FOCUSED FEASIBILITY STUDY
Munger Landing

SR#1015
Duluth, Minnesota
MPCA Work Order #3000019769

Prepared for:

Minnesota Pollution Control Agency
525 South Lake Avenue Suite 400
Duluth, Minnesota 55802

Prepared by:

Bay West LLC
5 Empire Drive
St. Paul, Minnesota 55103

June 2018
Revision 01
BWJ170470

tdr-fg19-01a

FOCUSED FEASIBILITY STUDY
Munger Landing

SR#1015
Duluth, Minnesota
MPCA Work Order #3000019769

June 2018
Revision 01
BWJ170470

Prepared for:

Minnesota Pollution Control Agency
525 South Lake Avenue Suite 400
Duluth, Minnesota 55802

Prepared by:

Bay West LLC
5 Empire Drive
St. Paul, Minnesota 55103
(651) 291-0456

Executive Summary

This Focused Feasibility Study (FFS) for Munger Landing (Site) presents: a summary of current Site conditions; a discussion of remedial action objectives (RAOs); and the identification, screening, evaluation, and comparison of potential alternatives. This report was prepared by Bay West LLC (Bay West) in accordance with the Minnesota Pollution Control Agency (MPCA) Contract Work Order No. 3000019769.

The Site was studied as a part of the St. Louis River (SLR) Area of Concern (AOC). Funding to complete an FFS was obtained through the United States Environmental Protection Agency (USEPA), Great Lakes Legacy Act (GLLA) and state funding through the Minnesota Legacy Fund and the Wisconsin Knowles-Nelson Stewardship Fund.

A remedial investigation (RI) was conducted for the Site in 2015 and additional characterization was completed in 2017. Contaminants of concern (COCs) identified during the RI were evaluated as part of this FFS. COCs identified for the Site include cadmium, copper, lead, mercury, nickel, zinc, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and polychlorinated dibenzo-p-dioxins/dibenzofurans (dioxins). Sediments with elevated levels of the COCs were generally identified in open water areas of the Site and are considered to present a high likelihood of significant effects to benthic invertebrates from exposure to surficial sediments and may present a human health risk through direct contact with sediments or ingestion of contaminated biota (i.e., fish consumption).

As identified in the SLR Remedial Action Plans (RAPs): RAP Stage I, MPCA and Wisconsin Department of Natural Resources (WDNR), 1992; and RAP Stage II, MPCA and WDNR, 1995; and later proven with testing, Mud Lake West, Duluth Harbor, Duluth, Minnesota (**Figure 1**), is potentially contributing to two impairments in the SLR AOC:

- Fish consumption advisory; and
- Degradation of the benthos environment.

Areas that are contributing to river sediment impairments should be addressed through remedial activities, as recommended by the RAP. In addition, addressing the contaminated sediments at the Site would also help in the reduction of impaired water resulting from bioaccumulative toxins in the SLR.

Remedial Action Objectives Developed by the MPCA for the Site

RAOs for the Site were developed based on the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 Code of Federal Regulations [CFR] §300.430[e][2][i]), which defines RAOs as a listing of the COCs and media of concern, potential exposure pathways, and remediation goals. Specific RAOs were developed from a review of the results of Site characterization activities, site-specific risk and fate and transport evaluations, and an initial review of Applicable or Relevant and Appropriate Requirements (ARARs). The following RAOs for the Site include goals for the protection of human health and the environment:

1. Minimize or remove exposure to sediment contaminants that bioaccumulate in the food chain and contribute to fish consumption advisories.
2. Minimize or remove exposure of the benthic organisms to contaminated sediments above sediment cleanup goals.
3. Preserve water depth to enable the current and/or planned use of the Site.

4. Enhance aquatic habitat, if conditions allow, in a manner that contributes to the removal of BUIs.
5. Minimize or remove human exposure to contaminated sediments above sediment cleanup goals.

The following present remedial alternatives developed to achieve these RAOs. Alternatives were identified and screened to determine if they could meet these RAOs. Areas of the remedial footprint exist within Wisconsin and remedial actions would be funded and implemented in cooperation with the WDNR; however, for the purposes of this FFS, remedies to address contamination at the Site and associated costs have been developed for the entire remedial footprint. The following alternatives were evaluated in this FFS:

Alternative 1: No Action – The NCP at Title 40 CFR provides that a No Action Alternative should be considered at every site. The No Action Alternative should reflect the site conditions described in the baseline risk assessment and remedial investigation. The No Action Alternative included within this FFS does not include any treatment or engineering controls, institutional controls (ICs), or monitoring. There are no costs associated with the No Action Alternative.

Alternative 2: Monitored Natural Recovery – This alternative consists of a monitoring and evaluation period of 30 years and implementation of ICs. Based on hydrodynamic findings at the U.S. Steel site, sufficient sedimentation may be occurring at the Site to reduce availability and concentrations of COCs in sediment and/or reducing toxic/bioaccumulative effects in marine organisms (i.e., benthics and fish). The objective of this alternative is to provide data to monitor natural recovery processes at the Site. The approximate present value cost associated with Alternative 2 is $244,000.

Alternative 3: Enhanced Monitored Natural Recovery with Broadcasted Amendment – This alternative would consist of applying a thin layer of amendment material directly on top of the sediment surface in areas with sediment concentrations of COCs exceeding the cleanup levels (CULs), hereafter referred to as remedial areas. Amendment material would be mixed into the sediments over time through bioturbation. The chosen amendment would reduce the bioavailability of the COCs to aquatic life by absorption to the sediment amendment. Monitoring of sediment chemical concentrations, sediment toxicity, and bioaccumulation of COCs in aquatic life would be conducted until sufficient contaminant sequestration, degradation, transformation, or other natural recovery processes reduce risks to acceptable levels. The approximate present value cost associated with Alternative 3 is $8,252,000.

Alternative 4: Enhanced Monitored Natural Recovery with Thin-Layer Amended Cover – This alternative would consist of constructing a 0.15-meter (6-inch) amended cover on top of the sediment surface in remedial areas, and thus adds an isolation component to Alternative 3. This alternative would incorporate use of the same amendment material as incorporated into Alternative 3 blended with a substrate such as sand to create the 0.15-meter layer. The chosen amendment would reduce the bioavailability of the COCs to aquatic life by absorption to the sediment amendment. Long-term mixing of cover materials into underlying in situ sediments from bioturbation would result in delivery of amendment materials to deeper sediment depths. Monitoring of chemical concentrations in sediment and cap material, sediment toxicity, and bioaccumulation of COCs in aquatic life would be conducted until sufficient contaminant sequestration, degradation, transformation, or other natural recovery processes reduce risks to acceptable levels. The approximate present value cost associated with Alternative 4 is $10,733,000.

Alternative 5: Excavate with Offsite Disposal – This alternative would consist of the complete removal of COCs within the established remedial areas and subsequent off-site disposal of contaminated sediment. Following dredging, a 0.15-meter (0.5-foot) layer of clean sand would be placed throughout the dredged areas to provide benthic habitat if dredging is conducted to bedrock in some areas of the Site. Based on input from MPCA multiple dredging passes instituted based on exceedances of post dredge verification criteria would not be conducted. Dredging would be conducted to a defined dredge prism neat line using best management practices to control and reduce contaminated dredge residuals. No long-term monitoring of COCs is required under this alternative. The approximate present value cost associated with Alternative 5 is $21,216,000.

Alternative 6: Hotspot Dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment – This alternative would consist the complete removal of the COCs in a hotspot area where the highest concentrations of COC were observed and where direct human contact is most likely. Following dredging, a 0.15-meter (0.5-foot) layer of clean sand would be placed throughout the dredged areas to provide benthic habitat if dredging is conducted to bedrock in some areas of the Site. Following dredging, a thin layer of amendment material would be added directly on top of the sediment surface in the remedial areas outside the hotspot area, similar to Alternative 3. Monitoring of sediment chemical concentrations, sediment toxicity, and bioaccumulation of COCs in aquatic life would be conducted until sufficient contaminant sequestration, degradation, transformation, or other natural recovery processes reduce risks to acceptable levels. The approximate present value cost associated with Alternative 6 is $13,388,000.

Comparative Analysis Summary

The comparative analysis of alternatives narrative discussion and quantitation table scored Alternatives 3, 4, and 6 the highest, with a one-point difference between the three. Alternative 5 scores lower than Alternatives 3, 4, and 6 but higher than Alternative 2. Alternative 1 scored the lowest overall. The modifying criteria, state/support agency acceptance, and community acceptance are assessed formally after the public comment period. Stakeholder and community input will provide valuable insight as the MPCA considers information for the selection of a preferred alternative. The MPCA will conduct outreach activities to resource managers, current Site users, the public and local units of government prior to the public comment period.

Further studies are recommended during the design phase of the selected alternative. These recommended studies, depending on the alternative selected, may include:

- Additional COC characterization and delineation throughout the Site;
- Additional COC characterization in Snively Creek to determine if the former Westinghouse Electric/Eastern Electric Apparatus Repair Co facility is a potential upland source contributing to Site contamination;
- Hydrodynamic study to understand natural processes such as depositional and scouring forces to inform design and placement cover materials, and effectiveness of Monitored Natural Recovery (MNR), if needed;
- Bench and/or pilot scale testing of amendment materials to determine the most appropriate material for use at the Site. Potential amendment materials include Sedimite™, bauxite, biopolymers, permeable Organoclay™, phosphate additives (i.e., apatite), and zeolite (USEPA, 2013); and
- Bench and/or pilot scale testing to determine appropriate application rates for the selected amendment material.

Additional information, including but not limited to the list above, as well as input from stakeholders and an understanding of project funding, is required to select a preferred remedial alternative. This document serves as an interim evaluation of alternatives under the current understanding of the site. This FFS document should be updated as additional information becomes available.

TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

Acronyms and Abbreviations

%	percent
µg/kg	micrograms per kilogram
AC	activated carbon
amsl	above mean sea level
AOC	area of concern
ARAR	Applicable or Relevant and Appropriate Requirement
BARR	BARR Engineering Company
Bay West	Bay West LLC
bss	below sediment surface
BUI	beneficial use impairment
CAD	confined aquatic disposal
CDF	confined disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
ch. or chs.	chapter or chapters
COC	contaminant of concern
COI	contaminant of interest
CSM	conceptual site model
CUL	cleanup level
dioxins	polychlorinated dibenzo-p-dioxins/dibenzofurans
EMNR	Enhanced Monitored Natural Recovery
FFS	Focused Feasibility Study
GHG	Greenhouse Gas
GLI	Great Lakes Initiative
GLLA	Great Lakes Legacy Act
GSR	Green Sustainable Remediation
IC	institutional control
IDT	Interlake/Duluth Tar
ITRC	Interstate Technology and Regulatory Council
IZ	isolation zone
LDB	left descending bank
LTM	long-term monitoring
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MERLA	Minnesota Environmental Response and Liability Act
mg/kg	milligrams per kilogram
MNR	Monitored Natural Recovery
MPCA	Minnesota Pollution Control Agency
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng TEQ/kg	nanograms toxic equivalency per kilogram
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
OIRW	Outstanding International Resource Water
OSWER	Office of Solid Waste and Emergency Response
PAH	polycyclic aromatic hydrocarbon
PBAZ	potentially bioactive zone
PCB	polychlorinated biphenyl
PFC	perfluorochemical
RAO	Remedial Action Objective
RAP	Remedial Action Plan
RBSE	Risk Based Site Evaluation
RCRA	Resource Conservation and Recovery Act
RFP	Request for Proposal
RI	Remedial Investigation
RME	reasonable maximal exposure
ROD	Record of Decision
ROM	rough order of magnitude
SDS	State Disposal System
SLR	St. Louis River
SLRIDT	St. Louis River/Interlake/Duluth Tar
SOMAT	SOMAT Engineering
SQT	sediment quality target
SSV	Sediment Screening Value
SVOC	semi-volatile organic compound
TBC	to be considered
TCLP	Toxicity Characteristic Leaching Potential
U.S.	United States
UECA	Uniform Environmental Covenants Act
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
WCA	Wetland Conservation Act
WDNR	Wisconsin Department of Natural Resources
WLSSD	Western Lake Superior Sanitary District

1.0 INTRODUCTION AND BACKGROUND

The St. Louis River (SLR), located on the border between Minnesota and Wisconsin, is the second largest United States (U.S.) tributary to Lake Superior and has a special significance in the region. The lower estuary empties into the Duluth-Superior Harbor, the largest freshwater seaport in North America. It serves as a geographic boundary for Wisconsin and Minnesota, and provides regional shipping access to Lake Superior.

Development along the SLR over the past 130 years has contributed to contaminated sediments. In 1987, concerns over environmental quality conditions prompted the designation of 73 miles of the lower SLR, which includes the segment from Cloquet, Minnesota, to the Duluth/Superior Harbor, as 1 of 43 Great Lakes Areas of Concern (AOCs). The Minnesota Pollution Control Agency (MPCA) and Wisconsin Department of Natural Resources (WDNR) worked together to divide the SLR AOC into Sediment Assessment Areas for the purposes of evaluation and prioritization of remediation and restoration activities. Contaminated sediments were identified and characterized through several studies that included the collection and analysis of sediments and biota samples throughout the AOC.

Historical sediment contamination in the SLR AOC has resulted in impaired uses, including degradation of bottom-feeding invertebrate communities, increased incidence of fish tumors and other abnormalities, fish consumption advisories, and restrictions on dredging, resulting in nine beneficial use impairments (BUIs; MPCA, 2008). BUIs are a change in the chemical, physical or biological integrity of the Great Lakes system sufficient to cause any 1 of the 14 established use impairments, or other related uses, such as the microbial objective for waters used for body contact recreational activities (joint commission). The MPCA and WDNR are currently working together to implement a comprehensive long-term plan to restore beneficial use and delist BUIs in the SLR AOC. Many of the BUIs in the AOC are linked to the presence of sediment contaminants. Some sediment-derived contaminants also appear suspended in the water column and carried by the SLR to Lake Superior.

As identified in the SLR Remedial Action Plans (RAPs): RAP Stage I, MPCA and WDNR, 1992; and RAP Stage II, MPCA and WDNR, 1995; and later proven with testing, Munger Landing (Site), SR#1015, Duluth, Minnesota (**Figure 1**), is potentially contributing to two impairments in the SLR AOC:

- Fish consumption advisory; and
- Degradation of the benthos environment.

Areas that are contributing to river and harbor sediment impairments should be addressed through remedial activities, as recommended by the RAPs. According to the MPCA, it is recommended by many programs that biotoxins be reduced within the SLR estuary and harbor. Removing or isolating the contaminated sediments from the surface water/sediment interface will help in the reduction of the impaired water resulting from bioaccumulative toxins in the SLR AOC.

This Focused Feasibility Study (FFS) was prepared to evaluate remedial alternatives for contaminated sediment at the Site. The scope of this FFS does not consider alternatives for any other matrix such as soil, surface water, or groundwater that may be impacted at the Site.

This report was developed pursuant to the Bay West LLC (Bay West) Master Contract No. 63186 and MPCA Contract Work Order No. 3000019769, dated July 21, 2015, and accompanying the Scope of Work/Cost Estimate for the Site. Funding to complete the FFS for the Site comes from the United States Environmental Protection Agency (USEPA), Great Lakes

Legacy Act (GLLA), and state funding through the Minnesota Legacy Fund and the Wisconsin Knowles-Nelson Stewardship Fund.

This FFS was written in general accordance with the MPCA Site Response Section Guidance Document Draft Guidelines on Remedy Selection (MPCA, 1998), the Minnesota Environmental Response and Liability Act (MERLA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300, along with other Minnesota and federal rules, statutes, and guidance.

1.1 Report Organization

Section 1.0 presents general background information including the Site history and a summary of current Site conditions. **Section 2.0** discusses Applicable or Relevant and Appropriate Requirements (ARARs) and summarizes Remedial Action Objectives (RAOs) to provide the framework for alternative evaluations for the Site. **Section 3.0** and **Section 4.0** present alternatives descriptions and the NCP remedy selection criteria used in this FFS, respectively. **Section 5.0** presents an evaluation of alternatives against standards and criteria. References are presented in **Section 6.0**.

1.2 Site Location and Current Use

The Site is located approximately 6 to 7 miles upstream of the Blatnick Bridge, which crosses from Rice's Point in Minnesota to Conner's Point in Wisconsin (**Figure 1**). The nearest identifiable landmark is the Munger Landing boat launch and the Smithville neighborhood of Duluth directly west of the Site. Directly upstream of the Site is Spirit Lake, the location of the former U.S. Steel plant and current U.S. Steel Superfund site.

The Site is a cut-off channel, separated from the current shipping channel by a long, narrow island that runs north to south along the majority of the length of the channel. The Site is approximately 1,000 feet wide at its upstream end, and slowly decreases in width towards its downstream (northerly) end, where it is approximately 300 to 400 feet in width. The western and eastern sides of the channel are characterized by shallow emergent vegetation areas and small intermittent islands of vegetation with water depths ranging between 1 and 3 feet. The central historical river channel portion of the Site is primarily characterized by a deeper channel with depths ranging from 6 to 10 feet. Flow direction is generally south to north, but Lake Superior seiche conditions periodically alter the magnitude and direction of the river's flow. Stewart Creek empties into the Site downstream of the boat landing along the left descending bank (LDB) (**Figure 2**). **Figure 3** shows the bathymetry of the Site, which was collected during the 2015 RI, when the Site was completely iced over.

The southern portion of the Site is divided by the Minnesota-Wisconsin state borderline. In order to fully characterize the area, RI sample locations were located in both Minnesota and Wisconsin. The state borders are depicted on each of the figures in this FFS.

1.3 Site History

Historical maps, aerial photographs, and drawings were reviewed for the Site as part of the 2015 RI (Bay West, 2015). Historically, the western shore of the Site was used for railroad transportation. Historical maps also indicate that steel mill operations occurred north and south of the western shore of the Site. Ship building operations occurred in the slips located directly adjacent to the north (downstream) of the Site. The 2015 RI presents additional details on these activities as well as an in-depth description of the historical documentation review for the Site.

1.4 Site Characterization

1.4.1 Site Geology

Regional geology in the Duluth area consists primarily of materials deposited during the last glaciation, and more recently as river sediment, overlying Precambrian igneous and sedimentary bedrock. These materials consist of silts, sands, and gravels that were deposited as the glaciers retreated northward. Fine grained sediment, primarily red silt and clay, was deposited in the ancestral glacial Lake Duluth. This red silt and clay occurs over much of the lower elevations in the Duluth area.

Bedrock units underlying the area consist of olivine gabbro and anorthositic gabbro members of the Duluth Complex, and the sedimentary units of the Fond du Lac Formation. The Duluth Complex is lower Precambrian, and the Fond du Lac Formation is upper Precambrian in age. The gabbroic members of the Duluth Complex form the hills to the west of the SLR and Lake Superior shore (MPCA, 1995).

Sediment in cores collected during the 2015 RI generally consisted of soft, loosely consolidated dark brown silt with occasional rootlets and other organic, woody debris, especially in areas of emergent vegetation within the upper 0.5 meters of sediment. Material observed at depths exceeding 0.5 meters consisted of increasingly stiff brown silt and clay mixtures. Occasional lenses of fine- to very fine-grained sand were encountered; however, these lenses were not laterally extensive and do not appear to be deposited consistently throughout the Site.

1.4.2 Site Hydrology

The regional groundwater flow system in the area generally flows from the Minnesota and Wisconsin uplands and discharges to Lake Superior and the SLR estuary.

Groundwater development within the region is limited and primarily restricted to the glacial lake sands and gravels (Barr, 2014). While not measured during this RI, flow velocities are likely lower at the Site than the main stream channel. The relatively low flow velocities may result in sediment deposition, especially on the margins within areas of emergent vegetation (common in shallow areas, typically on the eastern and western margins). The upper meter of sediment generally consisted of silt and clay with occasional lenses of fine-grained sand, typical of low energy fluvial environments (cut-off channels, oxbows, etc.).

