 29, 2010

Data Reviewer: Emily Strake (URS Philadelphia Office)

To: Gary Long (URS Philadelphia Office)

Subject: Ashland Inc. – Port Ewen, NY
FWIA Step IIC Sampling – June 2010

Laboratory: Test America Laboratories, Inc., Pittsburgh, PA

SDG: C0F300566r Earthworm Composite Tissue

Methodology

Data were analyzed by the following methods:

Select Total Metals by USEPA SW-846 Method 6020 and 7471A.

Percent Moisture (%M) by SM20 2540G.

Table 1 summarizes sample numbers, sampling dates, and requested analytical parameters:

Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F300566-001	PE-S3-EWTIS-COMP-01	6/25/2010	Metals, %M
C0F300566-002	PE-S3-EWTIS-COMP-02	6/25/2010	Metals, %M
C0F300566-003	PE-S3-EWTIS-COMP-03	6/25/2010	Metals, %M
C0F300566-004	PE-S3-EWTIS-COMP-04	6/25/2010	Metals, %M
C0F300566-005	PE-S3-EWTIS-COMP-05	6/25/2010	Metals, %M
C0F300566-006	PE-N2-EWTIS-COMP-01	6/24/2010	Metals, %M
C0F300566-007	PE-N2-EWTIS-COMP-02	6/24/2010	Metals, %M
C0F300566-008	PE-N2-EWTIS-COMP-05	6/24/2010	Metals, %M
C0F300566-009	PE-N1-EWTIS-COMP-01	6/24/2010	Metals, %M
C0F300566-010	PE-N1-EWTIS-COMP-02	6/24/2010	Metals, %M
C0F300566-011	PE-N1-EWTIS-COMP-03	6/24/2010	Metals, %M
C0F300566-012	PE-N1-EWTIS-COMP-05	6/25/2010	Metals, %M
C0F300566-013	PE-S1-EWTIS-COMP-03	6/25/2010	Metals, %M
C0F300566-014	PE-S1-EWTIS-COMP-04	6/25/2010	Metals, %M
C0F300566-015	PE-S1-EWTIS-COMP-05	6/25/2010	Metals, %M
C0F300566-016	PE-S2-EWTIS-COMP-03	6/25/2010	Metals, %M
C0F300566-017	PE-S2-EWTIS-COMP-04	6/25/2010	Metals, %M
C0F300566-018	PE-S2-EWTIS-COMP-05	6/25/2010	Metals, %M
C0F300566-019	PE-N3-EWTIS-COMP-01	6/24/2010	Metals, %M
C0F300566-020	PE-N3-EWTIS-COMP-02	6/24/2010	Metals, %M
C0F300566-021	PE-N3-EWTIS-COMP-03	6/24/2010	Metals, %M

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Lab Sample ID	*Client Project Sample ID*	*Sample Date*	*Analyses Requested*
C0F300566-022	PE-N3-EWTIS-COMP-04	6/24/2010	Metals, %M
C0F300566-023	PE-N3-EWTIS-COMP-05	6/24/2010	Metals, %M
C0F300566-024	PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals, %M
C0F300566-025	PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals, %M
C0F300566-026	PE-S1-EWTIS-COMP-02	6/25/2010	Metals, %M
C0F300566-027	PE-S1-EWTIS-COMP-01	6/25/2010	Metals, %M

Validation Overview

Data have been validated using the specifics of the analytical methods listed above. Data qualifiers have been applied using the requirements as specified in *USEPA Region 2 Standard Operating Procedure #HW-2:* Validation of Metals for the CLP based on SOW ILM05.3 (September 2006), and the QAPP.

The following qualifiers may be applied as a result of data validation:

- **R –** Result is considered unusable due to a major quality control anomaly.
- **U –** Result is non-detect to due to the presence of blank contamination.
- **J –** Result is estimated due to a minor quality control anomaly.
- **UJ –** Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

Validation qualifiers will supersede the laboratory-applied qualifiers.