Seiche was also not specifically measured during the 2015 RI; however, Lake Superior seiches are known to create water-level changes ranging from imperceptible to at least 3 feet within a period of 7.9 hours. Lake Superior seiche stirs nutrients and pollutants into the water column and can result in the SLR reversing flow upstream for 11 miles (beyond the Site location in the SLR) when a seiche floods the harbor.

According to the National Oceanic and Atmospheric Administration (NOAA) and the Great Lakes Dashboard Project, Lake Superior water level elevations have ranged from 599.5 feet to 603.4 feet amsl since measurements began in 1918 (NOAA, 2016). Seasonal water level fluctuations of Lake Superior affect water level elevations at the Site and may affect Site remedies; however, these effects have not been studied.

1.4.3 Nature and Extent of Contamination

The nature and extent of contamination at the Site was investigated during several studies between 2011 and 2015. The most recent investigation was an RI conducted specifically for the Site during August 2014 and June of 2015. A summary of previous Site investigations, as presented within the 2015 RI report, is provided in **Section 1.4.3.1**. A brief summary of activities completed in 2015 and 2017 is presented in **Section 1.4.3.2** and **Section 1.4.3.3**, respectively.

Screening criteria for application to sediment contaminants identified at the Site are discussed in **Section 1.4.3.4**. **Section 1.4.3.5** presents a discussion of the contaminants of concern (COCs) and **Section 1.4.3.6** presents the known depth, thickness, and volume of contaminated sediments at the Site.

1.4.3.1 Previous Studies

The following is a list of previous investigation reports that include the Site:

- Sediment Investigation Report, Lower St. Louis River, Fond Du Lac Dam to Kingsbury Bay, SOMAT Engineering (SOMAT), 2012a, Study ID 72;
- Sediment Remedial Investigation Report, Spirit Lake Sediment Site, Former U. S. Steel Duluth Works, BARR Engineering Company (BARR), 2013, Study ID 84;
- *St. Louis River Area of Concern Sediment Characterization: Final Report,* prepared by LimnoTech, July 11, 2013 (LimnoTech Report);
- Sediment Remedial Investigation Report, Mud Lake West, Duluth, Minnesota, prepared by Bay West, December 2015 (2015 RI Report); and
- Evaluation of Sediments from Munger Landing for Toxicity to *Hyalella azteca, Chironomus dilutus*, and Bioaccumulation in *Lumbriculus variegatus* Final Report, prepared by Lake Superior Research Institute, University of Wisconsin-Lake Superior, May 31, 2016.
- Additional polychlorinated biphenyls (PCB) and polychlorinated dibenzo-p-dioxins/dibenzofurans (dioxins) contamination characterization, results and associated lab reports included in this report.

The Site was investigated during the Lower SLR Study in 2011 (SOMAT, 2012a; Study ID 72) and the Spirit Lake Study in 2012 (BARR, 2013; Study ID 84). Analytical results from these investigations indicated that contaminants are present at the Site at concentrations that pose a risk to the environment; however, the number of sediment sample locations was insufficient to completely characterize the sediments. Multiple investigations were conducted directly upstream at the U.S. Steel Superfund Site, mainly within Spirit Lake, beginning as early as 1986 and as recently as 2014. In general, these investigations categorized sediments into pre-industrial, industrial, and post-industrial-related sediments. The contaminants of interest (COIs), as defined in the 2013 BARR report, are polynuclear aromatic hydrocarbons (PAHs), arsenic, chromium, lead, zinc, copper, and nickel.

The 2015 RI Report concluded that exposure pathways are complete or potentially complete for recreational users through direct contact with contaminated sediments and ingestion of biota (i.e., fish consumption) and for ecological receptors through ingestion and dermal contact. The 2015 RI Report identified lead, nickel, and zinc as COIs for risk to sediment dwelling organisms. Dioxins and PCBs were also identified as a potential COI for risk to human health and sediment dwelling organisms; however, the 2015 RI noted that these contaminants required further evaluation to define their distribution and to compare the concentrations to background concentrations.

1.4.3.2 November 2015 Bioaccumulation and Toxicity Testing

In November 2015, Bay West collected sediment samples for the purpose of conducting bioaccumulation and toxicity testing on benthic organisms under laboratory conditions in order to assess the risk to the benthic community due to contaminated sediments at the Site.

Sediment samples were collected from the upper 0.15 meter of sediment at two control locations and nine Site locations (see the following table and **Figure 2**):

Locations	Treatment Identification	Designation
Control Locations	Silica Sand	Performance Control
	West Bearskin Lake	Natural Sediment Control
Sample Locations	BW15ML-004*	Treatment
	BW15ML-006	Treatment
	BW15ML-010*	Treatment
	BW15ML-018	Treatment
	BW15ML-022	Treatment
	BW15ML-032*	Treatment
	BW15ML-034*	Treatment
	BW15ML-037	Treatment
	BW15ML-038	Treatment

* = bioaccumulation analysis

The following tests were conducted:

- Sediment chemistry including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), PCBs, and dioxins at nine locations;
- 10-day sediment toxicity test with Hyalella azteca at nine locations;
- 10-day sediment toxicity test with Chironomus dilutus at nine locations; and
- 28-day bioaccumulation test with Lumbriculus variegatus at four locations.

Survival and growth were determined as endpoints for both 10-day tests. Tissue analysis from bioaccumulation testing included metals, PCBs, and dioxins.

Results of testing indicated that sediment at one location resulted in reduced survival of Chironomus dilutus and reduced weight of Hyalella azteca. Sediment contaminants at three locations resulted in the reduced growth of Hyalella azteca during laboratory testing. Arsenic concentrations in the sediments likely contributed to increased levels of arsenic in Lumbriculus variegatus in all locations and concentrations of chromium, lead, and nickel at one location likely contributed to increased concentrations of these metals in Lumbriculus variegatus after laboratory exposure. In summary, results of this study indicate that contaminated sediments at the Site can potentially have adverse effects on benthic populations; therefore, as determined by the MPCA, remedy is required at the Site. The complete toxicity and bioaccumulation laboratory report is included in **Appendix A**.

1.4.3.3 October 2017 PCB and Dioxin Sediment Sampling

In October 2017, Bay West mobilized to the Site to collect sediment samples at 27 locations at the Site. Sediment locations were chosen based on gaps in PCB and dioxin data to refine the remedial footprint. Sediment sampling and laboratory analysis was completed in accordance with the SLR Sediment Quality Assurance Project Plan (QAPP). Samples were collected from the upper 0.5-meters of sediment using a check-valve core sampler. Sediment cores were split into two intervals, one from the 0.0 to 0.15-meter interval and one from the 0.15 to 0.5-meter interval, depending on sediment core recovery. Sediment samples were submitted for laboratory analysis of PCBs, dioxins, and total organic carbon (TOC). Results of PCBs and dioxin/furan analysis were used to refine the remedial footprint presented later in this FFS. A table showing the list of samples collected, sampling intervals, and coordinates, is presented in Table 1 of

Appendix A. TOC, PCB, and dioxins results are presented in Table 2, 3, and 4 of **Appendix A**, respectively. Laboratory analytical reports are also included in **Appendix A**.

1.4.3.4 Screening Criteria

Numerical sediment quality targets (SQTs), adopted for use in the SLR AOC to protect benthic invertebrates, can be used throughout Minnesota as benchmark values for making comparisons to surficial sediment chemistry measurements. Level I and Level II SQTs for the protection of sediment-dwelling organisms are available for 8 trace metals, 13 individual PAHs, total PAHs (all 13 priority PAHs), total PCBs, and 10 organochlorine pesticides. In addition, Level I and Level II SQTs for dioxins were adopted for the protection of fish, as insufficient information is available for sediment-dwelling organisms. SQTs are highly useful when evaluating risk for a specific compound or a group of compounds (i.e., total PCBs and total PAHs).

Contaminant concentrations below the Level I SQTs are unlikely to have harmful effects on sediment-dwelling organisms (i.e., benthic invertebrates). Contaminant concentrations above the Level II SQTs are more likely to result in harmful effects to benthic invertebrates (MPCA, 2007). Based on conversations with the MPCA, a qualitative comparison value midway between the Level I SQTs and Level II SQTs (i.e., Midpoint SQT) were used as criteria to identify, rank, and prioritize sediment-associated COCs within the Site.

Sediment Screening Values (SSVs) were developed to provide a human health-based toxicity value specifically related to sediment for the U.S. Steel Superfund site in the SLR (Minnesota Department of Health [MDH], 2013). The SSVs were developed using reasonable maximal exposures (RMEs) specific to the U.S. Steel site and the Lower SLR. The Updated Human Health Screening Values for SLR Sediments: U.S. Steel site, dated April 2013, describes the updated SSVs. Chemical concentrations in water-covered sediments at or below the SSVs are considered safe for the general public; however, chemical concentrations in sediments exceeding the SSVs should not be considered unsafe because the SSVs were developed using conservative measures of exposure, bioavailability, and toxicity. Based on ongoing ambient concentration studies, some SSVs likely approach, or are less, than ambient concentrations in sediment, including SSVs for mercury, benzo(a)pyrene equivalents, PCBs, and dioxins. Further, the SSVs do not include RMEs specific to the Site and are not intended to be used as sediment cleanup values; therefore, SSVs will not be used to identify, rank, and prioritize sediment-associated COCs within the Site. Following finalization of the ambient concentration studies, SSVs for COCs may need to be reviewed for applicability to the Site.

In 2018, the MPCA developed site-specific human health-based criteria to provide a recommendation regarding the potential risks to people from PCBs in sediments that use the Site for recreational purposes. To develop the values, an assessment was completed to evaluate potential risks to people from the following exposure pathways: ingestion, dermal contact and inhalation. The assessment did NOT include the fish consumption pathway as MDH does have fish consumption advisory for this area for PBCs. To evaluate these exposure pathways, a reasonable maximum estimate of water depth that someone could wade in is 5.5 feet. For sediments in 5.5 feet of water or less, human health-based site-specific sediment cleanup values (SDCVs) were developed for two site specific PCB exposure scenarios: water covered sediments, and intertidal sediments. For water covered sediments, potential risks may be present at concentrations exceeding 7.8 mg/kg. For intertidal sediments on the shores of the long, narrow island, potential risks may be present at concentrations exceeding 1.6 mg/kg. Areas of the Site where water covered sediment and intertidal sediment SDCVs apply are shown on **Figure 5**. Both SDCVs exceed the respective SQT values; therefore, SDCVs will not be used to define the remedial footprint. Additional details on the development and applicability of the site-specific SDCVs are detailed in the Munger Landing PCB Human Health SDCV Technical Memorandum is included in **Appendix B**.

1.4.3.5 Contaminants of Concern

Potential COIs are discussed in depth in the 2015 RI Report and are summarized below. The 2015 RI determined that exposure pathways are complete or potentially complete for recreational users at the Site and identified PCBs and dioxins as potential COIs for risk to human health; however, these COIs were not carried forward in the 2015 RI as COCs because the SSVs for these contaminants are expected to be at or below background concentrations.

The 2015 RI Report also determined that exposure pathways are complete or potentially complete for direct exposure of ecological receptors to sediment contaminants through ingestion and dermal contact and identified PCBs, dioxins, lead, nickel, and zinc as potential COIs for risks to ecological health; PCBs and dioxins were not carried forward as COCs in the RI because additional delineation was required for these contaminants; however, based on discussions with the MPCA and on the findings of the 2015 RI and 2017 delineation sampling activities, as well as the MDH Munger Landing SDCV Technical Memorandum, PCBs and dioxins are now considered the primary COCs for the Site. Concentrations of PAHs, cadmium, copper, lead, nickel, mercury, and zinc exceed the respective Midpoint SQTs but are considered secondary COCs. The primary COCs will drive remedial actions at the Site; however, the other COCs will also be taking into consideration. Locations of COC SQT exceedances are shown for lead, nickel, zinc, PCBs, and dioxins on **Figures 4A** through **4E**, respectively. **Table 1** presents a COC summary.

1.4.3.6 Depth, Thickness, and Volume of Contaminated Sediment

The 2015 Remedial Investigation (RI) Report and the 2017 sediment investigation was used to define the COCs, remedial areas, and remedial volumes used to compile this FFS. Distribution of primary COCs at the Site is discussed below. Locations of primary and secondary COC SQT exceedances are shown for lead, nickel, zinc, PCBs, and dioxins on **Figures 4A** through **4E**, respectively. The areas to be considered for remedial action are those where primary COCs exceeded their respective Midpoint SQT; however, locations of secondary COC Midpoint SQT exceedances were also taken into account to develop the remedial footprint, which is presented in **Figure 6**.

Lead concentrations exceeded the Midpoint SQT at relatively high frequencies in the upper 0.5 meters of sediment, with 23 percent (%) and 19% of samples exceeding the Midpoint SQT in the 0- to 0.15-meter interval and 0.15- to 0.5-meter interval, respectively. Midpoint SQT exceedances were horizontally distributed relatively evenly throughout the Site.

Nickel concentrations exceeded the Midpoint SQT at the highest frequencies in the upper 0.15 meters of sediment, with 21% of samples exceeding in this interval. Nickel Midpoint SQT exceedances decreased with depth from 11% in the 0.15- to 0.5-meter interval followed by 4% in the 0.5- to 1.0-meter interval.

Zinc concentrations exceeded the Midpoint SQT at relatively high frequencies in the upper 0.5 meters of sediment, with 23% and 19% of samples exceeding the Midpoint SQT in the 0- to 0.15-meter interval and 0.15- to 0.5-meter interval, respectively. Midpoint SQT exceedances were horizontally distributed relatively evenly throughout the Site.

PCB concentrations exceeded the Midpoint SQT at relatively low frequencies in the upper 0.5 meters of sediment throughout the Site, with 10.8 percent (%) and 12.9% of samples exceeding the Midpoint SQT in the 0- to 0.15-meter interval and 0.15- to 0.5-meter interval, respectively;

however, PCBs appear in relatively high concentrations in areas with high potentials for human exposure.

Dioxin concentrations exceeded the midpoint ins relatively high frequencies in the upper 0.5 meters of sediment throughout the Site, with 65.6 percent (%) and 54.2% of samples exceeding the Midpoint SQT in the 0- to 0.15-meter interval and 0.15- to 0.5-meter interval, respectively. Midpoint SQT exceedances appear to be distributed in the central and northern portions of the Site.

Figure 6 identifies remedial areas based on exceedances of the Midpoint SQT for primary COCs at any of the sampled depth intervals. Sediments impacted with primary COCs exceeding the Midpoint SQTs at the Site generally occur in an approximately 39-acre area as shown on **Figure 6**; however, 5.9 acres of the remedial footprint exists within Wisconsin and remedial actions will be addressed and funded in cooperation with the WDNR. A 7.4-acre contamination hotspot was also identified within the remedial footprint, as shown on **Figure 6**. The MPCA determined the criteria for the footprint, which encompasses sample locations where PCB concentrations exceed the Level 2 SQT (680 µg/kg) and/or dioxins concentrations that exceed the ambient TEQ value of 25 ng/ TEQ kg.

Remedies to address contamination at the Site have been developed for the entire remedial footprint. Contaminated sediments appear to generally exist in this area within the upper 0.5 meter of sediment; however, core shortening during sampling in the area of contamination resulted in an average percent recovery of 50%, indicating that the average depth of contamination in this area may exist as deep as 1 meter or greater. Based on these general estimates, and for the purposes of the FFS, the volume of contaminated sediment in the remedial footprint shown on **Figure 6** is approximately 134,000 cubic yards of contaminated sediment, and approximately 25,000 cubic yards of contaminated sediment in the hotspot area.

1.4.4 Exposure Pathways

Exposure pathways represent the linkages among contaminant sources, release mechanisms, exposure pathways and routes, and receptors to summarize the current understanding of the risks to human health and the environment due to contamination. The 2015 RI concluded that the incidental ingestion and dermal contact exposure routes were potentially complete for human recreational users of the Site. Additionally, the ingestion of biota via fish consumption was complete for human recreational users of the Site. Recreational users of the Site include boat and paddle users accessing the Site from the Munger Landing boat launch. The Site is also included in the proposed National Water Trail, which will attract more recreational users and increase the risk to human receptors.

The MPCA also evaluated potential human exposure pathways at the Site to developed site-specific human health-based criteria. The MPCA assessed ingestion, dermal contact and inhalation exposure pathways. The assessment did NOT include the fish consumption pathway as MDH does have fish consumption advisory for this area for PBCs. The assessment indicated that a reasonable maximum estimate of water depth that someone could wade in is 5.5 feet. For sediments in 5.5 feet of water or less, human health-based site-specific sediment cleanup values (SDCVs) were developed for two site specific PCB exposure scenarios: water covered sediments, and intertidal sediments. Areas of the Site where water covered sediment and intertidal sediment SDCVs apply are shown on **Figure 5**. Additional details on the development and applicability of the site-specific SDCVs are detailed in the Munger Landing PCB Human Health SDCV Technical Memorandum is included in **Appendix B**.

The 2015 RI also concluded that the exposure routes including the ingestion of and dermal contact with contaminated sediments were complete for ecological receptors. In addition, uptake through the ingestion of biota in contact with contaminated sediment is also complete for ecological human receptors.

The bioaccumulation and toxicity testing conducted in 2015 confirms that ecological exposure pathways are complete and that contaminated sediments at the Site present a potential risk for adverse effects to benthic organisms.

Reduction or isolation of sediment contamination at the Site will likely reduce contaminate concentrations found in biota tissue; therefore, addressing the ecological risk pathway identified for the Site will concurrently address the ingestion of biota via fish consumption pathway for human health.

Further discussions of human and ecological health risks posed by contaminated sediments at the Site are provided within the 2015 RI report.

1.4.5 Conceptual Site Model

The development of a conceptual site model (CSM) allows data obtained during ongoing investigations to be integrated in an iterative approach that increases the understanding of the physical and environmental setting of the Site and the fate and transport of COCs. The CSM provides a baseline for consideration of how remedy alternatives could be implemented to protect human and environmental health at the Site. The CSM is provided within the 2015 RI report and is illustrated in **Figure 7**.

The area surrounding the Site has undergone significant industrial development over the past 100 years. Specifically, development has occurred directly upstream (the U.S. Steel plant) and directly downstream (formerly Barnes-Duluth and McDougall-Duluth Shipbuilders, currently the location of the Riverside Marina) of the Site. Industrial activities related to these sites may have resulted in contaminated sediment at the Site.

PCBs and dioxins are known contaminants at the U.S. Steel Superfund Site. It is possible that contaminants from upland or estuary sources on the U.S. Steel Superfund Site have eroded and deposited via the SLR into the Site. Elevated concentrations of primary COCs within the upper 0.5 meter of Site sediments indicate that an ongoing source is present or insignificant sediment deposition is occurring at the Site since industrial activities ended; however, high sedimentation rates would be expected during a high flow event at the Site. High discharge events lead to dramatically increased sediment loads in the river, due to availability of additional sediment from various processes. In addition to overland flooding, the upstream impoundments are less able to trap natural sediment loads, and other significant events can create spikes in the river sediment load. The relatively high sediment loads during these periods are prone to deposition the Site, due to widening of the flow and the associated decrease in velocity through the lake. The size and location of the sediment deposited depends on how the velocities of the river flow are distributed as the flow propagates across the Site (Barr, 2013). Additional details regarding the CSM are contained within the 2015 RI Report. If ongoing sources are present, additional upland investigation and remedial actions may be necessary to protect any remedial actions taken at the Site from future contaminant inputs.

PCBs have also been detected at the former Westinghouse Electric/Eastern Electric Apparatus Repair Co facility, upstream of the Site along Snively Creek. Investigation sampling and confirmation sampling after soil excavations at the former Westinghouse Electric/Eastern Electric Apparatus Repair Co facility have confirmed elevated concentrations of PCBs in site soils. PCB-contaminated soil and runoff related to this site may have been introduced to, and transported by, Snively Creek, which terminates at the Site, resulting in PCB-contaminated sediments at the Snively Creek terminus.

2.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND REMEDIAL ACTION OBJECTIVES

Remedial actions for releases and threatened releases of hazardous substances, pollutants, or contaminants must be selected and carried out in accordance with state and federal requirements. The remedial footprint of the Site extends beyond the Minnesota State boundary in to Wisconsin. ARARs for both Minnesota and Wisconsin were examined; however, this section primarily discusses ARARs related to Minnesota. Remedial actions at the Site will be implemented and funded with cooperation between both Minnesota and Wisconsin remedies have been developed for the entire remedial footprint. These requirements are referred to as ARARs. RAOs specify COCs, media of concern, potential exposure pathways, and remediation goals. Initially, Site remediation goals for the COCs are developed based on readily available information such as chemical-specific ARARs or other reliable information. The Site RAOs are modified, as necessary, as more information becomes available during the FFS process.

This section presents the preliminary ARARs, RAOs, and COCs to be used in the development of this FFS. The final ARARs, RAOs, and COCs will be developed in the Record of Decision (ROD) for the Site.

2.1 Applicable or Relevant and Appropriate Requirements

This preliminary ARAR section summarizes the MPCA, Minnesota Department of Natural Resources (MDNR), MDH, and WDNR ARARs, and to be considered (TBC) criteria for aquatic sediment associated with the Site. Local and federal ARARs have also been included; however, the list may not include all applicable local and federal ARARs.

The NCP (40 CFR 300.5) defines “applicable” requirements as: “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA [Comprehensive Environmental Response, Compensation, and Liability Act] site.” Only those promulgated state standards identified by a state in a timely manner that are substantive and equally or more stringent than federal requirements may be applicable.

The NCP (40 CFR 300.5) further defines “relevant and appropriate” requirements as: “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility citing laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.” Like “applicable” requirements, the NCP also provides that only those promulgated state requirements that are identified in a timely manner and are more stringent than corresponding federal requirements may be relevant and appropriate.

ARARs generally fall into one of the following three classifications:

- **Chemical-specific:** These ARARs are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in numerical values. These values establish an acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. These requirements provide the basis for protective Site remediation levels for the COCs in the designated media.

- **Location-specific:** These ARARs generally restrict certain activities or limit concentrations of hazardous substances solely because of geographical or land use concerns. Requirements addressing wetlands, historic places, floodplains, or sensitive ecosystems and habitats are potential location-specific ARARs.
- **Action-specific:** These ARARs are restrictions on the conduct of certain activities or the operation of certain technologies at a particular site. Examples of action-specific ARARs would be regulations dictating the design, construction, and/or operating procedures for dredging, on-site landfilling, or capping. Action-specific requirements do not themselves determine the cleanup alternative, but define how the chosen cleanup alternative should be achieved.

In addition, criteria, advisories, guidance, and proposed standards developed by federal and state environmental and public health agencies that are not legally enforceable, but contain helpful information, are collectively referred to as TBCs. TBCs can be helpful in carrying out selected remedies or in determining the level of protectiveness of selected remedies. TBCs are meant to complement the use of ARARs, not compete with or replace them. TBCs are included, where appropriate, in the chemical-, location-, and action-specific discussions.

Several federal and state laws govern or provide the framework for remedial actions. Remedial actions must comply with substantive portions of these laws or acts, which were also reviewed during the ARAR development process. The following provides a summary of laws and acts that do not readily fall into one of the chemical-, location-, or action-specific classifications, but are applicable to the Site:

ARAR/TBC	Citation	Description/Potential Application
CERCLA	42 United States Code (USC) §§9601 et seq.	Federal Superfund Law.
NCP	40 CFR Part 300	Provides organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants.
MERLA	Minn. Stat. §§115B.01 to 115B.20	State Superfund Law.
Water Pollution Control Act	Minn. Stat. chapter (ch.) 115	Administration and enforcement of all laws relating to the pollution of any waters of the state.
Duty to Notify and Avoid Water Pollution	Minn. Stat. §115.061	Requires notification and recovery of discharge pollutants to minimize or abate pollution of the waters of the state.
Pollution Control Agency	Minn. Stat. ch. 116	Provides organizational structure and procedures for responding to problems relating to water, air, and land pollution.
Water Law	Minn. Stat. chs. 103A, 103B, 103C, 103D, 103E; 103F, and 103G	Provides regulations pertaining to any waters of the state, including surface water, wetlands and groundwater.
Safe Drinking Water Act	42 USC §§300f et seq.	Established to protect the quality of drinking water (above or underground).
Clean Water Act	33 USC §§1251 et seq.	Establishes structure for regulating discharges of pollutants and regulating quality standards for surface waters.

ARAR/TBC	Citation	Description/Potential Application
Resource Conservation and Recovery Act (RCRA)	42 USC §§6901 et seq.	Establishes RCRA Program and Regulations.
Clean Air Act	42 USC §§7401 et seq.	Regulates air remissions from stationary and mobile sources.

2.1.1 Chemical-Specific ARARs and TBCs

The primary COC associated with the sediments includes lead, nickel, and zinc. Secondary COCs include PAHs, cadmium, copper, mercury, PCBs, and dioxins. The following are the chemical-specific ARARs and TBCs associated with the sediments and shall be used to develop site-specific cleanup levels (CULs):

ARAR/TBC	Citation/Source	Description/Application
Sediment		
SSVs	MDH, 2013. Public Health Consultation, Updated Human Health Screening Values for SLR Sediments: U.S. Steel site, April.	To be used as benchmark values for making comparisons to surficial sediment chemistry measurements
SQTs	Guidance for the Use and Application of SQTs for the Protection of Sediment-dwelling Organisms in Minnesota.	To be used as benchmark values for making comparisons to surficial sediment chemistry measurements
SQGs	WDRN Consensus-Based Sediment Quality Guidelines	To be used as benchmark values for making comparisons to the concentrations of contaminant levels in sediments at sites under evaluation for various reasons
All Media		
Contaminated Sediments Remediation	Contaminated Sediments Remediation. http://www.itrcweb.org/contseds_remedy-selection/	Guidance to assist in selecting remedial technology most appropriate for a specific site.
Contaminated Sediment Remediation	Contaminated Sediment Remediation Guidance for Hazardous Waste Sites, USEPA, December 2005.	Guidance to assist in selecting remedial technology most appropriate for a specific site.
Contaminated Sediment Remediation	Use of Amendments for In Situ Remediation at Superfund Sediment Sites, USEPA, April 2013.	Guidance to assist in situ remediation.
Site screening guidelines	Working Draft Site Screening Evaluation Guidelines. MPCA Risk-Based Site Evaluation (RBSE) Manual (09/98).	Guidelines and criteria for screening human health and ecological risks.

Sediment

Human Health Risk

SSVs are tools for screening contaminated sediments for potential impacts to human health; however, as described in **Section 1.4.3.2**, SSVs will not be used to evaluate sediment contamination at the Site until ambient concentrations have been studied. Further, the complete and potentially complete human health exposure pathway will be mitigated by addressing ecological exposure pathways.

Ecological Risk

SQTs values were adopted for use in the SLR AOC to minimize exposure of the benthic organisms to contaminated sediments and movement of contaminants up the food chain. The MPCA does not have sediment quality standards. Instead, SQTs can be used in the SLR AOC and throughout the state as benchmark values for making comparisons to surficial sediment chemistry measurements as described in **Section 1.4.3.4**. For this FFS, the Midpoint SQT was used to identify, evaluate, and prioritize sediment-associated risk to ecological health. WDNR has developed consensus-based sediment quality guidelines (SQGs) for the protection of macroinvertebrate species, similar to MPCA SQTs; however, for the purpose of the FFS, only SQTs will be used in the evaluation of ecological risk for sediments.

All Media

This guidance document assists in selecting remedial technology most appropriate for a specific site based on contaminated sediment and site specific characteristics (http://www.itrcweb.org/contseds_remedy-selection/).

The USEPA document *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* presents remedial options available for contaminated sediments discussing advantages and limitations associated with the options.

The USEPA document *Use of Amendments for In Situ Remediation at Superfund Sediment Sites* presents remedial options using amendments available for contaminated sediments discussing advantages and limitations associated with the options.

The MPCA *Site Screening and Evaluation Document* presents an overall process for conducting a Tier 1 evaluation of the various exposure pathways at a site. The screening criteria worksheet can be found at the MPCA website (https://www.pca.state.mn.us/waste/risk-based-site-evaluation-guidance).

2.1.2 Location-Specific ARARs and TBCs

The location-specific ARARs and TBCs for the Site are as follows:

ARAR/TBC	Citation/Source	Description/Application
Waters of the State and Groundwater Protection	Minn. Stat. 103G and 103H	Groundwater protection, nondegredation, and best management practices.
Floodplain Management and Wetlands Protection	40 CFR Part 6, Appendix A, Section 6.a.(1)	Requires agencies to evaluate potential effects of actions in a floodplain to avoid adverse impacts
Shoreland and Floodplain Management	Minn. Rules ch. 6120	Conserves economic and natural environmental values (MDNR)
St. Louis County Land Use Ordinances	St. Louis County Zoning Ordinances, ch. 1003	Floodplain management, Manages on-site waste disposal and other site activities
Shoreland Management	Duluth City Code §51-26 et seq.	The City of Duluth requires a permit for any excavation or grading above the Ordinary High Water Mark within 300 feet of a river.
Endangered Species Act	16 USC §§1531 et seq. 50 CFR §17.11-12	Conservation of threatened and endangered plants and animals and their habitats.

ARAR/TBC	Citation/Source	Description/Application
Endangered, Threatened, Special Concern Species	Minn. Rules ch. 6134 Minn. Statute, § 84.0895	Protection of endangered, threatened, special concern species (MDNR).
Migratory Bird Treaty Act	16 USC Chapter 7, Subchapter II §§703 and 712.2	Protects migratory birds and their ecosystems
MDH Advisory for St. Louis River	MDH	Provides fish consumption advisories.
Wisconsin Navigable Water, Harbors, and Navigation	Wisconsin Statutes Chapter 30	Regulates work performed in navigable waters and harbors.

The Site is located within the Lake Superior Drainage Basin. Surface water quality standards and provisions for Class 2B and 3B waters apply. In addition, USEPA and the Great Lakes states agreed in 1995 to a comprehensive plan to restore the health of the Great Lakes. The Final Water Quality Guidance for the Great Lakes System, also known as the Great Lakes Initiative (GLI), includes criteria for states to use when setting water quality standards for 29 pollutants, including bioaccumulative chemicals of concern, and prohibits the use of mixing zones for these toxic chemicals. Because the surface water at the Site is within the drainage basin of Lake Superior, the ARARs specified in the GLI, Minn. Rules ch. 7052 are applicable to the Site. Requirements of the Great Lakes Water Quality Agreement of 2012 apply to the Site. In addition, the surface waters adjacent to the Site are identified as an Outstanding International Resource Water (OIRW). The objective for OIRW is to maintain water quality at existing conditions when the quality is better than the water quality standards. Generally, OIRWs are considered surface water quality standards applicable to the SLR for Class 2B and OIRWs, as set forth in Minn. Rules, chs. 7050 and 7052, and to the additional surface water quality standards for the SLR, as set forth in Minn. Rules ch. 7065. The OIRW was established after the ROD was issued.

As stated in Minn. Rules ch. 7050.0210 Subp. 2:

> *Nuisance conditions prohibited. No sewage, industrial waste, or other wastes shall be discharged from either point or nonpoint sources into any waters of the state so as to cause any nuisance conditions, such as the presence of significant amounts of floating solids, scum, visible oil film, excessive suspended solids, material discoloration, obnoxious odors, gas ebullition, deleterious sludge deposits, undesirable slimes or fungus growths, aquatic habitat degradation, excessive growths of aquatic plants, or other offensive or harmful effects.*

Title 40 CFR Part 6, Appendix A, Section 6 Requirements, requires federal agencies to evaluate the potential effects of actions taken within a floodplain to avoid adversely impacting floodplains wherever possible.

Title 40 CFR Part 6, Appendix A, Section 6.a.(1) Floodplain/Wetlands Determination: Before undertaking an Agency action, each program office must determine whether or not the action will be located in or affect a floodplain or wetlands. The Agency shall utilize maps prepared by the Federal Insurance Administration of the Federal Emergency Management Agency (Flood Insurance Rate Maps or Flood Hazard Boundary Maps), Fish and Wildlife Service (National Wetlands Inventory Maps), and other appropriate agencies to determine whether a proposed action is located in or will likely affect a floodplain or wetlands. If there is no floodplain/wetlands impact identified, the action may proceed without further consideration of the remaining procedures set in this section. If floodplain/wetlands impact is identified, this section presents procedures that must be taken.

Shoreland and Floodplain Management (Minn. Rules ch. 6120): Provides standards and criteria intended to preserve and enhance the quality of surface waters, conserve the economic and natural environmental values of shorelands, and provide for the wise use of water and related land resources of the state. St. Louis County Zoning Ordinances, ch. 1003, establish additional floodplain management and manage site activities such as on-site waste disposal.

Shoreland Management Permit (Duluth City Code §51-26 et seq.), as defined by the City of Duluth: Requires a permit for any excavation or grading above the Ordinary High Water Mark within 300 feet of a river. Each alternative will involve some of these activities. The substantive requirements of this permit are found in the ordinance and may govern removal of natural vegetation, grading and filling, placement of roads, sewage and waste disposal, and setbacks.

The Endangered Species Act (16 USC §1531 et seq.) and the Minnesota Endangered, Threatened, Special Concern Species Act (Minn. Rules ch. 6134): Protect threatened and endangered plants and animals and their habitats.

Title 16 USC Chapter 7, Subchapter II §§703 and 712.2. (The Migratory Bird Treaty Act): Protects migratory birds and their ecosystems by specifying the taking, killing, or possessing migratory birds unlawful. Public Law 95-616, an amendment to this act, provides measures to protect identified ecosystems of special importance to migratory birds such as bald eagles against pollution, detrimental alterations, and other environmental degradations.

The MDH has established various fish consumption advisories for the SLR due to the presence of perfluorochemicals (PFCs), PCBs, and mercury in water and sediments (MDH, 2000).

Under Wisconsin Statutes Chapter 30. A bulkhead line is required prior to placing deposits in navigable waters. If a legislative bulkhead line or lakebed grant is issued, then these areas cease to be waters of the state and the title is transferred to a local municipality.

2.1.3 Action-Specific ARARs and TBCs

The following summarizes the action-specific ARARs for the Site. In addition, Occupational Safety and Health Standards (Minn. Rules ch. 5205) for worker health, safety, and training are applicable to remedial actions performed at the Site.

ARAR/TBC	Citation/Source	Description/Application
Waters of the State (both surface and underground)	Minn. Rules ch. 7050 and 7052	Surface water quality during remedy construction.
Wetland Conservation Act (WCA)	Minn. Stat. §§103G.221-.2373	Protection of wetlands.
Wetlands Conservation	Minn. Rules 8420	Protection of wetlands, wetland functions for determining public values.
Floodplain Management Order	Executive Order 11988 and 40 CFR Part 6, Appendix A,	Regulates remedial action implementation in floodplains.
Section 404 Permit and Section 401 Certification (Clean Water Act)	33 CFR pts 320 and 323; 33 USC §1341	Applies to discharge of dredged or fill material into waters of the United States.

ARAR/TBC	Citation/Source	Description/Application
National Pollutant Discharge Elimination System (NPDES)/ State Disposal System (SDS) permits	Clean Water Act 33 USC §1342	Surface water quality requirements for discharges of pollutants to waters of the state.
Section 10 (Rivers and Harbors Act of 1899)	33 USC 403	Applies to activities that will obstruct or alter any navigable water of the United States.
Work in Public Waters	Minn. Stat. §103G.245	Permit requirements applicable to work in public waters that will change or diminish its course, current, or cross-section.
Public Water Resources	Minn. Rules ch. 6115	Water appropriation permitting, standards and criteria for alterations to structure of public water (MDNR).
Minnesota Sediment Quality Targets	Guidance for the Use and Application of Sediment Quality Targets for the Protection of Sediment-dwelling Organisms in Minnesota, MPCA Document Number: tdr-gl-04	Establishes procedures for potentially bioactive zone (PBAZ) caps and covers.
Western Lake Superior Sanitary District (WLSSD)	WLSSD Industrial Pre-Treatment Ordinance	Requirements for any dredge water discharged into public sanitary sewers.
Construction and Use of Public Sewers	Minn. Rules ch. 4715	Governs the use of sewers and public water systems if any dredge water is disposed of in public sewers.
MDNR Invasive Species Management	Minn. Statutes 84D.02	Requirements for sediment transportation if invasive species are present
Solid Waste	Minn. Rules ch. 7035	Requirements and standards for solid waste facilities.
Hazardous Waste	Minn. Rules ch. 7045	Hazardous waste listing, and generator, transport, and facility standards.
Air Pollution Emissions and Abatement	Minn. Stat. §116.061	Duty to notify and abate excessive or abnormal unpermitted air emissions.
Ambient Air Quality Standards	Minn. Rules ch. 7009	Provides air quality standards.
Preventing Particulate Matter From Becoming Airborne and Emission Standards	Minn. Rule Parts 7011.0150 and 7011.8010	Provides measures to control dust and emission standards for hazardous air pollutants.
Noise Pollution Control	Minn. Rules ch. 7030	Noise standards applicable to remedy construction.
Hazardous Waste Management	Wisconsin WAC NR 600	Establishes standards for handling and management of hazardous wastes. These disposal standards apply for both new and existing hazardous waste landfills.
Solid Waste Management	Wisconsin WAC NR 500 and Wisconsin Statute 289.43	Exemptions for the management of solid and low-hazard wastes

ARAR/TBC	Citation/Source	Description/Application
Air Pollution Control	Wisconsin WAC NR 400	Establishes air quality standards for removal and disposal of hazardous waste. They also set allowable chemical concentration levels for removal and disposal of contaminated sediments.
Applications for Discharge Permits and Water Quality Standards Variances	Wisconsin WAC NR 200	Establishes water quality effluent limits for discharges during sediment remediation activities.
Navigable Waters, Harbors, and Navigation	Wisconsin Statutes Chapter 30	Regulates work performed in navigable waters and harbors.

Water Quality

If any activity associated with the remedial actions results in an unregulated release, in accordance with the Water Pollution Control Act and Minn. Stat. 115.061, Duty to Notify, a notification and recovery of any pollutants discharged to minimize or abate pollution of the waters of the state is required. Wisconsin WAC NR 292 and 700 establishes the framework for remedial actions and the standards and procedures that allow for site-specific flexibility, pertaining to the identification, investigation and remediation of sites

In accordance with Minn. Rules ch. 7050, surface water quality standards for the maintenance and preservation of surface water quality during remedy construction, including discharges from treatment/work and stormwater runoff zones, shall be based on surface water quality standards that currently apply to Class 2B and OIRWs, as set forth in Minn. Rules, chs. 7050 and 7052, and to the additional surface water quality standards for the SLR set forth in Minn. Rules ch. 7065. Therefore, if water is discharged directly to the waters on or adjacent to the Site, it shall be treated to a level that meets applicable surface water discharge standards. Groundwater non-degradation and standards for the protection of groundwater during remedy construction are presented in Minn. Rules 7060. Wisconsin WAC NR 200 also establishes water quality effluent limits for discharges during sediment remediation activities.