Qualification Summary

Table 2 represents all validator applied data qualification:

Sample	*Sample Date*	*Analysis*	*Analyte*	*Qualification*
				Validator Flag (final flag)
PE-S3-EWTIS-COMP-01	6/25/2010	Metals	Chromium	**J**
PE-S3-EWTIS-COMP-01	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-01	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-01	6/25/2010	Metals	Mercury	**J**
PE-S3-EWTIS-COMP-02	6/25/2010	Metals	Chromium	**J**
PE-S3-EWTIS-COMP-02	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-02	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-02	6/25/2010	Metals	Mercury	**J**
PE-S3-EWTIS-COMP-03	6/25/2010	Metals	Chromium	**J**
PE-S3-EWTIS-COMP-03	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-03	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-03	6/25/2010	Metals	Mercury	**J**
PE-S3-EWTIS-COMP-04	6/25/2010	Metals	Chromium	**J**

Sample	Sample Date	Analysis	Analyte	Qualification Validator Flag (final flag)
PE-S3-EWTIS-COMP-04	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-04	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-04	6/25/2010	Metals	Mercury	**J**
PE-S3-EWTIS-COMP-05	6/25/2010	Metals	Chromium	**J**
PE-S3-EWTIS-COMP-05	6/25/2010	Metals	Lead	**J**
PE-S3-EWTIS-COMP-05	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S3-EWTIS-COMP-05	6/25/2010	Metals	Mercury	**J**
PE-N2-EWTIS-COMP-01	6/24/2010	Metals	Chromium	**J**
PE-N2-EWTIS-COMP-01	6/24/2010	Metals	Lead	**J**
PE-N2-EWTIS-COMP-01	6/24/2010	Metals	Mercury	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Arsenic	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Cobalt	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Chromium	**U (0.20)**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Copper	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Lead	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Selenium	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Zinc	**J**
PE-N2-EWTIS-COMP-02	6/24/2010	Metals	Mercury	**J**
PE-N2-EWTIS-COMP-05	6/24/2010	Metals	Chromium	**J**
PE-N2-EWTIS-COMP-05	6/24/2010	Metals	Lead	**J**
PE-N2-EWTIS-COMP-05	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N2-EWTIS-COMP-05	6/24/2010	Metals	Mercury	**J**
PE-N1-EWTIS-COMP-01	6/24/2010	Metals	Chromium	**J**
PE-N1-EWTIS-COMP-01	6/24/2010	Metals	Lead	**J**
PE-N1-EWTIS-COMP-01	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N1-EWTIS-COMP-01	6/24/2010	Metals	Mercury	**J**
PE-N1-EWTIS-COMP-02	6/24/2010	Metals	Chromium	**J**
PE-N1-EWTIS-COMP-02	6/24/2010	Metals	Lead	**J**
PE-N1-EWTIS-COMP-02	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N1-EWTIS-COMP-02	6/24/2010	Metals	Mercury	**J**
PE-N1-EWTIS-COMP-03	6/24/2010	Metals	Chromium	**J**
PE-N1-EWTIS-COMP-03	6/24/2010	Metals	Lead	**J**
PE-N1-EWTIS-COMP-03	6/24/2010	Metals	Mercury	**J**
PE-N1-EWTIS-COMP-05	6/25/2010	Metals	Chromium	**J**
PE-N1-EWTIS-COMP-05	6/25/2010	Metals	Lead	**J**
PE-N1-EWTIS-COMP-05	6/25/2010	Metals	Antimony	**U (0.20)**
PE-N1-EWTIS-COMP-05	6/25/2010	Metals	Mercury	**J**
PE-S1-EWTIS-COMP-03	6/25/2010	Metals	Chromium	**U (0.20)**
PE-S1-EWTIS-COMP-03	6/25/2010	Metals	Lead	**J**
PE-S1-EWTIS-COMP-03	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S1-EWTIS-COMP-03	6/25/2010	Metals	Mercury	**J**
PE-S1-EWTIS-COMP-04	6/25/2010	Metals	Chromium	**J**
PE-S1-EWTIS-COMP-04	6/25/2010	Metals	Lead	**J**
PE-S1-EWTIS-COMP-04	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S1-EWTIS-COMP-04	6/25/2010	Metals	Mercury	**J**
PE-S1-EWTIS-COMP-05	6/25/2010	Metals	Chromium	**U (0.20)**