During remediation, the MPCA would consider the areas in which work is performed as “treatment/work zones,” to which the surface water quality standards normally applicable to the SLR would temporarily not apply. These treatment/work zones would be physically separated from adjacent waters through the use of engineering controls such as single or multiple silt curtains, inflatable dams, sheet piling, or other measures. During construction of the remedy, any discharges occurring within those controlled treatment/work zones, such as the discharge of capping material during capping operations, the release of contaminants during dredging operations, or runoff from activities on shore, would not be subject to water quality standards. Rather, water quality standards would apply outside of the treatment/work zone, beyond the outermost engineering control structure where the water from the treatment/work zone is discharged. Other discharges occurring during remedy construction that are not included in a treatment/work zone, including discharges of treated dredge water, and discharges of stormwater runoff from shoreland modifications outside of the treatment/work zones, would also be subject to regulation.

If water is discharged, it would be treated to a level that meets applicable surface water discharge standards. The MPCA water quality standards may apply to these discharges. Final standards would be determined by the MPCA prior to implementation of the remedial actions. In the event that a standard is exceeded, further management practices would likely be required during remedy construction to reduce the amount of suspended contaminants escaping the treatment/work zone.

Wetlands, Shoreland, and Floodplain Management

In accordance with Minn. Rules ch. 7050, wetlands at the Site are classified as unlisted wetlands, Class 2B and 3B waters. In accordance with Minn. Rules ch. 8420, compliance with wetland ARARs will involve consultation with the MDNR to determine the category of wetlands present at the Site and any avoidance, mitigation, and replacement that may be necessary. Water quality standards for the maintenance and preservation of surface water quality during remedy construction including discharges from treatment/work and stormwater runoff zones shall be based on surface water quality standards that currently apply to Class 2B and 3B waters and shall comply with Minn. Stat. §§103G.221-.2373. Standards and specifications applicable to shoreland and floodplain management can be found in Executive Order 11988 and 40 CFR Part 6, Appendix A, Minn. Rules ch. 6120.

Minn. Stat. §103G.222 provides that a wetland replacement plan must be approved by the Local Governmental Unit before any Wetland Conservation Act (WCA) wetlands may be drained or filled, unless draining or filling falls within the "De Minimis" exemption or another exemption of Minn. Stat. §103G.2241. WCA wetlands are those wetlands that are not public water wetlands regulated by the MDNR and United States Army Corps of Engineers (USACE). WCA wetlands would be located above the Ordinary High Water Mark. The South St. Louis Soil and Water Conservation District provides additional guidance regarding WCA requirements for the Site at the following website: http:// www.southstlouisswcd.org/wcact.html.

Permits and Certifications

Possible permits for cleanup activities include the following:

Section 404 Permit (Clean Water Act): Required for discharge of dredged or fill material into waters of the United States. The substantive requirements of this permit shall be met for alternatives that dredge or fill waters of the state. USACE evaluates applications for Section 404 permits. Substantive requirements that may be incorporated within a Section 404 permit for off-site activities can be found in 33 CFR Parts 320 and 323.

Section 401 Certification: The Clean Water Act, 33 USC §1341, requires that any application for a federal permit that may result in a discharge to a navigable water must be accompanied by a certification from the affected state indicating that the discharge will comply with all applicable water quality standards and effluent limitations of the Act. Thus, a Section 401 certification or a 401 certification waiver for remedial action at the Site would be necessary before the USACE may issue a Section 404 permit, and a certification may be necessary before the USACE may issue a Section 10 permit if that permit authorizes a "discharge."

National Pollutant Discharge Elimination System (NPDES; Clean Water Act 33 USC §1342): Discharges of pollutants to waters of the state associated with construction of the selected remedy would be subject to the requirements applicable to a NPDES permit. Discharges could include the discharge of capping material, the discharge of contaminants released and suspended by dredging operations, the discharge of treated dredge water during dredging operations, and the discharge of stormwater runoff from shoreland modifications. These types of discharges would be subject to the same regulatory standards and controls that would apply under an MPCA permit. In addition, NPDES General Permit number MNG990000 was required for managing dredged materials; however, this permit has expired and has not been renewed. According to Managing Dredged Materials in the State of Minnesota (MPCA, 2009), an individual NPDES/State Disposal System (SDS) Dredge Materials Management permit may be required. A NPDES Construction Permit and a Stormwater Pollution Prevention Plan are required by the MPCA if more than one acre of land is disturbed by excavation activities.

Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403): A Section 10 permit is required from the USACE for any construction in or over any navigable water, or the excavation or discharge of material into such water, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters. The substantive requirements that may be incorporated within a Section 10 permit can be found in 33 CFR Parts 320 and 322.

Work in Public Waters (Minn. Stat. §103G.245 and Wisconsin Statutes Chapter 30): A permit from the MDNR is necessary for any work in public waters that will change or diminish its course, current, or cross-section. If an alternative under consideration involves dredging or capping, a public waters permit from the MDNR may be required. The substantive requirements that the MDNR may incorporate within its public waters permit are codified in statute and at Minn. Rules, ch. 6115. These requirements include compensation or mitigation for the detrimental aspects of any major change in the resource. The MDNR permits may require restoration of bathymetry (water depth) and habitat substrate (bottom) as part of the public waters permit. The MDNR would set the specific cover depth and composition requirements.

Additionally, if capping of contaminated sediments is conducted, requirements would include specifications for cap construction. In situ caps constructed for the containment of contaminated sediment must contain an isolation zone (IZ) and a potentially bioactive zone (PBAZ). The IZ is the portion of the cap that is applied directly over the contaminated sediments and is designed to isolate and attenuate the Site contaminants that could potentially be transported upward into the PBAZ at concentrations above the CULs by diffusion or advection transport mechanisms. The PBAZ is the area within the cap above the IZ where significant biological activity may potentially be present. The thickness and material specifications for the IZ and PBAZ should be determined based on pore water transport and attenuation modeling.

Under Wisconsin Statutes Chapter 30 (Permit in Navigable Waters), a permit is required from the WDNR or authorization from the legislature prior to removing material from navigable waters.

Air Emissions and Waste Management Permits: In accordance with Minn. Stat. §116.081, a permit is required for the construction, installation or operation of an emission facility, air contaminant treatment facility, treatment facility, potential air contaminant storage facility, storage facility, or system or facility related to the collection, transportation, storage, processing, or disposal of waste, or any part thereof, unless otherwise exempted by any agency rule now in force or hereinafter adopted, until plans have been submitted to the agency, and a written permit granted by the agency.

On-Site Disposal: The placement of dredged sediment into an on-site confined aquatic disposal (CAD) area and any subsequent seepage from the CAD, if implemented, would be regulated by the MPCA under the requirements applicable to an SDS permit. The legal requirements in Minnesota for an SDS are found in Minn. Stat. §115.07, Minn. Rules, Parts 7065.0100 to 7065.0160 and in other MPCA water quality rules including Minn. Rules chs. 7050 and 7052. The legal requirements in Minnesota for an SDS are found in Wisconsin WAC NR 400, 500, 600, and Wisconsin Statute 289.43.

Discharge into Sewers: A permit from the Western Lake Superior Sanitary District (WLSSD) will be necessary if any dredge water is discharged into the public sewers. Pretreatment standards that would likely apply can be found at:

http://www.wlssd.duluth.mn.us/pdf/WLSSDPretreatmentOrdinance.pdf.

The permit will also include requirements to ensure that there will be no detrimental effects to their bio-solids program. A WLSSD permit would also represent compliance with Minn. Rule, Part 4715.1600 and the MPCA water rules governing indirect discharges.

Invasive Species: A prohibited/regulated invasive species permit will be required to transport sediment to a landfill, if invasive species are present near the proposed work area.

CERCLA provides for waiving of necessary permits for on-site work, provided the work is conducted in compliance with the substantial conditions of such permits. Although the permits themselves may not be required on CERLCA Sites, compliance with the substantial conditions of these identified permits shall be met.

Construction and Use of Public Sewers

Minn. Rules ch. 4715 governing the use of sewers and public water systems would apply if any water associated with remedial activities is disposed of in public sewers.

Waste Management

Solid and hazardous waste management requirements and standards can be found in Minn. Rules chs. 7035 and 7045, respectively. USEPA guidance has consistently stated that Superfund remedies involving movement of contaminated material within the area of a Site where such material is already located (sometimes referred to as an AOC) do not create a “waste” that is subject to RCRA (42 USC §§6901 et seq.) or other waste management requirements. Remedy alternatives that require contaminated materials to be moved to an off-site land disposal site are considered to generate waste that must be managed under applicable waste management requirements.

St. Louis County Zoning Ordinances, ch. 1003, establish additional floodplain management and manage site activities such as on-site waste disposal.

Ambient Air Quality Standards

Air quality standards applicable to releases into the air from cleanup activities include Min. Stat. 116.061, Air Pollution Emissions and Abatement. During remedy construction, activities such as transportation, storage and placement of capping material may result in particulate matter becoming airborne. Minn. Rules ch. 7009 establishes ambient air quality standards for criteria pollutants regulated under the Clean Air Act. Compliance points shall be selected in accordance with Minn. Rules ch. 7009. The ambient air quality standards for particulate matter that apply to remedial actions are found at: https://www.revisor.mn.gov/rules/?id=7009.0080.

Control of the generation of airborne particulate matter during remedy construction is regulated in Minn. Rule part 7011.0150, *Preventing Particulate Matter from Becoming Airborne*, which includes measures to control dust that may be generated during remedy construction activities such as transportation, storage, and placement of capping material, which shall be addressed in the remedial design plan. Minn. Rules part 7011.8010, Site Remediation, incorporates the National Emission Standards for Hazardous Air Pollutants applicable during Site remediation activities.

Noise Pollution Control

Minn. Rules ch. 7030 establishes noise standards for various land uses. Compliance points will be selected in accordance with Minn. Rules ch. 7030. The noise standards that will apply to the selected remedial action can be found at:

https://www.revisor.leg.state.mn.us/rules/?id=7030.0040

2.1.4 Other Considerations

Other considerations under MERLA set forth the regulatory requirements, RAOs and CULs that must be met by a remedy to meet the legal standard for a remedy under MERLA and the threshold criterion for protection of public health and welfare and the environment. A remedy, as defined under MERLA, must also include any monitoring, maintenance and institutional controls (ICs) and other measures that MPCA determines are reasonably necessary to ensure the protectiveness of the selected remedy over the long term.

It is particularly important to consider the requirements for long-term assurance of protectiveness where the remedy alternatives involve the use of capping or containment to manage contaminated media within the Site. Some requirements may also be necessary to ensure long-term protectiveness of alternatives that involve excavation or dredging and off-site disposal of contaminated soil or sediment.

In addition, MERLA requires the MPCA to consider the planned use of the property where the release of contaminants is located when determining the appropriate standards to be achieved by a remedy.

In Wisconsin, regulatory requirements are set forth by Wisconsin WAC NR 292 and 700, which establishes the framework for remedial actions and standards and procedures that allow for site-specific flexibility, pertaining to the identification, investigation and remediation of sites.

Long-Term Assurance of Protectiveness

MERLA requires that a remedy include measures that are reasonably required to ensure the ongoing protectiveness of a remedy once the components of the remedy have been constructed and entered their operational phase. Such measures may include, but are not limited to, ICs and monitoring and maintenance requirements. This section discusses the measures that MPCA determines are reasonably necessary to ensure long-term protectiveness.

Institutional Controls

ICs are legally enforceable restrictions, conditions or controls on the use of property, groundwater or surface water at a property that are reasonably required to ensure the protectiveness of a remedy or other response actions taken at the Site. Areas of the Site where contaminated media remains in place after remedial construction will be subject to ICs (such as easements and restrictive covenants) that are legally binding on current and future owners of the property to ensure ongoing protection from disturbance of or exposure to the contamination. Restrictions on use may also be required for areas of the Site where contaminated media are treated and/or removed and where some residual contamination may remain.

Minn. Stat. §115B.16, subd. 2, requires an Affidavit Concerning Real Property Contaminated with Hazardous Substances to be recorded with the St. Louis County recorder by the owner of the property. The Uniform Environmental Covenants Act (UECA) and the authority for requiring environmental covenants can be found in Minn. Stat. ch. 114E. This statute requires MPCA approval of environmental covenants (which include restrictive covenants and access) when there is an environmental response project (which includes superfund cleanups) is overseen by the MPCA. Because the Site is not platted, the UECA may not apply and other ICs such as a City Ordinance may be required to prevent anchoring, fishing, dredging, and other activities that may disturb a cap or contaminated sediments left in place.

Long-Term Operation and Maintenance, Monitoring, and Contingency Action

On-site containment facilities and capping of impacted media (sediment) or any other alternative that may leave impacted media on-site will require post-construction monitoring, operation and maintenance (O&M), and contingency action plan to ensure that ARARs, RAOs and CULs that apply to the alternative are fully achieved and maintained over time.

General details of the post-construction monitoring, O&M, and contingency action plan requirements would be set forth in the FFS, along with an estimate of the cost to carry out each activity.

Sediment traps or other means of limiting incoming sediment to maintain appropriate water depth may be required; this need will be further evaluated in the design phase of this project. If sediment traps are implemented, long-term maintenance of these traps such as sediment removal will be required.

Planned Use of Property

In a provision entitled "Cleanup Standards" (Minn. Stat. §115B.17, subd. 2a), MERLA provides that when MPCA determines the standards to be achieved by response actions to protect public health and welfare and the environment from a release of hazardous substances, the agency must consider the planned use of the property where the release is located. The purpose of this provision of MERLA is to allow the MPCA to select cleanup standards that provide a level of protection that is compatible with the uses of the Site property that can be reasonably foreseen.

The specific properties directly affected by the remedies are currently idle land but under consideration for development in the near future. The cleanup standards must provide protection of public health and welfare and the environment that is consistent with any planned or potential future uses of the Site, including natural resource and habitat restoration, navigation and recreational uses. These cleanup standards are also compatible with the use of the adjacent land for residential, recreational, habitat restoration, or commercial and industrial use.

2.2 Remedial Action Objectives

The RAOs developed by the MPCA for the Site are:

1. Minimize or remove exposure to sediment contaminants that bioaccumulate in the food chain and contribute to fish consumption advisories.
2. Minimize or remove exposure of the benthic organisms to contaminated sediments above sediment cleanup goals.
3. Preserve water depth to enable the current and/or planned use of the Site.
4. Enhance aquatic habitat, if conditions allow, in a manner that contributes to the removal of BUIs.
5. Minimize or remove human exposure to contaminated sediments above sediment cleanup goals.

The following subsection presents preliminary sediment CULs developed to achieve these RAOs.

2.2.1 Preliminary Sediment CULs

The selected remedy should meet the Preliminary Sediment CULs and provide protection of ecological and human health. The CULs should also provide cleanup standards consistent with any planned or potential future uses of the Site. The Midpoint SQT for cadmium, copper, lead, mercury, nickel, zinc, PAHs, PCBs, and dioxins will serve as the CULs for the Site. The SQTs for cadmium, lead, nickel, and zinc are more conservative than the SSVs and SDCVs (PCBs); therefore, if sediments are cleaned up to the respective Midpoint SQTs to protect ecological receptors, human receptors will also be protected. Copper does not have an SSV; therefore, the sediments will be cleaned up to the Midpoint SQT. The SSVs for mercury PCBs and dioxins are expected to be below ambient concentrations in the SLR AOC; therefore, based on discussions with the MPCA, the Midpoint SQT was selected for the CULs until ambient concentrations studies are completed. The following table presents the CULs for the COCs identified in **Section 1.4.3.5**.

Contaminant	Units	CUL
Cadmium	mg/kg	3
Copper	mg/kg	91
Lead	mg/kg	83
Mercury	mg/kg	0.64
Nickel	mg/kg	36
Zinc	mg/kg	290
Total PAHs	µg/kg	12,300
PCBs	µg/kg	370
Dioxins	ng TEQ/kg	11.2

Notes:
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
ng TEQ/kg = nanograms toxic equivalency per kilogram

3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

3.1 Remedial Technology Identification and Screening Process

Potential technologies for addressing conditions at the Site were identified based upon professional experience of Bay West staff, discussions between Bay West and MPCA staff, and guidance developed for the remediation of contaminated sediment sites (USEPA, 2005; Interstate Technology and Regulatory Council [ITRC], 2014). Information collected during the 2015 RI was used to compile the CSM and identify feasible technologies for the Site.

A qualitative approach was used to screen technologies using a three-part ranking system where each technology was evaluated on effectiveness, implementability, and relative cost:

- Effectiveness was evaluated by the predicted ability of the technology under consideration to ensure long-term protection of human health and the environment while minimizing short-term impacts during implementation, as well as the technology's ability to meet RAOs.
- Implementability was evaluated by considering the technical and administrative feasibility of the technology. Technical feasibility includes the ability to achieve RAOs and the avoidance of creating additional risk during implementation, including the degree of disruption in the project area. Administrative feasibility includes the consideration of permits required for technology implementation, availability of disposal facilities and equipment necessary for the technology, and coordination with applicable agencies and stakeholders.
- Relative costs used for technology screening were based on engineering judgment, rather than detailed estimates. Detailed cost estimates were compiled for each individual alternative, which incorporate technologies meeting screening criteria, and are presented in **Section 3.3**.

Table 2 presents a summary of the technology screening results. The following sections describe the technologies that were screened using the three-part ranking system.

3.1.1 Institutional Controls

ICs are legally enforceable restrictions, conditions, or controls on the use of property, ground water, or surface water at a contaminated site that are reasonably required to ensure the protectiveness of a remedy or other response actions taken at the Site. If contaminated sediments remain in place after remedial actions are taken, the Site would be subject to ICs (such as easements and restrictive covenants) that are legally binding on current and future owners of the property to ensure ongoing protection from disturbance of or exposure to the contamination. Most remedial alternatives include ICs until long-term monitoring (LTM) indicates that risk reduction was achieved and the RAOs have been met (ITRC, 2014). The following information obtained from USEPA sediment remediation guidance (USEPA, 2005) details ICs likely appropriate for use at the Site.

Fish consumption advisories are informational devices that are frequently already in place and incorporated into sediment site remedies. Commercial fishing bans are government controls that ban commercial fishing for specific species or sizes of fish or shellfish. Usually, state departments of health are the governmental entities that establish these advisories and bans. An advisory usually consists of informing the public that they should not consume fish from an area, or consume no more than a specified number of fish meals over a specific period of time from a particular area. Sensitive sub-populations or subsistence fishers may be subject to more stringent advisories. Advisories can be publicized through signs at popular fishing locations, pamphlets, or other educational outreach materials and programs. Consumption advisories are not enforceable controls and their effectiveness can be extremely variable (USEPA, 2005).

Waterway use restrictions may be necessary to ensure the integrity of the alternative for any alternative where subsurface contamination remains in place (e.g., capping, Monitored Natural Recovery [MNR], or an in-water confined disposal site). Examples include restricting boat traffic in an area to establish a no-wake zone, or prohibiting anchoring of vessels. In considering boating restrictions, it is important to determine who can enforce the restrictions, and under what authority and how effective such enforcement was in the past. In addition, a restriction on easements for installing utilities, such as fiber optic cables, can be an important mechanism to help ensure the overall protectiveness of a remedy (USEPA, 2005).

It may be necessary to work with private parties, state land management agencies, or local governments to implement use restrictions on nearshore areas and adjacent upland properties where contamination remains in place. For example, construction of boat ramps, retaining walls, or marina development can expose subsurface contamination and compromise the long-term effectiveness of a remedy. Where contaminated sediment exceeding CULs is identified in proximity to utility crossings or other infrastructure and temporary or permanent relocation of utilities in support of a dredging remedy may not be feasible or practical, capping may be desirable even though temporary cap disruption may be necessary periodically (USEPA, 2005).

3.1.2 Monitoring

Monitoring is the collection and analysis of data (chemical, physical, and/or biological) over a sufficient period of time and frequency to determine the status and/or trend in one or more environmental parameters or characteristics. Monitoring should not produce a “snapshot in time” measurement, but rather should involve repeated sampling over time in order to define the trends in the parameters of interest relative to clearly defined management objectives. Monitoring is recommended for all types of sediment remedies both during and after remedial action and can be classified as construction monitoring and performance monitoring (also referred to as LTM), respectively. Monitoring should be conducted for a variety of reasons, including: 1) to assess compliance with design and performance standards; 2) to assess short-term remedy performance and effectiveness in meeting sediment CULs; and/or 3) to evaluate long-term remedy effectiveness in achieving RAOs and in reducing human health and/or environmental risk. In addition, monitoring data are usually needed to complete the five-year review process where a review is conducted.

Monitoring activities applicable to the Site could include one or more of the following based on the selected remedy:

- Collection of sediment chemical data to ensure that CULs have been achieved (due to dredging, in situ treatments, or degradation);
- Measurements of cover/cap thicknesses or other engineered controls to ensure continued isolation of contaminants and physical cap integrity;
- Measurement of COC concentrations in cover/cap material to ensure that contaminants are not migrating into or through the cover/cap; and
- Measurement of toxicity to and bioaccumulation of COCs within aquatic organisms such as benthics and fish in order to evaluate reduction trends.

Construction monitoring may also be performed to ensure that contamination or nuisance materials are not released during construction activities. Construction monitoring activities applicable to the Site include one or more of the following:

- Turbidity monitoring to ensure that the off-site release of suspended sediments containing COCs is mitigated during dredging and/or cover/cap placement;
- Air monitoring to ensure that the off-site release of nuisance and/or contaminated dusts is mitigated during construction activities such as the mixing of sediments and amendment materials, hauling over dirt or gravel roadways, and excavation or other intrusive Site work;
- Periodic sampling of treated dredge contact water to mitigate contaminant inputs to water bodies or local sewage systems and to ensure that treated water meets permit or municipality requirements;
- Periodic sampling of dredged materials to ensure that landfill requirements for acceptance are achieved;
- Periodic sampling of imported materials (e.g., cover/cap materials, shoreline restoration materials, etc.) to mitigate impacts to water bodies or upland areas as a result of placement; and
- Pre- and post-construction soil sampling to access impacts of construction activities on lands used during the construction phase.

Both construction and performance monitoring (referred to as LTM) are incorporated into each of the remedial alternatives developed for this FFS.

3.1.3 Monitored Natural Recovery

MNR is defined by the National Research Council as a remediation practice that relies on natural processes to protect the environment and receptors from unacceptable exposures to contaminants. This remedial approach depends on natural processes to decrease chemical contaminants in sediment to acceptable levels within a reasonable time frame. With MNR, contaminated sediments are left in place and monitored for ongoing physical, chemical, and biological processes that transform, immobilize, isolate, or remove contaminants until they no longer pose a risk to receptors. Natural processes that contribute to MNR may include sediment burial, sediment erosion or dispersion, and contaminant sequestration or degradation (for example, precipitation, adsorption, or transformation). These natural processes can reduce exposure to receptors (and thus reduce risk) and contribute to the recovery of the aquatic habitat and the ecological resources that it supports. MNR can be used alone or in combination with active remediation technologies to meet RAOs (ITRC, 2014).

3.1.4 Enhanced Monitored Natural Recovery

Enhanced Monitored Natural Recovery (EMNR) relies on the same natural processes as MNR to decrease chemical contaminants in sediment but includes the application of material or amendments to enhance these natural recovery processes. EMNR can use several technologies including, but not limited to, thin-layer capping and introduction of reactive amendments such as activated carbon (AC). Thin-layer caps (typically up to 1 foot) are often applied as part of an EMNR approach. These caps enhance ongoing natural recovery processes, while minimizing effects on the aquatic environment. Thin-layer caps are not intended to completely isolate the affected sediment, as in a conventional isolation capping remedy. This layer also accelerates the process of physical isolation, which continues over time by natural sediment deposition (ITRC, 2014).

3.1.5 In Situ Treatment

In situ sediment treatment involves applying or mixing of an amendment into sediments. Mixing may be achieved either passively, through natural biological processes such as bioturbation, or actively through mechanical means such as augers. In situ treatment technologies can achieve risk reduction in environmentally sensitive environments such as wetlands and emergent aquatic vegetation habitats, where sediment removal or containment by capping might be harmful. Treatment amendments typically reduce concentrations of freely dissolved chemicals that are available for exposure to organisms or that may be mobilized and transferred from sediment to the overlying water column (ITRC, 2014). The following in situ treatment technologies were screened in this evaluation:

- Immobilization – Immobilization treatments add chemicals or cements to reduce the leachability of contaminants. Mechanisms include solidification (encapsulation) or stabilization (chemical or absorptive reactions that convert contaminants to less toxic or mobile forms);
- Enhanced bioremediation – Microbial degradation by bacteria or fungi is enhanced by adding materials such as oxygen, nitrate, sulfate, hydrogen, nutrients, or microorganisms to the sediment;
- Oxidation/reduction – Chemicals are injected into sediment to act as an oxidant/electron acceptor to facilitate aerobic decomposition of organic matter;
- Chemical oxidation – The addition of chemical oxidizers to sediment can cause the rapid and complete chemical destruction of many toxic organic chemicals;
- Phytoremediation – Phytoremediation uses plant species to remove, transfer, stabilize, and destroy contaminants in sediment. Generally limited to sediments in shallow water zones and low concentrations; and
- Adsorption – Adsorbents can be used as sediment amendments for in situ treatment of contaminants. Sorption of metals and organics can take place simultaneously with a suitable combination of sorbents.

3.1.6 Capping

Capping is the process of placing a clean layer of sand, sediments, or other material over contaminated sediments in order to mitigate risk posed by those sediments. The cap may also include geotextiles to aid in layer separation or geotechnical stability, amendments to enhance protectiveness, or additional layers to armor and maintain its integrity or enhance its habitat characteristics.

When amendments are mixed directly into sediments, the resulting remedy is termed “in situ treatment.” When these amendments are added to cap material, the remedy is called an “amended cap,” and the amendments enhance the performance of the cap material. The same amendment used in the same proportions is generally more effective at isolating contaminants when used in a cap than when placed directly into sediments. The amended cap provides the benefits of capping in addition to the benefits of the treatment amendment (ITRC, 2014).

A cap should consist of at least two parts; an IZ and a PBAZ. The IZ is the portion of the cap that is applied directly over the contaminated sediments and is designed to isolate and attenuate contaminants that could potentially be transported upward into the PBAZ by diffusion or advection transport mechanisms. The PBAZ is the area within the cap above the IZ where biological activity may potentially be present. The PBAZ thickness can be estimated based on the potential organisms (both plant and animal) that may be present or take up residency once the cap is constructed. Contaminant levels should not exceed CULs for COCs throughout the entire thickness of the PBAZ.

3.1.7 Dredging and Excavation

Dredging consists of the removal of contaminated sediment from water bodies in order to reduce risks to human health and the environment. Removal is particularly effective for source control (mass removal of hot spots) but potentially less effective for overall risk reduction because of resuspension and residual contamination. The three methods of contaminated sediment removal are mechanical dredging, hydraulic dredging, and excavation. As with any type of removal operation, additional technologies are required to appropriately handle the removed sediment. Dredged material handling technologies may involve transport, dewatering, treatment, and or disposal of sediment (ITRC, 2014). Mechanical dredging, hydraulic dredging, and excavation were screened independently in this evaluation.

After removal, the contaminated sediment can be treated or disposed of in a controlled setting, such as an off-site landfill or other treatment, storage, and disposal facility, an on-site aquatic or terrestrial confined disposal facility (CDF), or a facility that converts the sediment to a reusable product. Disposal methods were evaluated independently from dredging and excavation and are described further in **Section 3.1.9**.

3.1.8 Dewatering

Dewatering may be necessary to prepare dredged materials for disposal. Dewatering reduces the water content and hence the volume and weight of the disposed sediment. If the material is to be reused or further treated, dewatering also leads to reduced transportation cost and improves handling properties. The nature and extent of dewatering needed depends on the sediment characteristics and the type of dredging, transport, and disposal methods planned for the removed material (ITRC, 2014). Dewatering technologies may rely upon gravity draining and evaporation processes (e.g., spreading and geotextile bags), mechanical processes (e.g., filter presses), and chemical conditioning (e.g., polymer additions and stabilization additives). The type of dewatering technology selected for use may depend upon the amount of space available for dewatering, the distance of the dewatering space from dredging operations, discharge options for treated dredge contact water, project scope, and cost of implementing the technology.

3.1.9 Disposal

Disposal of dredged or excavated sediment is the placement of materials into a controlled site or facility to permanently contain contaminants within the sediment. Management is achieved through the placement of materials into facilities such as sanitary landfills, hazardous material landfills, CDFs, or CAD facilities. Off-site landfills are generally used for dredged material disposal when on-site disposal is not feasible or when off-site disposal is more cost effective.

Landfills have been used for sediment volumes of over 1 million cubic yards. Typically, some type of on-site or near-site disposal facility is used at sites where dredged material volumes greater than 200,000 cubic yards are generated. Landfilling is also favored at smaller or moderately sized sites, where transportation is feasible. The associated hazards and cost of transporting and landfilling large volumes of sediment make this disposal method somewhat less desirable than other solutions. Other considerations, such as public and stakeholder acceptance, lack of access to suitable on-site land- or water-based disposal facilities, and proximity to an existing off-site landfill may support the landfilling option.

CDFs are constructed to isolate dredged sediment from the surrounding environment. CDFs can be located upland, near shore, or in the water (as an island). Material staging or a temporary CDF may be necessary for dewatering dredged sediment. CDFs represent a common disposal method and typically are built for larger volume sites (200,000 cubic yards or more of sediment).

The CAD method deposits dredged material within a nearby body of water. A pre-existing depression within the sediment surface is preferred, though one can be created if necessary. Dredged sediment is deposited in the depression and capped with clean material. This process carries with it the same risks associated with using capping as a remedy. The goal of moving the contaminated sediment to the aquatic disposal site is to reduce the risk of exposure to contaminated materials (ITRC, 2014).

Disposal at landfills, CDFs, and CADs were screened independently in this evaluation.

3.1.10 Remedial Technology Screening Results

Table 2 documents the technology screening process and results. The following remedial technologies were determined to be the most effective, implementable, and cost-effective and were retained for assembling the alternatives described in **Section 3.3**:

- ICs;
- Monitoring;
- Enhanced Monitored Natural Recovery; and,
- Excavation with off-site disposal.

3.2 Implementation Assumptions

This section describes important factors and assumptions for implementing one or more of the alternatives presented in **Section 3.3**.

Implementation of alternatives involving placement of sand and/or amendment materials would require identification and construction of a staging area in which to receive and stockpile imported materials and for loading of materials into barges for transport to the Site. Based on conversations between Bay West and the Duluth Seaway Port Authority, City of Duluth, and MPCA, the most likely staging area location would be Hallett Dock #7. Hallett Dock #7 is located approximately 3 miles downriver of the Site and is located within part of the Interlake/Duluth Tar (IDT) Superfund site. It is currently being considered for purchase by the Duluth Seaway Port Authority and could serve as a staging facility for future remediation projects throughout the Duluth/Superior Harbor. Although previous remedial activities have resulted in capping of sediments between Hallett Dock #7 and lands to the west, the end of the dock is nearly 500 feet in width and could potentially be used as a mooring location for sediment/cap material transport barges operating between Hallett Dock #7 and remediation sites (Sharrow, 2016).

Hallett Dock #7 is not currently used for barge mooring, berthing, or as a staging area, but has served similar purposes in the past. The facilities are currently in fair to poor condition and may require repairs before use. Inspection of the dock walls and their suitability for use should be conducted prior to the design phase. For the purposes of this FFS, the dock end wall was assumed to be in acceptable condition for mooring barges and the dock suitable for use as a staging area for all alternatives. Satellite imagery indicates the presence of a large paved area at the end of Hallett Dock #7, which is appropriately sized for stockpiling materials.

3.3 Development of Alternatives

This section describes the alternatives developed for the Site. The alternatives were developed using the selected remedial technologies discussed in **Section 3.1**, Site data collected during previous investigations and the 2015 RI, 2017 sampling, and the CSM. Site sediment chemical data was used to estimate the depth and spatial extent of the remedial areas for COCs as presented in **Figure 6**. A summary of the proposed alternatives is presented in **Table 3**. Calculations used to determine volumes, rates, and time frames related to remedy construction are presented in Table 1 in **Appendix C**. Assumptions made to compile cost estimates were incorporated into a Technical Analysis and are also included in **Appendix C**. Areas of the Site exceeding the CULs equal approximately 39 acres; however, 5.9 acres of the remedial footprint exists within Wisconsin, so all remedial alternatives may be funded and implemented in cooperation with the WDNR.

The total present value costs for alternatives presented within this FFS should be considered to be rough order of magnitude (ROM) costs. Based on the Association for the Advancement of Cost Engineering ROM classification chart, estimates presented in this FFS are considered Class 4. Class 4 estimates are considered Schematic Designs; 15 to 20% of the level of effort required to have a complete estimate was done. Actual cost of the project could be 50% greater or 30% less (+50/-30) than the estimates developed thus far. ROM cost estimates for the FSS were compiled using a variety of sources. These sources include construction cost data from RSMeans estimating software for open shop pricing in Duluth, Minnesota; current Bay West and state contract rates for labor, equipment, and sample analysis; personal communication with vendors; historic cost data from projects similar in size and scope; other FFS documents, presentations, or technical papers that provided estimated or real construction cost data; and available online vendor pricing of materials. Preset value calculations are included in Table 5 in **Appendix C**.

3.3.1 Alternative 1: No Action

The NCP at Title 40 CFR provides that a No Action Alternative should be considered at every site. A No Action Alternative should reflect the site conditions described in the baseline risk assessment and remedial investigation. The No Action Alternative included within this FFS does not include any treatment or engineering controls, ICs, or monitoring. There are no costs associated with the No Action Alternative. The No Action Alternative could potentially be a viable alternative if a future toxicity/bioaccumulation study indicates that concentrations of Site COCs in sediments pose no significant detrimental effects to aquatic life (i.e., benthics and fish).

3.3.2 Alternative 2: Monitored Natural Recovery

This alternative consists of a monitoring and evaluation period of 30 years and implementation of ICs. Based on hydrodynamic findings at the U.S. Steel site, sufficient sedimentation may be occurring at the Site to reduce availability and concentrations of COCs in sediment and/or reducing toxic/bioaccumulative effects in marine organisms (i.e., benthics and fish). The objective of this alternative is to provide data to determine the potential for natural recovery processes at the Site. The major components of the MNR alternative are described in the following sections.

3.3.2.1 Monitoring and Evaluation

Contaminated sediments would remain in place as part of the MNR alternative and therefore a monitoring and evaluation period would be necessary to evaluate whether COC concentrations in affected media meet RAOs, or continue to decrease and are expected to meet RAOs in an acceptable time frame. A 30-year monitoring period was used to determine monitoring and evaluation costs based on discussions with the MPCA. Monitoring and evaluation events would be performed 1, 3, and 5 years following selection of the MNR remedy. It is likely that the monitoring and evaluation period will be recommended to continue after the initial 5 years. The monitoring and evaluation period includes the following elements:

- Collecting hydrodynamic Site data to include analysis of erosion and sediment deposition rates, flow velocities, and new bathymetric survey data;
- Collection of sediment samples to be analyzed for Site COCs;
- Collection of sediment samples for benthic toxicity and bioaccumulation analysis;
- Collection of fish tissue samples for bioaccumulation analysis;
- Bathymetric survey of the entire Site on Year 5; and
- Review of IC enforcement status.

3.3.2.2 Long-Term Monitoring

LTM would commence if results of the monitoring and evaluation period indicate that MNR is occurring in a reasonable time frame to achieve RAOs. LTM would include collection of Site data to monitor sedimentation rates and sequestration of COCs in sediments; monitor reduction trends in sediment toxicity to benthic organisms and COC bioaccumulation in benthic and fish tissue; and ensure that ICs continue to be enforced as long as COCs remain in sediments above the CUL.

LTM data collection would be conducted periodically for an indefinite period of time or until concentrations of COCs in sediments attenuate to levels below the CULs and are deemed protective of human health and the environment. For the purposes of this FFS, it was assumed that data collection would occur once every 5 years for a period of 30 years. If attenuation of COC concentrations to levels below the CULs does not occur after 30 years then monitoring will likely continue.

Data collection will consist of the following:

- Collection of sediment cores or sediment profile imagery to observe sediment accumulation;
- Collection of sediment samples to be analyzed for Site COCs;
- Collection of sediment samples for benthic toxicity and bioaccumulation analysis;
- Collection of fish tissue samples for bioaccumulation analysis; and
- Review of IC enforcement status.

Potential monitoring locations are presented in **Figure 8**.

3.3.2.3 Institutional Controls

ICs applicable to this alternative include those that would protect against direct human contact with contaminated sediments and ingestion of contaminants through fish consumption. The MDH currently communicates fish consumption guidelines for the lakes and rivers of Minnesota. Advisories for consumption of fish within the SLR and below the Fond du Lac Dam are in place for 11 species of fish due to the presence of mercury and PCBs within fish tissue. No specific advisories are in place related COCs. It is currently unknown whether the meal advice provided within the fish consumption guidelines is protective for these compounds; therefore, the applicability of meal guidelines to COCs would require investigation. Postings warning of contaminated sediments would be posted near potential Site access locations and would be modified according to changes in Site use (e.g., placed at boat launch and fishing dock).

3.3.2.4 Cost

The estimated total present value cost for Alternative 2 is approximately $244,000. **Table 4** presents a general breakdown of the estimated costs associated with Alternative 2.

3.3.3 Alternative 3: Enhanced Monitored Natural Recovery with Broadcasted Amendment

This alternative would consist of broadcasting an amendment material over sediments with COC concentrations exceeding their respective CULs (**Figure 9**). The objective of applying an amendment material to in situ sediments at the Site is to reduce the bioavailability of the COCs to aquatic life by absorption to the sediment amendment. The reduction in availability of COCs in sediments and sediment pore water limits transfer of chemical contaminants to higher trophic organisms. This alternative was developed to minimize intrusive remedial action construction activities within emergent vegetation areas already established at the Site.

ICs would be implemented and LTM would commence following application of the selected amendment to remedial areas. The major components of Alternative 3 are described in the following sections.

3.3.3.1 Amendment Selection and Application Rate

This alternative consists of applying a thin layer of amendment material directly on top of in situ contaminated sediments. It is anticipated that the amendment material would be mixed into the underlying sediments over time through natural bioturbation processes caused by burrowing organisms, larger animal life, and rooting plants; therefore, this alternative is intended to reduce contaminant availability rather than provide isolation from contaminants as in a traditional capping scenario. The chosen amendment material would reduce exposure of aquatic life to COCs through sequestration of COCs in sediments and sediment pore water. Selection of an amendment material would be conducted during the design phase and would likely be selected based on results of bench and/or pilot scale testing. Potential amendment materials for consideration include permeable Sedimite™, Organoclay™, phosphate additives (e.g., apatite), bauxite, biopolymers, and zeolite (USEPA, 2013). Any potential negative effects of these amendments, such as the potential for increased levels of eutrophication for phosphate additives, should also be considered during amendment selection.

The chosen application rate (i.e., thickness) of amendment to be applied should be capable of sequestering COCs in sediments and sediment pore water for an indefinite period of time, assuming that no ongoing source of contamination is present. According to Sedimite™ technical staff, a product dose of 31 tons per acre is required for the Site, resulting in a 0.01-meter (0.5-inch) layer of amendment material applied to in situ sediments strictly for cost analysis purposes. The final amendment application rate would be determined during the design phase and may largely depend upon COC sediment concentrations, depth of contamination, and the presence or absence of groundwater upwelling.