Sample	Sample Date	Analysis	Analyte	Qualification
				Validator Flag (final flag)
PE-S1-EWTIS-COMP-05	6/25/2010	Metals	Lead	**J**
PE-S1-EWTIS-COMP-05	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S1-EWTIS-COMP-05	6/25/2010	Metals	Mercury	**J**
PE-S2-EWTIS-COMP-03	6/25/2010	Metals	Chromium	**U (0.20)**
PE-S2-EWTIS-COMP-03	6/25/2010	Metals	Lead	**J**
PE-S2-EWTIS-COMP-03	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S2-EWTIS-COMP-03	6/25/2010	Metals	Mercury	**J**
PE-S2-EWTIS-COMP-04	6/25/2010	Metals	Chromium	**J**
PE-S2-EWTIS-COMP-04	6/25/2010	Metals	Lead	**J**
PE-S2-EWTIS-COMP-04	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S2-EWTIS-COMP-04	6/25/2010	Metals	Mercury	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Barium	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Cobalt	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Chromium	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Copper	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Lead	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Antimony	**U (0.20)**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Selenium	**J**
PE-S2-EWTIS-COMP-05	6/25/2010	Metals	Mercury	**J**
PE-N3-EWTIS-COMP-01	6/24/2010	Metals	Chromium	**J**
PE-N3-EWTIS-COMP-01	6/24/2010	Metals	Lead	**J**
PE-N3-EWTIS-COMP-01	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N3-EWTIS-COMP-01	6/24/2010	Metals	Mercury	**J**
PE-N3-EWTIS-COMP-02	6/24/2010	Metals	Chromium	**U (0.20)**
PE-N3-EWTIS-COMP-02	6/24/2010	Metals	Lead	**J**
PE-N3-EWTIS-COMP-02	6/24/2010	Metals	Antimony	**U (0.20)**
PE-N3-EWTIS-COMP-02	6/24/2010	Metals	Mercury	**J**
PE-N3-EWTIS-COMP-03	6/24/2010	Metals	Chromium	**J**
PE-N3-EWTIS-COMP-03	6/24/2010	Metals	Mercury	**R**
PE-N3-EWTIS-COMP-04	6/24/2010	Metals	Chromium	**J**
PE-N3-EWTIS-COMP-04	6/24/2010	Metals	Mercury	**R**
PE-N3-EWTIS-COMP-05	6/24/2010	Metals	Chromium	**J**
PE-N3-EWTIS-COMP-05	6/24/2010	Metals	Mercury	**R**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Arsenic	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Cobalt	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Chromium	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Selenium	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Zinc	**J**
PE-N2-EWTIS-COMP-02 DUP	6/24/2010	Metals	Mercury	**R**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Barium	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Cobalt	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Chromium	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Copper	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Lead	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Selenium	**J**
PE-S2-EWTIS-COMP-05 DUP	6/25/2010	Metals	Mercury	**R**

Sample	Sample Date	Analysis	Analyte	Qualification
				Validator Flag (final flag)
PE-S1-EWTIS-COMP-02	6/25/2010	Metals	Chromium	**U (0.20)**
PE-S1-EWTIS-COMP-02	6/25/2010	Metals	Mercury	**R**
PE-S1-EWTIS-COMP-01	6/25/2010	Metals	Chromium	**J**
PE-S1-EWTIS-COMP-01	6/25/2010	Metals	Mercury	**R**

Major Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

Matrix spike/spike duplicate (MS/SD) sample PE-N3-EWTIS-COMP-05 did not recover (i.e., 0%) for mercury. The associated sample results were qualified as "R", for rejected.