Implementation of this alternative assumes that approximately 2,000 cubic yards of amendment material would be broadcasted over a 39-acre area at an average thickness of 0.01 meter (approximately 0.5 inches).

3.3.3.2 Long-Term Monitoring

LTM would commence after remedy implementation and would include collection of Site data to monitor mixing of the amendment material throughout the sediment column over time; monitor sequestration of COCs in sediments; monitor reduction trends in sediment toxicity to benthic organisms and COC bioaccumulation in benthic and fish tissue; and ensure that ICs continue to be enforced as long as COCs remain in sediments above the CUL.

Data collection would be conducted periodically for an indefinite period of time or until remedial goals are achieved. For the purposes of this FFS, it was assumed that data collection would occur once every 5 years, starting at year zero, for a period of 30 years, totaling seven events. If no remedial or developmental activity has taken place to reduce or isolate sediment contamination after 30 years, then monitoring may continue or a different remedy may be evaluated.

Data collection will consist of the following:

- Collection of sediment cores or sediment profile imagery to observe mixing of amendment material throughout the sediment column;
- Collection of sediment samples to be analyzed for Site COCs;
- Collection of sediment samples for benthic toxicity and bioaccumulation analysis;
- Collection of fish tissue samples for bioaccumulation analysis; and
- Review of IC enforcement status.

Potential monitoring locations are presented in **Figure 9**.

3.3.3.3 Institutional Controls

ICs applicable to Alternative 3 are the same as presented in **Section 3.3.2.3** for Alternative 2. No ICs are necessary for maintenance of the cover as cover material is anticipated to mix with underlying sediments; any intrusive activities conducted at the Site in the future would likely serve to further mix cover materials with underlying sediments.

3.3.3.4 Cost

Calculations used to determine unit rate costs for each of the alternatives are presented in Table 2 in **Appendix C**. Other project costs determined on a lump sum basis are presented in Table 3 in **Appendix C**. The monitoring and evaluation program and associated costs developed for each alternative are presented in Table 4 in **Appendix C**. The costs associated with each alternative are presented as Class 4 (+50/-30) estimates and are appropriate for remedial design alternative evaluations only.

The estimated total present value cost for Alternative 3 is $8,252,000. **Table 5** presents a breakdown of the estimated costs associated with Alternative 3.

3.3.4 Alternative 4: Enhanced Monitored Natural Recovery with Thin-Layer Amended Cover

This alternative would consist of constructing a 0.15-meter (0.5-foot) thin-layer amended cover over sediments with COC concentrations exceeding the CULs (**Figure 10**). The objective of this alternative is to reduce the availability of COCs to aquatic organisms through addition of an amendment material and subsequent sequestration of contaminants as discussed for Alternative 3, and to provide some immediate isolation of contaminated sediments through construction of 0.15 meters (6 inches) of clean substrate. Construction of the thin-layer amended cover would take place in both open water and emergent vegetation areas of the Site.

ICs would be implemented and LTM would commence following construction of the thin-layer amended cover. The major components of Alternative 4 are described in the following sections.

3.3.4.1 Cover Design

It was assumed for the purposes of this FFS that a 0.15-meter thin-layer amended cover would be constructed and that the thin-layer amended cover would consist of sand mixed with the same volume of amendment applied in Alternative 3 (31 tons per acre). It is anticipated that a single layer of a sand/amendment mix would be constructed rather than separate amendment and sand layers. Amendments mixed into and applied with soil or sand may provide better dispersion, uniformity, placement controls, and contact time when the required quantity of amendment is small, versus bulk placement of amendment materials (USEPA, 2013). The assumed thin-layer amended cover thickness and amendment ratio was selected strictly for the purposes of the cost analysis and should be refined during the design phase. The chosen application rate (i.e., mix ratio) of amendment to be applied should be capable of sequestering COCs migrating upward through the thin-layer amended cover material and should account for mixing of cover material into underlying sediments over time through bioturbation processes. The chosen amendment material would reduce exposure of aquatic life to COCs through sequestration of COCs in sediments and sediment pore water, as discussed for Alternative 3, and should be selected during the design phase based on bench or pilot scale testing.

Implementation of this alternative assumes that approximately 31,000 cubic yards of sand and 2,000 cubic yards of amendment material would be mixed and applied over a 39-acre area at an average thickness of 0.15 meter. The total volume of material to be placed, amendment plus sand, would be approximately 33,000 cubic yards. The need for burning, mowing, or laying down of vegetation in wetland areas prior to construction of the thin-layer amended cover should be determined during the design phase.

3.3.4.2 Long-Term Monitoring

LTM would commence after remedy implementation and would include collection of Site data to monitor concentrations of COCs in cover material; monitor mixing of cover materials throughout the sediment column over time; monitor attenuation and/or sequestration of COCs in sediments; monitor reduction trends in sediment toxicity to benthic organisms and COC bioaccumulation in benthic and fish tissue; and ensure that ICs continue to be enforced as long as COCs remain in sediments above the CUL.

Data collection would be conducted periodically for an indefinite period of time or until remedial goals are achieved. For the purposes of this FFS, it was assumed that data collection would occur once every 5 years, starting at year zero, for a period of 30 years, totaling seven events. If no remedial or developmental activity has taken place to reduce or isolate sediment contamination after 30 years, then monitoring may continue or a different remedy may be evaluated.

Data collection will consist of the following:

- Collection of thin-layer amended cover samples (0 to 0.15 meter bss) to be analyzed for COCs;
- Collection of sediment samples below 0.15 meter bss to be analyzed for COCs;
- Collection of sediment cores or sediment profile imagery to observe mixing of cover materials throughout the sediment column;
- Collection of sediment samples for benthic toxicity and bioaccumulation analysis;
- Collection of fish tissue samples for bioaccumulation analysis; and
- Review of IC enforcement status.

Potential monitoring locations are presented in **Figure 10**.

3.3.4.3 Institutional Controls

ICs applicable to Alternative 4 are the same as presented in **Section 3.3.2.3** for Alternative 2. No ICs are necessary for maintenance of the thin-layer amended cover as cover material is anticipated to mix with underlying sediments; any intrusive activities conducted at the Site in the future would likely serve to further mix cover materials with underlying sediments.

3.3.4.4 Cost

Calculations used to determine unit rate costs for each of the alternatives are presented in Table 2 in **Appendix C**. Other project costs determined on a lump sum basis are presented in Table 3 in **Appendix C**. The monitoring and evaluation program and associated costs developed for each alternative are presented in Table 4 in **Appendix C** The costs associated with each alternative are presented as Class 4 (+50/-30) estimates and are appropriate for remedial design alternative evaluations only.

The estimated total present value cost for Alternative 4 is $10,733,000. **Table 6** presents a breakdown of the estimated costs associated with Alternative 4.

3.3.5 Alternative 5: Excavate with Offsite Disposal

This Alternative consists of complete removal of sediments with COCs exceeding the CULs within the remedial footprint (**Figure 11**). Removal of contaminated sediments would mitigate exposure of aquatic and human receptors to sediment contaminants, thus allowing for achievement of RAOs. The presence of any dredge residuals exceeding CULs following completion of dredging activities may require additional actions to be taken, such as placement of a cover to mix, dilute, and cover any remaining dredge residuals, enforcement of ICs, and post-construction monitoring. The success of a dredging and excavation remedy at removing all contaminated sediments cannot be determined at this time and, therefore, IC and monitoring costs associated with addressing dredge residuals were not incorporated into the cost analysis. The placement of a 0.15-meter (0.5-foot) layer of clean sand following dredging implementation was assumed within the cost analysis to manage dredge residuals and to provide benthic habitat if dredging is conducted to bedrock in some areas of the Site.

Based on input from MPCA multiple dredging passes instituted based on exceedances of post dredge verification criteria would not be conducted. Dredging would be conducted to a defined dredge prism neat line using best management practices to control and reduce contaminated dredge residuals. A Normal Dredge Residue verification approach may be used to insure that best management practices are being followed and that “undredged inventory” is accounted for.

The major components of Alternative 5 are described in the following sections.

3.3.5.1 Dredge and Excavation Volume Assumptions

The estimated remedial footprint for this alternative is presented in **Figure 11**. As stated previously, the remedial footprint is estimated at 39 acres and all areas that comprise the remedial footprint are assumed to contain historically deposited sediments with COCs exceeding CULs. The depth of contamination was estimated at 0.50 meter (1.6 feet) within the remedial footprint. These estimates equate to a total volume of approximately 134,000 cubic yards of contaminated sediments requiring removal. Further sampling would be required to further delineate the vertical and horizontal extent of contamination at the Site.

3.3.5.2 Construction Implementation

Potential sediment removal methods were reviewed along with Site constraints to develop a construction scenario and cost analysis for this alternative. Assumptions regarding construction implementation are contained within the Technical Analysis (**Appendix C**) and consist of the following elements:

- Construction of a staging area, to include a lined sediment dewatering area and materials staging area;
- Installation of a water-tight cofferdam and subsequent dewatering of the area within the cofferdam;

- Dredging of sediments “in the wet” using a barge-mounted excavator in areas adjacent to the primary river channel and outside the cofferdam area (production rate of 34 cubic yards per hour or approximately 740 cubic yards per day, assuming 22 hour work days);
- Sediment solidification and off-site landfill disposal;
- Construction of a 0.15-meter sand cover over the entire remedial footprint;
- Habitat restoration and wetland plantings; and
- Site restoration.

Implementation of the construction scenario above would require multiple construction phases to be conducted concurrently in order to implement the remedy within two construction seasons. The estimated time frame to implement the sediment dredging and excavation construction period, given the assumptions outlined above, is approximately 45 weeks over two construction season assuming a 5-day work week. See the Technical Analysis (**Appendix C**) text and tables for further project implementation assumptions used to compile the cost analysis.

3.3.5.3 Cost

Calculations used to determine unit rate costs for each of the alternatives are presented in Table 2 in **Appendix C**. Other project costs determined on a lump sum basis are presented in Table 3 in **Appendix C**. The monitoring and evaluation program and associated costs developed for each alternative are presented in Table 4 in **Appendix C**. The costs associated with each alternative are presented as Class 4 (+50/-30) estimates and are appropriate for remedial design alternative evaluations only.

The estimated total present value cost for Alternative 5 is $21,216,000. Table 7 presents a breakdown of the estimated costs associated with Alternative 5.

3.3.6 Alternative 6: Hotspot Dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment

This Alternative consists of removal of sediments with COCs exceeding the CULs within the 7.4-acre contamination hotspot identified within the remedial footprint, combined with a broadcast amendment applied to the remedial footprint (excluding the hotspot area) as shown on **Figure 12**. Alternative 6 combines the methods and procedures outlined in Alternative 3 for the broadcasting of amendment materials and the excavation of contaminated sediments outlined in Alternative 5.

Removal of sediments with the highest concentrations of primary COC contaminates, which happens to occur in publicly accessible areas most likely to result in human exposures, would mitigate exposure of aquatic and human receptors to sediment contaminants, thus allowing for achievement of RAOs. The presence of any dredge residuals exceeding CULs in the hotspot area following completion of dredging activities may require additional actions to be taken, such as placement of a cover to mix, dilute, and cover any remaining dredge residuals, enforcement of ICs, and post-construction monitoring. The success of a dredging and excavation remedy at removing all contaminated sediments cannot be determined at this time and, therefore, IC and monitoring costs associated with addressing dredge residuals were not incorporated into the cost analysis. The placement of a 0.15-meter (0.5-foot) layer of clean sand in the hotspot area following dredging implementation was assumed within the cost analysis to manage dredge residuals and to provide benthic habitat if dredging is conducted to bedrock in some areas of the

Site. Dredging of the hotspot area would be conducted in a similar manner as described in Alternative 5.

This alternative consists of applying a thin layer of amendment material, assumed for the purposes of this FFS to be Sedimite™, directly on top of in situ contaminated sediments as described in Alternative 3. It is anticipated that the amendment material would be mixed into the underlying sediments over time through natural bioturbation processes caused by burrowing organisms, larger animal life, and rooting plants; therefore, this alternative is intended to reduce contaminant availability rather than provide isolation from contaminants as in a traditional capping scenario.

ICs would be implemented and LTM would commence following application of the selected amendment to remedial areas.

The major components of Alternative 6 are described in the following sections.

3.3.6.1 Dredge and Excavation Volume Assumptions

The estimated hotspot excavation area for this alternative is presented in **Figure 12**. As stated previously, the hotspot area is estimated at 7.4 acres and all areas that comprise the remedial footprint are assumed to contain historically deposited sediments with COCs exceeding CULs. The depth of contamination was estimated at 0.50 meter (1.6 feet) within the hotspot area. These estimates equate to a total volume of approximately 25,300 cubic yards of contaminated sediments requiring removal. Further sampling would be required to further delineate the vertical and horizontal extent of contamination at the Site.

3.3.6.2 Construction Implementation

Construction implementation would be the same as described in Alternative 5; however, due to the smaller footprint being dredged, a 12-hour work day was assumed, resulting in a daily production rate of 350 cubic yards a day. The estimated time frame to implement the sediment dredging and excavation construction period is approximately 33 weeks over a single construction season assuming a 5-day work week. See the Technical Analysis (**Appendix C**) text and tables for further project implementation assumptions used to compile the cost analysis.

3.3.6.3 Amendment Selection and Application Rate

Amendment selection and application rates are the same as those described in Alternative 3; however, amendment will not be applied to the hotspot area, as COCs in that area will be removed, resulting in an application of approximately 1,500 cubic yards of amendment material.

3.3.6.4 Long-Term Monitoring

LTM would be completed in the same way that is described in Alternative 3.

3.3.6.5 Institutional Controls

ICs would be applied in the same way that is described in Alternative 3.

3.3.6.6 Cost

Calculations used to determine unit rate costs for each of the alternatives are presented in Table 2 in **Appendix C**. Other project costs determined on a lump sum basis are presented in Table 3 in **Appendix C**. The monitoring and evaluation program and associated costs developed for each alternative are presented in Table 4 in **Appendix C**. The costs associated with each alternative are presented as Class 4 (+50/-30) estimates and are appropriate for remedial design alternative evaluations only.

The estimated total present value cost for Alternative 5 is $13,388,000. Table 8 presents a breakdown of the estimated costs associated with Alternative 6.

4.0 REMEDY SELECTION CRITERIA

The alternatives were evaluated and compared using the NCP remedy selection criteria outlined below and in general accordance with USEPA guidelines for feasibility studies (USEPA, 1990). The NCP remedy selection criteria are divided into three groups based on the function of the criteria in remedy selection. The NCP definitions of each criterion are included below. Green Sustainable Remediation (GSR) criteria were also evaluated during this FFS and are included as a fourth group of criteria. Additional detail may be added from MPCA and/or USEPA guidance where appropriate.

4.1 Threshold Criteria

The Threshold Criteria relate to statutory requirements that each alternative must satisfy in order to be eligible for selection and include the following:

4.1.1 Overall Protection of Human Health and the Environment

Alternatives shall be assessed to determine whether they can adequately protect human health and the environment, in both the short term and long term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the Site by eliminating, reducing, or controlling exposures to levels established during development of remediation goals. Overall protection of human health and the environment draws on the assessment of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

4.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

The alternatives shall be assessed to determine whether they attain applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility citing laws or provide grounds for invoking a waiver.

4.2 Primary Balancing Criteria

The Primary Balancing Criteria are the technical criteria upon which the detailed analysis is primarily based and include the following.

4.2.1 Long-Term Effectiveness and Permanence

Alternatives shall be assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful. Factors that shall be considered, as appropriate, include the following:

1. Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the conclusion of the remedial activities. The characteristics of the residual should be considered to the degree that they remain hazardous, taking into account their volume, toxicity, mobility, and propensity to bioaccumulate.

2. Adequacy and reliability of controls, such as containment systems and ICs, necessary to manage treatment residuals and untreated waste. This factor addresses, in particular, the uncertainties associated with land disposal for providing long-term protection from residuals; the assessment of the potential need to replace technical components of the alternative, such as a cap, a slurry wall, or a treatment system; and the potential exposure pathways and risks posted should the remedial action need replacement.

4.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

The degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume shall be assessed, including how treatment is used to address the principal threats posed by the Site. Factors that shall be considered, as appropriate, include the following:

1. The treatment or recycling processes the alternatives employ and materials they will treat;
2. The amount of hazardous substances, pollutants, or contaminants that will be destroyed, treated or recycled;
3. The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment or recycling and the specification of which reductions(s) are occurring;
4. The degree to which the treatment is irreversible;
5. The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents; and
6. The degree to which treatment reduces the inherent hazards posed by principal threats at the Site.

4.2.3 Short-Term Effectiveness

The short-term impacts of alternatives shall be assessed considering the following:

1. Short-term risks that might be posed to the community during implementation of an alternative;
2. Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures;
3. Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigating measures during implementation; and
4. Time until protection is achieved.

4.2.4 Implementability

The ease or difficulty of implementing the alternatives shall be assessed by considering the following types of factors, as appropriate:

1. Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy;
2. Administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions); and
3. Availability of services and materials, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources; the availability of services and materials; and the availability of prospective technologies.

4.2.5 Costs

The types of costs that shall be assessed include the following:

1. Capital costs, including both direct and indirect costs;
2. Annual O&M costs; and
3. Net present value of capital and O&M costs.

The USEPA guidance document *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (USEPA, 2000) was used to develop cost estimates presented in this Revised FFS. The cost estimates developed for this Revised FFS are primarily for the purpose of comparing remedial alternatives during the remedy selection process, not for establishing project budgets.

4.3 Modifying Criteria

The third group is made up of the Modifying Criteria specified below. These last two criteria are assessed formally after the public comment period, although to the extent that they are known will be factored into the identification of the preferred alternative.

4.3.1 State/Support Agency Acceptance

Assessment of state/agency concerns may not be completed until comments on this Revised FFS are received, but may be discussed, to the extent possible, in the proposed plan issued for public comment. The state/agency concerns that shall be assessed include the following:

1. The state's/agency's position and key concerns related to the preferred alternative and other alternatives; and
2. State/agency comments on ARARs or the proposed use of waivers.

4.3.2 Community Acceptance

This assessment includes determining which components of the alternatives interested persons in the community support, have reservations about, or oppose. This assessment may not be completed until comments on the proposed plan are received.

4.4 Green Sustainable Remediation

The last group is made up of the GSR criteria specified below. There are six criteria included with this analysis, which are then summarized to provide each alternative with an overall GSR rating. The six GSR criteria evaluated with this Revised FFS include the following:

- Greenhouse Gas (GHG) Emissions;
- Toxic Chemical Usage and Disposal;
- Energy Consumption;
- Use of Alternative Fuels;
- Water Consumption; and
- Waste Generation.

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The purpose of the comparative analysis is to identify and compare advantages and disadvantages of each evaluated alternative relative to one another with respect to remedy selection criteria presented in **Section 4.0** in order to determine which of the alternatives best meets those criteria. The comparative analysis is documented in this section and summarized in **Table 7** and **8**. **Table 9** presents a numerical comparison of the evaluated alternatives.

5.1 Threshold Criteria

Only those alternatives that would meet the threshold criteria of providing overall protection of human health and the environment, and whether they would attain compliance with ARARs were carried forward with the comparative analysis, with the exception of Alternative 1. Alternative 1 does not meet the threshold criteria, but was carried forward as it is required for analysis under the NCP. Alternative 2 provides a low achievement of threshold criteria because additional study of natural processes at the site to bury and degrade COC-impacted sediment is required.

Alternatives 3, 4, 5 and 6 will achieve protection of human health and the environment and comply with the identified ARARs. Alternatives 3, 4, and 6 would eliminate, reduce, or control exposure to contaminated sediment; however, contaminated sediment would remain in place under both alternatives, requiring monitoring to ensure long-term effectiveness. Alternative 4 and 6 would provide similar levels of protection, since Alternative includes a thicker cover than Alternative 3, while Alternative removes the most contaminated sediments (hotspot area). Alternative 5 would provide the highest level of protection as all COCs exceeding CULs would be removed from the remedial footprint.

5.2 Balancing Criteria

5.2.1 Long-Term Effectiveness and Permanence

Alternative 1 is not effective in the long term or permanent. Alternative 2 maybe be effective and permanent in the long term; however, RAOs may not be achieved in a reasonable time frame because the natural degradation processes are poorly understood at the Site and a possible contamination source is located directly upstream of the Site. Alternatives 3, 4, and 6 are effective in the long term; however, contaminated sediment would remain in place under each, though the most contaminated sediments would be removed under Alternative 6. Alternatives 3, 4, and 6 require long-term O&M and ICs to ensure long-term effectiveness. Alternative 5 is the most effective in the long term as COC contaminated sediment would be permanently removed from the remedial footprint.

In summary, Alternatives 3 and 4 will provide a moderate achievement of this criterion by reducing COC concentrations in sediments with reactive amendments. Alternative 6 provides a moderate to high level of achievement because it combines removal of the hotspot area with the addition of reactive amendments. Alternative 5 provides the highest level of achievement as all COCs exceeding CULs are removed from the remedial footprint.

5.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

Treatment of contaminated sediments to reduce toxicity, mobility, or volume is not a component of Alternatives 1 and 2; therefore, these alternatives provide no achievement of this criterion. Alternatives 3, and 4 provide a moderate to high achievement and Alternative 6 provides a high achievement of this criterion because they include the use of addition amendment material such as Sedimite™ in similar volumes. While not through treatment, Alternative 6 also reduces the volume of contaminated sediments through dredging and off-site disposal. These amendments reduce the toxicity and mobility of COCs in sediments over time. While Alternative 5 reduced the volume of contaminated sediment at the Site by dredging, achievement of this criterion is low as reduction in volume is not achieved via treatment.

In summary, Alternative 3, 4, and 6 will provide the highest achievement of this criterion by applying amendment material. Alternative 3 provides a moderate achievement of this criterion, since it utilizes amendment material broadcasted throughout the COC-impacted portions of the Site. Alternatives 1, 2, and 5 will provide the lowest achievement of this criterion because treatment of COC-impacted sediment is not a component of these remedies.

5.2.3 Short-Term Effectiveness

There are no short-term risks associated with Alternatives 1 and 2 as no actions would be implemented at the Site. The rest of the alternatives would have some short-term risks during implementation of the remedy. Short-term adverse effects to aquatic habitat and biota would be similar among Alternatives 3 and 4 and would include displacement of fish and smothering of benthic organisms. Alternative 3 would provide the least adverse effects of these alternatives because only a thin 0.05-meter (2-inch) layer of amendment material would be placed rather than a 0.15-meter (6-inch) thin-layer amended cover as in Alternative 4. The effects from Alternatives 3 and 4 would occur during remedy construction and during the recovery period thereafter. Alternatives 5 and 6 would result in substantially more adverse effects than Alternatives 3 and 4 because entire benthic communities would be removed, with the most adverse effects occurring with Alternative 5. Alternatives 5 and 6 both include some level of habitat restoration, and benthic organisms would be expected to be reestablished for all alternatives within several growing seasons.

In summary, Alternatives 1 and 2 would provide a high achievement of the short-term effectiveness criterion as there would be no impact to surrounding community and aquatic habitat and no risk to Site workers. Alternatives 3 and 4 would have a high and moderately high achievement of the short term effectiveness criterion, respectively, due to an increase in short-term adverse effects to aquatic biota during cover construction; however, impacts are anticipated to be small. Alternatives 5 and 6 would provide low and moderate achievement of this criterion, respectively resulting in the most adverse effects to benthic communities.

5.2.4 Implementability

There are no implementability concerns associated with Alternatives 1 and 2.

Application of cover materials utilized in Alternatives 3, 4, 5, and 6 would require barging of materials to and/or from a nearby staging area or a staging area located along the SLR, such as Hallett Dock #7. It is anticipated that Hallett Dock #7 would be available as a staging area but these alternatives assume the use of Hallett Dock #7 and successful coordination of future access agreements. Methods for placement of cover materials are technically feasible and implementable from an engineering perspective.

Weather could significantly impact productivity, particularly if done in the early spring or late fall. High winds in the late fall produce large waves that could impact productivity. Barge traffic and any Site activities would be postponed in the spring until ice melt is completed. Winter or freezing conditions in the fall could shorten the construction season. Alternative 5 has the longest estimated time to complete and, therefore would stand to be the most impacted by weather.

Implementability also includes administrative feasibility of the remedy. As with most sediment remediation activities, multiple state and federal agencies and other stakeholder input is required, providing a lower achievement of administrative feasibility of implementing a remedy.

Additional time would be required to obtain any necessary approvals and permits from other agencies. Alternatives 5 and 6 would require more coordination with regulatory agencies than Alternatives 3 and 4 because of the additional permitting required for dredging and increased impacts to the ecosystem. For these reasons Alternatives 5 and 6 provide a only a moderate level of achievement of the implementability criterion, while Alternatives 3 and 4 provide a moderate to high achievement.

In summary, Alternatives 1 and 2 have no actions to be implemented and thus provides a high achievement of the implementability criterion. Alternatives 3 and 4 provide a moderate to high level of achievement. Alternative 5 provides a moderate to low level of achievement of the implementability criterion because it is a more complex alternative to execute due to the coordination of dredging sediments and placement of sand cover. Alternative 6 is the most complex because it involves complexities of both dredging and broadcasting amendment.

5.2.1 Cost

Cost estimates developed for each alternative are included in **Section 3.0** and summarized in **Table 3**. The cost estimates include the following: capital costs, including both direct and indirect costs; annual O&M costs; and net present value of capital and O&M costs. While this FFS assumes that Former Hallet Dock #7 will be used as a staging area for Alternatives 3, 4, 5 and 6, costs associated with renting it are not included in this estimate as the property may be purchased by the Port Authority. If the property is not purchased by the Port Authority, rental costs could significantly impact the final cost.

In summary, Alternative 1 provides the most cost-effective option with no costs, followed by Alternative 2 ($244,000) because it requires only monitoring. Alternative 3 ($8,252,000) is the next most cost-effective option as less volume of cover materials are required compared to Alternative 4 ($10,733,000), making Alternative 4 a less cost-effective option than Alternative 3. Alternative 5 ($21,216,000) is the least cost-effective option because it requires the removal and off-site disposal of contaminated sediments within the remedial footprint. Alternative 6 ($13,388,000) is a combination of Alternative 3 and Alternative 5, making it less cost effective than Alternative 3 but more cost effective than Alternative 5. **Table 9** presents a numerical score that compares the cost for all alternatives.

5.3 Modifying Criteria

The modifying criteria, state/support agency acceptance and community acceptance, are assessed formally after the public comment period, and to the extent that they are known will be factored into the identification of the preferred alternative.

5.3.1 State Support/Agency Acceptance

State/agency input will be assessed to assist in determining the appropriate alternative for the Site. Key factors that will influence alternative selection include but are not limited to knowledge of future Site use, Site remediation prioritization, and funding source availability. Alternatives 1 through 4 will be formally assessed after public comment period.

5.3.2 Community Acceptance

Lands surrounding the Site are owned by the City of Duluth and private owners and access is generally limited to the Munger Landing boat launch and fishing dock. Any remediation work completed at the Site involving dredging or application of amendments or construction of a cover would require construction of a mooring area adjacent to the boat launch (i.e., driving of dolphin pilings); therefore, coordination with the City of Duluth would be required for implementation of Alternatives 3, 4, 5, and 6, which incorporate dredging and/or cover material placement. Additional coordination would be required with the current or future owners of Hallett

Dock #7 for use as a material staging area. The majority of work related to implementation of Alternatives 3, 4, 5, and 6 would take place directly on-site and presumably at a privately owned staging area. It is anticipated that community acceptance of Alternatives 3, 4, 5, ,and 6 will be high based on the factors outlined above.

5.4 Green Sustainable Remediation Criteria

5.4.1 Greenhouse Gas Emissions

Alternative 1 would have no GHG emissions. Alternative 2 would only produce GHG emissions associated with mobilization/demobilization and boat operation associated with sampling efforts. Alternatives 3, 4, 5 and 6 would result in GHG emissions from the mobilization, operation, and demobilization of all fuel-powered construction equipment required to place cover material and dredging. Reduction of emissions can be accomplished by using equipment that is compliant with the latest USEPA non-road engine standards and retrofitting older equipment with appropriate filters.

5.4.2 Toxic Chemical Usage and Disposal

There are no known toxic chemicals associated with any alternatives.

5.4.3 Energy Consumption

Alternative 1 would consume no additional energy. Alternative 2 would consume minimal amounts of fossil fuels compared to the other alternatives. Alternatives 3, 4, 5 and 6 would result in the consumption of fossil fuels for the mobilization, operation, and demobilization of all diesel-powered construction equipment associated with dredging and the placement of the cover material, with Alternative 5 requiring the most energy consumption due to the volume of sediments to be dredged.

5.4.4 Use of Alternative Fuels

Alternatives 1 and 2 would not require the use of alternative fuels. Biodiesel blended fuels (B10 or B20) could be used as a supplemental fuel source for all diesel-powered construction equipment associated with Alternatives 3, 4, 5, and 6.

5.4.5 Water Consumption

Alternatives 1 and 2 would not require the consumption of water and there are few water consumption considerations associated with Alternatives 3, 4, 5, and 6.

5.4.6 Waste Generation

Alternatives 1, 2, 3, and 4 would not generate significant amounts of waste. Alternatives 5 and 6 would generate a significant dredge material that will require disposal at a landfill, with Alternative 5 producing the most waste.

5.5 Comparative Analysis Summary

The comparative analysis of alternatives narrative discussion and quantitation table scored Alternatives 3, 4, and 6 the highest, with a one-point difference between the three. Alternative 5 scores lower than Alternatives 3, 4, and 6 but higher than Alternative 2. Alternative 1 scored the lowest overall.

Alternative 1 does not achieve overall protection of human health and the environment, does not achieve ARARs, is not effective in the long term, and does not reduce toxicity, mobility, or volume of contamination through treatment. Natural processes occurring at the Site are currently poorly understood; therefore, Alternative 2 ranks low for overall protection of human health and the environment, achievement ARARs, and effectiveness in the long term and short term. Alternative 2 does not reduce toxicity, mobility, or volume of contamination through treatment. Short-term risks associated with Alternatives 1 and 2 are low, and both are implementable and cost effective.

Alternative 5 provides the highest achievement of protection of human health and the environment and achievement of ARARs, followed by Alternative 6. Alternative 5 has the highest long-term effectiveness, followed by Alternative 6 because the alternatives remove some or all contaminated sediment at the site permanently. Alternatives 3 and 4 have similar long-term effectiveness and treatment of contaminants sediments to reduce toxicity, mobility, or volume, although Alternative 4 includes a thicker cover than Alternatives 3 and 6, which further reduces mobility of COCs. Alternative 5 does not reduce the toxicity, mobility, or volume through treatment; however, it does reduce the volume of contaminated sediment through dredging and disposal. Alternative 3 is superior to Alternative 4 in the short-term effectiveness criterion because there is less disturbance of the aquatic community. Alternative 5 results in the most short-term impacts to the benthic community and also provide the most risk to site workers. Alternative 6 is a mix between Alternative 3 and 5. Alternatives 3 and 4 are similar in implementability; while, Alternative 5 is slightly less implementable. Alternative 6 is the most complicated and therefore least implementable. Alternative 3 is the most cost effective, followed by Alternative 4, 6 and 5, respectively.

The modifying criteria, state/support agency acceptance, and community acceptance are assessed formally after the public comment period. Stakeholder and community input will provide valuable insight as the MPCA considers information for the selection of a preferred alternative. The MPCA will conduct outreach activities to resource managers, current Site users, the public and local units of government prior to the public comment period.

Further studies are recommended during the design phase of the selected alternative. These recommended studies, depending on the alternative selected, may include:

- Additional COC characterization and delineation throughout the Site;
- Additional COC characterization in Snively Creek to determine if the former Westinghouse Electric/Eastern Electric Apparatus Repair Co facility is a potential upland source contributing to Site contamination;
- Hydrodynamic study to understand natural processes such as depositional and scouring forces to inform design and placement cover materials, and effectiveness of MNR, if needed;
- Bench and/or pilot scale testing of amendment materials to determine the most appropriate material for use at the Site. Potential amendment materials include Sedimite™, bauxite, biopolymers, permeable Organoclay, phosphate additives (i.e., apatite), and zeolite (USEPA, 2013); and
- Bench and/or pilot scale testing to determine appropriate application rates for the selected amendment material.

Additional information, including but not limited to the list above, as well as input from stakeholders and an understanding of project funding, is required to select a preferred remedial alternative. This document serves as an interim evaluation of alternatives under the current understanding of the site. This FFS document should be updated as additional information becomes available.

6.0 REFERENCES

Barr Engineering Company, 2013. “Sediment Investigation Report, Volume 1, Great Lakes Legacy Act Project, Spirit Lake Sediment Site, Form U. S. Steel Duluth Works, Saint Louis River, Duluth Minnesota.” March.

Barr Engineering Company, 2014. “Draft Final Feasibility Study, Former Duluth Works and Spirit Lake Sediment Site.” November.

Bay West LLC (Bay West), 2015. “Draft Sediment Remedial Investigation Report, Munger Landing, Duluth Minnesota.” December.

Interstate Technology and Regulatory Council (ITRC) Contaminated Sediments Team, 2014. “Contaminated Sediments Remediation – Remedy Selection for Contaminated Sediments.” August.

LimnoTech, 2013. “St. Louis river Area of Concern Sediment Characterization: Final Report.” July 11.

Minnesota Department of Health (MDH), 2000. “Minnesota fish consumption advisory. Health Risk Assessment Unit, MDH, St. Paul, Minnesota.”

MDH, 2013. Public Health Consultation, “Updated Human Health Screening Values for St. Louis River Sediment: US Steel Site, Duluth, St. Louis County, Minnesota.” April.

Minnesota Pollution Control Agency (MPCA) and Wisconsin Department of Natural Resources (WDNR), 1992. “The St. Louis River System Remedial Action Plan. Stage One.”

MPCA and WDNR, 1995. “The St. Louis River System Remedial Action Plan, Progress Report Stage II.”

MPCA, 1995. “Draft Work Plan, Sediment Operable Unit Supplemental Remedial Investigation and Feasibility Study Reports SLRIDT Site, Duluth Minnesota.” November 1995.

MPCA, 1998. “Risk-Based Site Evaluation Manual,” September.

MPCA, 2007. “Guidance for the Use and Application of Sediment Quality Targets for the Protection of Sediment-Dwelling Organisms in Minnesota.” February.

MPCA, 2008. “Beneficial Use Impairments.” June.

MPCA, 2009. “Managing Dredged Materials in the State of Minnesota.” June.

MPCA 2018. “Munger Landing – Polychlorinated Biphenyl (PCBs) in Sediment.” April.

Sharrow, J., DeLuca, D., 2016. Duluth Seaway Port Authority, personal communication. March.

Somat Engineering, April 12, 2013, “Sediment Investigation Report, St. Louis River, Duluth Harbor.” August.

United States Environmental Protection Agency (USEPA), 1990. “The Feasibility Study: Detailed Analysis of Remedial Action Alternatives.” Office of Solid Waste and Emergency Response (OSWER) Directive 9955.3-01FS4. March.

USEPA, 2000. “A Guide to Developing and Documenting Cost Estimates During the Feasibility Study,” USEPA. 2000. A Guide to Developing and Documenting Cost Estimates During Feasibility Studies, EPA-540-R-00-002, July.

USEPA, 2005. “Contaminated Sediment Remediation Guidance for Hazardous Waste Sites.” December.

Figures

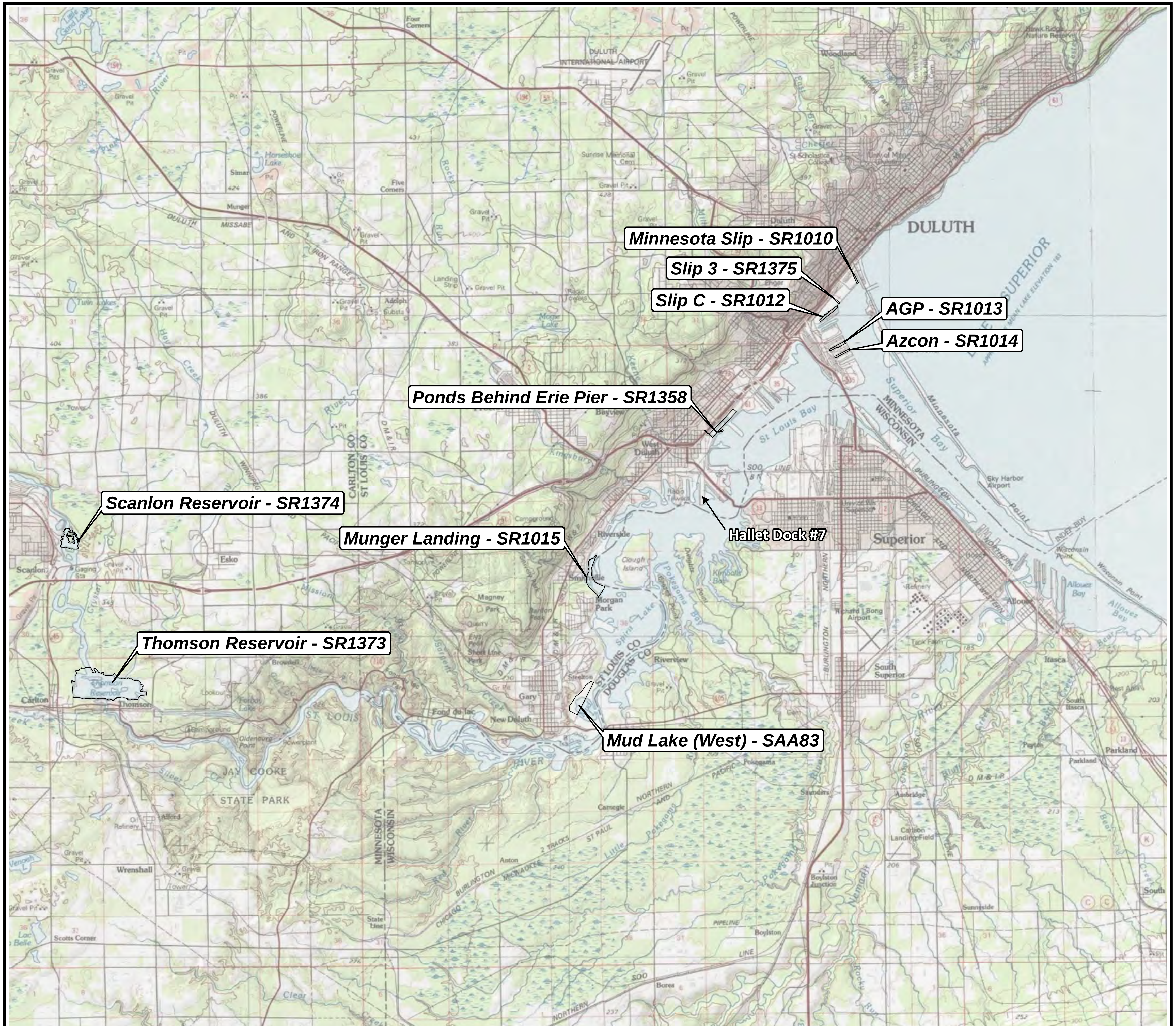


Figure 1

Site Location Map

Munger Landing
SLR Sediment AOCs
Duluth, MN

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: National Geographic Society, i-cubed