Minor Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The method blank analyzed in conjunction with preparation batch 191035 displayed positive detections greater than the MDL but less than the RL for antimony at 0.026 mg/kg, chromium at 0.058 mg/kg, copper at 0.046 mg/kg, lead at 0.0036 mg/kg, and zinc at 0.029 mg/kg. Associated positive detections less than the RL were qualified as "U" and detections greater than the RL but less than 10X the blank concentration were qualified as "J".

The method blank analyzed in conjunction with preparation batch 191036 displayed positive detections greater than the MDL but less than the RL for chromium at 0.019 mg/kg and selenium at 0.070 mg/kg. Associated positive detections less than the RL were qualified as "U" and detections greater than the RL but less than 10X the blank concentration were qualified as "J".

The MS/SD relative percent difference (RPD) associated with spiked sample PE-S1-EWTIS-COMP-04 was greater than the control limit (i.e., 20%) for lead at 48%. The associated sample results were positive detections and were qualified as "J".

The MS/SD recoveries for mercury associated with spiked sample PE-S1-EWTIS-COMP-04 were less than the lower control limit (i.e., 75%) for mercury at 49% and 27%, respectively. The associated sample results were positive detections and were qualified as "J".

The serial dilution percent differences (%Ds) for chromium associated with sample batches 0191035 and 0191036 were greater than the control limit (i.e., 10%) at 45.3% and 11.8%, respectively. The associated positive detections were qualified as "J", unless previously qualified "U" for blank contamination.

Field duplicate and parent sample pair PE-N2-EWTIS-COMP-02 and PE-N2-EWTIS-COMP-02 DUP displayed RPDs greater than the control limit (i.e., 35%) for arsenic, cobalt, selenium, zinc, and mercury at 46.9%, 41.2%, 87.4%, 37.2%, and 60%, respectively. The associated positive detections were qualified as "J".

Field duplicate and parent sample pair PE-S2-EWTIS-COMP-05 and PE-S2-EWTIS-COMP-05 DUP displayed RPDs greater than the control limit for cobalt, copper, lead, and mercury at 40%, 154.5%, 52.5%, and 47.1%, respectively. The associated positive detections were qualified as "J". In addition, the absolute difference for barium, chromium, and selenium was greater than the control limit (i.e., 2X the RL) at 3.89 mg/kg, 0.71 mg/kg, and 3.9 mg/kg, respectively. The associated sample results were positive detections and were qualified as "J".

Other Deficiencies: *Metals by USEPA SW-846 Method 6020 and 7471A:*

The SD recovery for lead associated with spiked sample PE-S1-EWTIS-COMP-04 was less than the lower control limit at 8.2%. The MS was within control; no qualification was required.

The MS recovery for zinc associated with spiked sample PE-S1-EWTIS-COMP-04 was less than the lower control limit at 65%. The SD was within control; no qualification was required.

The MS recovery for arsenic associated with spiked sample PE-N3-EWTIS-COMP-05 was less than the lower control limit at 72%. The SD was within control; no qualification was required.

The MS recovery for zinc associated with spiked sample PE-N3-EWTIS-COMP-05 was greater than the upper control limit at 141%. The SD was within control; no qualification was required.

The continuing calibration blank analyzed on 7/12/2010 at 09:18 displayed a negative detection for mercury at -0.1 μg/L. The associated sample results were greater than 10X the blank concentration; no qualification was required.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified analytical method according to the provisions of the guidelines, with the exception of errors discussed above. If a given fraction is not mentioned above, that means that all specified criteria were met for that fraction.

Signed:

Emily Strake