0 2 4 Miles
0 3 6 Kilometers

1 inch = 10,000 feet

Site Location (Labeled on map)

CLEAN WATER LAND & LEGACY AMENDMENT

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: SG Date Drawn/Revised:6/26/2018 Project No.J150329

Y:\Clients\MPCA\SLR_Sediment_AOCs\Mud_Lake\MapDocs\J150329 FIG 1 Mud Lake West Site Location Map.mxd

Figure 2

Site Map

Munger Landing
SLR Sediment AOCs

Duluth, MN

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

1 inch = 450 feet

- Sediment Sample (Bay West)
- Historical Sediment Sample
- Sewer Outfall
- Sanitary Sewer
- Storm Sewer
- Shipping Channel
- State Border
- Bathymetry Elevation Contour
- Munger Landing Site Boundary
- Parcel Boundary (With Property Owners)

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: S.G. Date Drawn/Revised:6/26/2018 Project No.J150329

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 02 Munger Landing Site Map.mxd

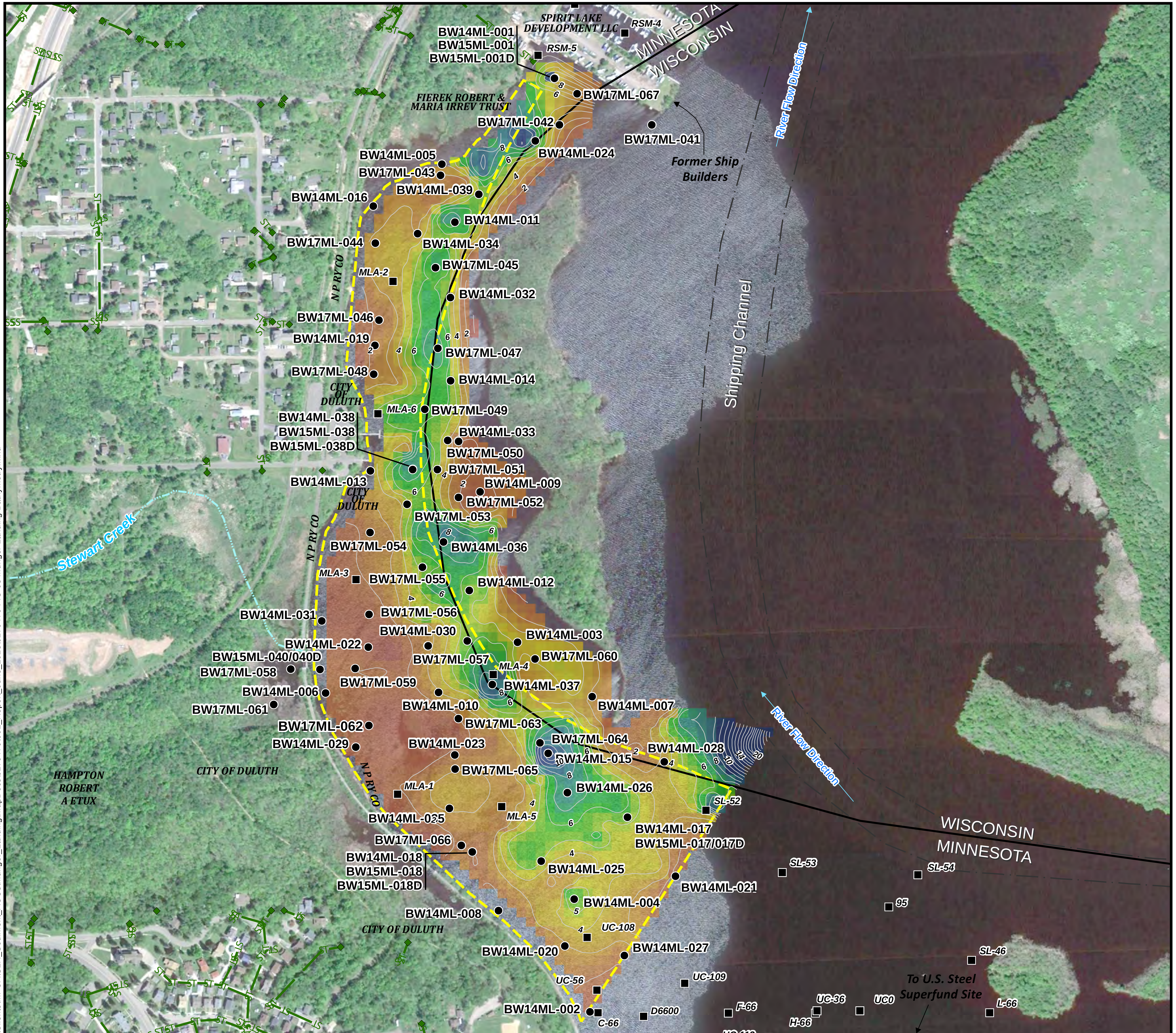


Figure 3

Bathymetry

Munger Landing SLR Sediment AOCs

Duluth, MN

N W E S

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

1 inch = 450 feet

- Sediment Sample (Bay West)
- Historical Sediment Sample
- Sewer Outfall
- SS Sanitary Sewer
- ST Storm Sewer
- Shipping Channel
- State Border
- Bathymetry Elevation Contour
- Munger Landing Site Boundary

Water Depth

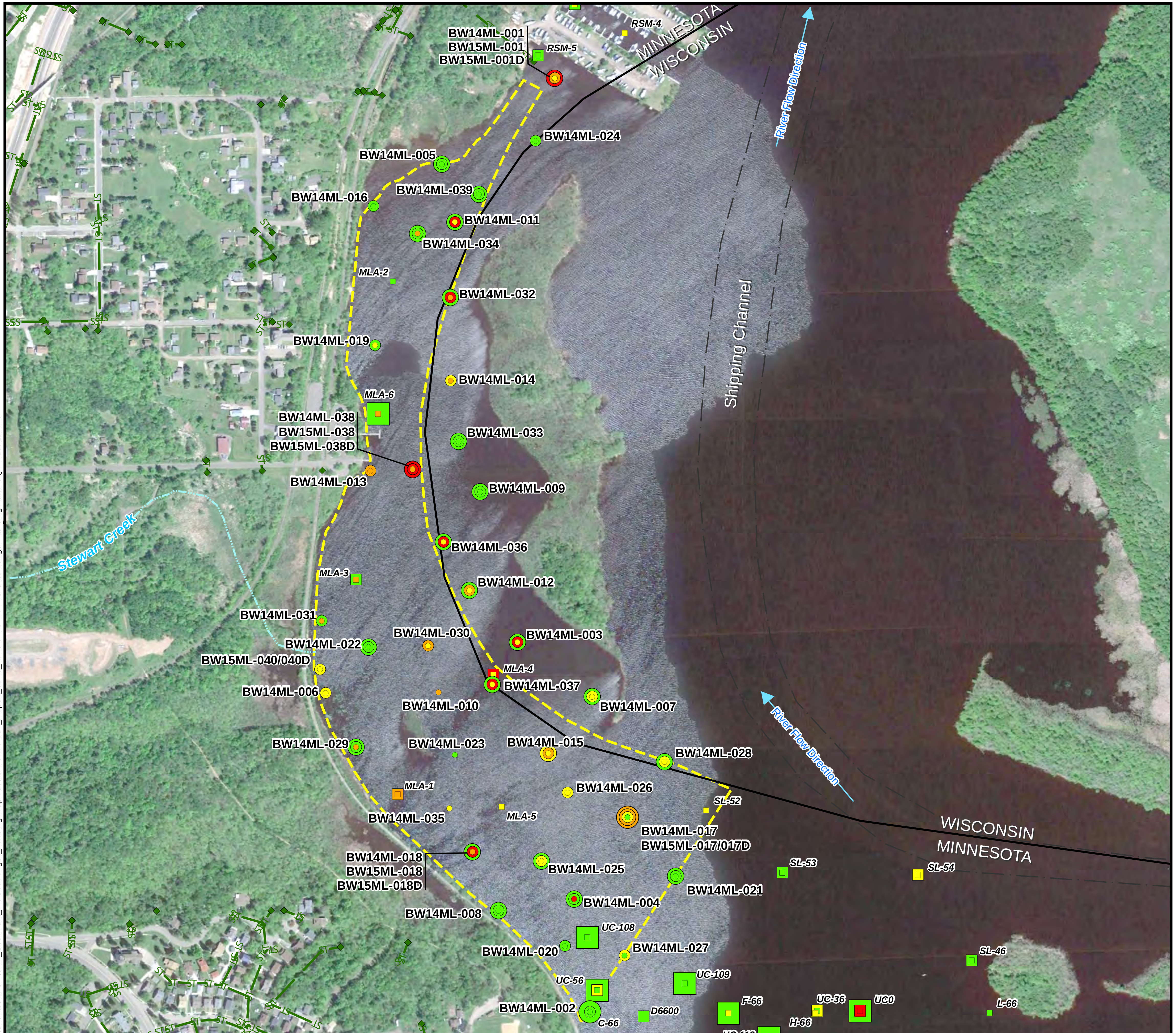
ELEVATION ABOVE MSL	DEPTH BELOW CHART DATUM
600 ft	0.9 ft
593 ft	8 ft
575 ft	26 ft

(Based on Jan 2014 GPR Data)
NOTE: Water depth based on 601.1 ft AMSL low water datum

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: S.G. Date Drawn/Revised:6/26/2018 Project No.J150329

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 03 Munger Landing Bathymetry.mxd



Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 04a Munger Landing Lead SQT Results.mxd

Figure 4A

Lead SQT Results

Munger Landing SLR Sediment AOCs

Duluth, MN

N W E S

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

1 inch = 450 feet

Sewer Outfall
SS Sanitary Sewer
ST Storm Sewer
Munger Landing Site Boundary

Sample Type

Sediment Sample (Bay West 2014/2015)
Historical Sediment Sample

Sample Interval

0-0.15 m
0.15-0.50 m
0.50-1.0 m
>1.0 m

Lead SQT Comparison

Does not exceed Level 1 SQT (36 mg/kg)
Exceeds Level 1 SQT (36 mg/kg)
Exceeds Midpoint SQT (83 mg/kg)
Exceeds Level 2 SQT (130 mg/kg)

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: S.G. Date Drawn/Revised:6/26/2018 Project No.J150329

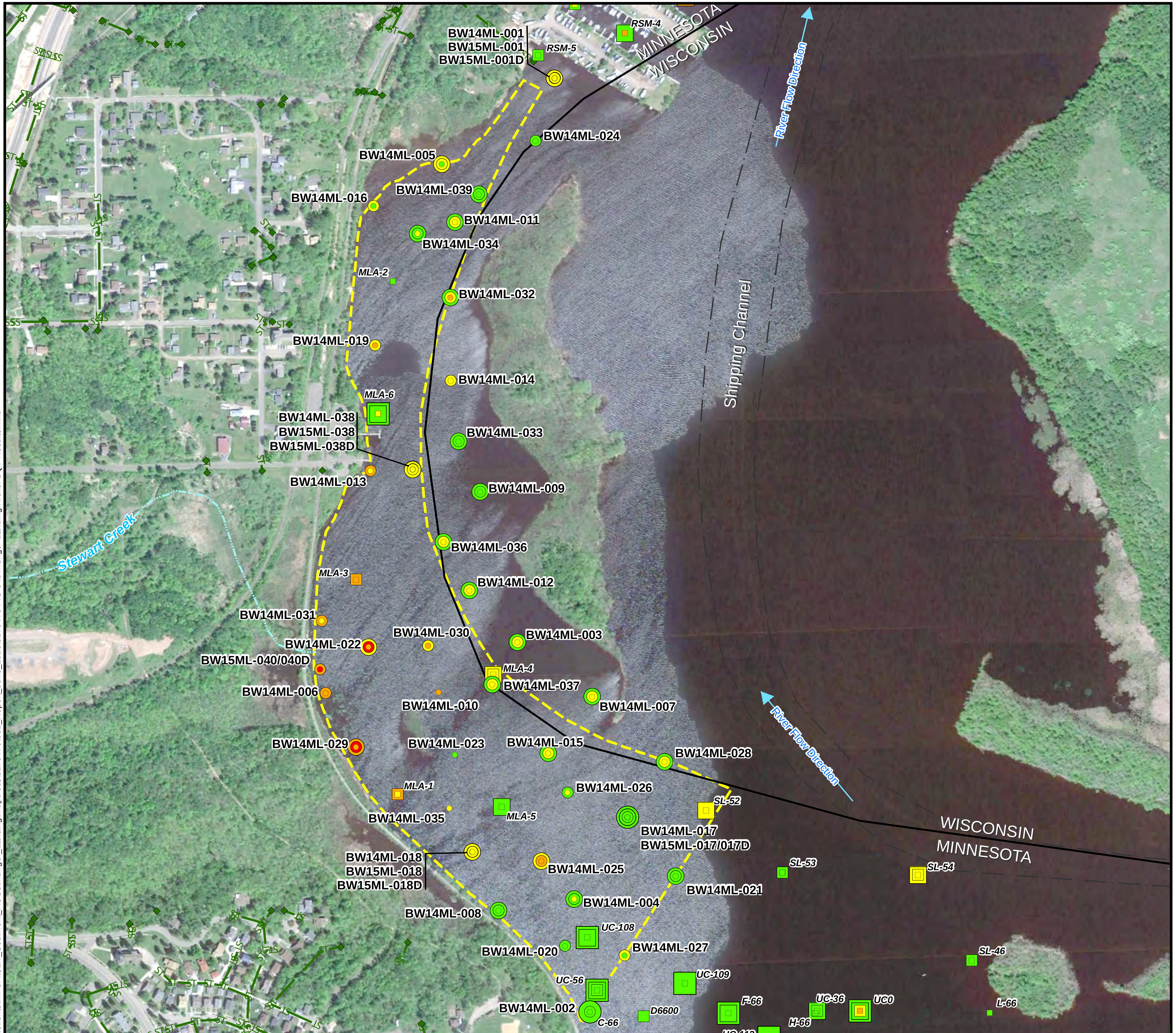


Figure 4B

Nickel SQT Results

Munger Landing
SLR Sediment AOCs
Duluth, MN

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters
1 inch = 450 feet

Sewer Outfall
Sanitary Sewer
Storm Sewer
Munger Landing Site Boundary

Sample Type

Sediment Sample (Bay West 2014/2015)
Historical Sediment Sample

Sample Interval

0-0.15 m
0.15-0.50 m
0.50-1.0 m
>1.0 m

Nickel SQT Comparison

Does not exceed Level 1 SQT (23 mg/kg)
Exceeds Level 1 SQT (23 mg/kg)
Exceeds Midpoint SQT (36 mg/kg)
Exceeds Level 2 SQT (49 mg/kg)

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: S.G. Date Drawn/Revised:6/26/2018 Project No.J150329

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 04b Munger Landing Nickel SQT Results.mxd

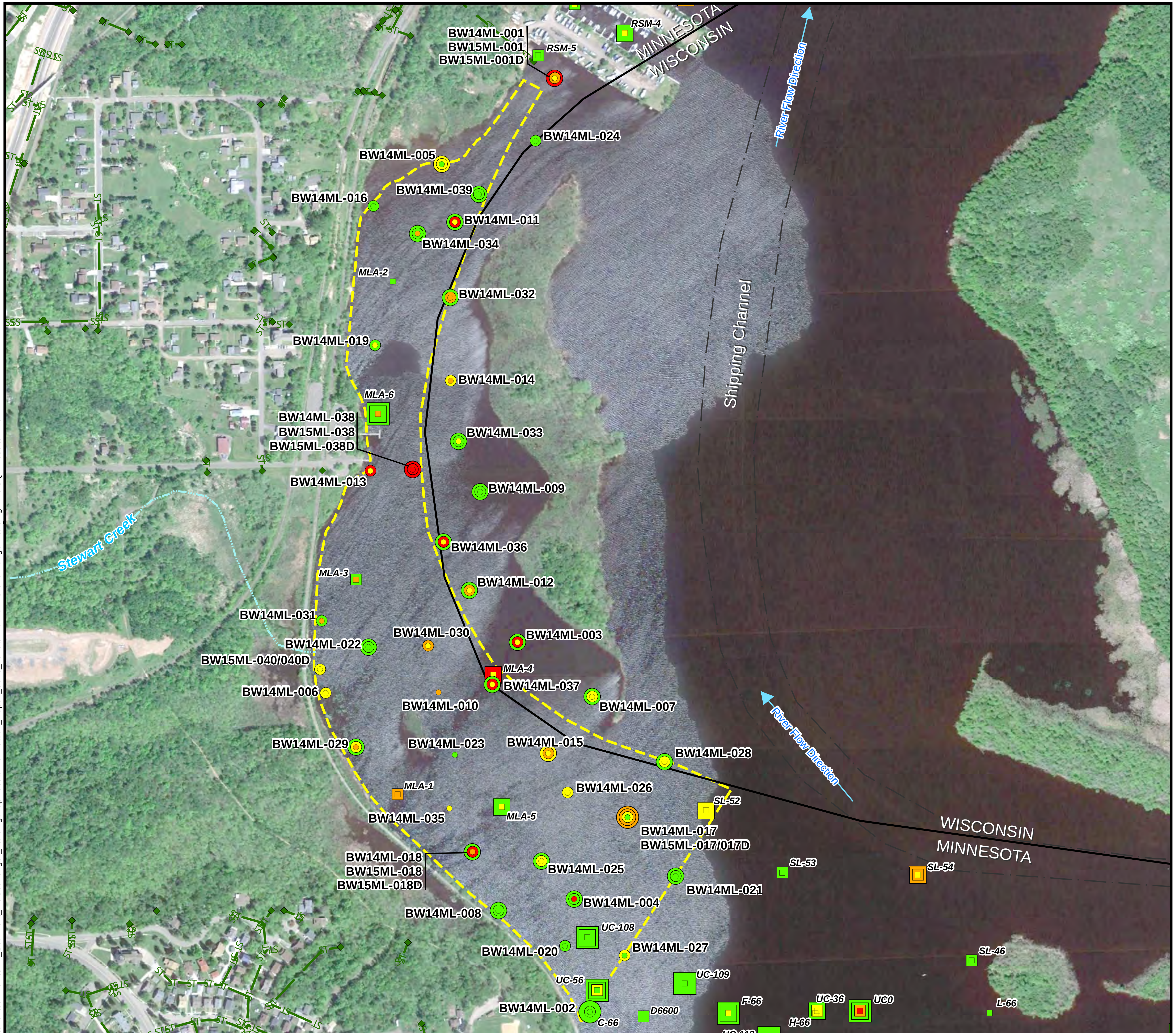
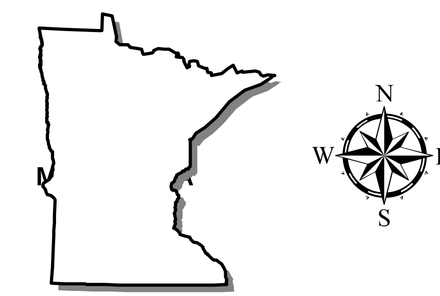


Figure 4C

Zinc SQT Results

Munger Landing SLR Sediment AOCs

Duluth, MN



Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

1 inch = 450 feet

Sewer Outfall
SS Sanitary Sewer
ST Storm Sewer
Munger Landing Site Boundary

Sample Type

Sediment Sample (Bay West 2014/2015)
Historical Sediment Sample

Sample Interval

0-0.15 m
0.15-0.50 m
0.50-1.0 m
>1.0 m

Zinc SQT Comparison

Does not exceed Level 1 SQT (120 mg/kg)
Exceeds Level 1 SQT (120 mg/kg)
Exceeds Midpoint SQT (290 mg/kg)
Exceeds Level 2 SQT (460 mg/kg)

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: S.G. Date Drawn/Revised:6/26/2018 Project No.J150329

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 04c Munger Landing Zinc SQT Results.mxd

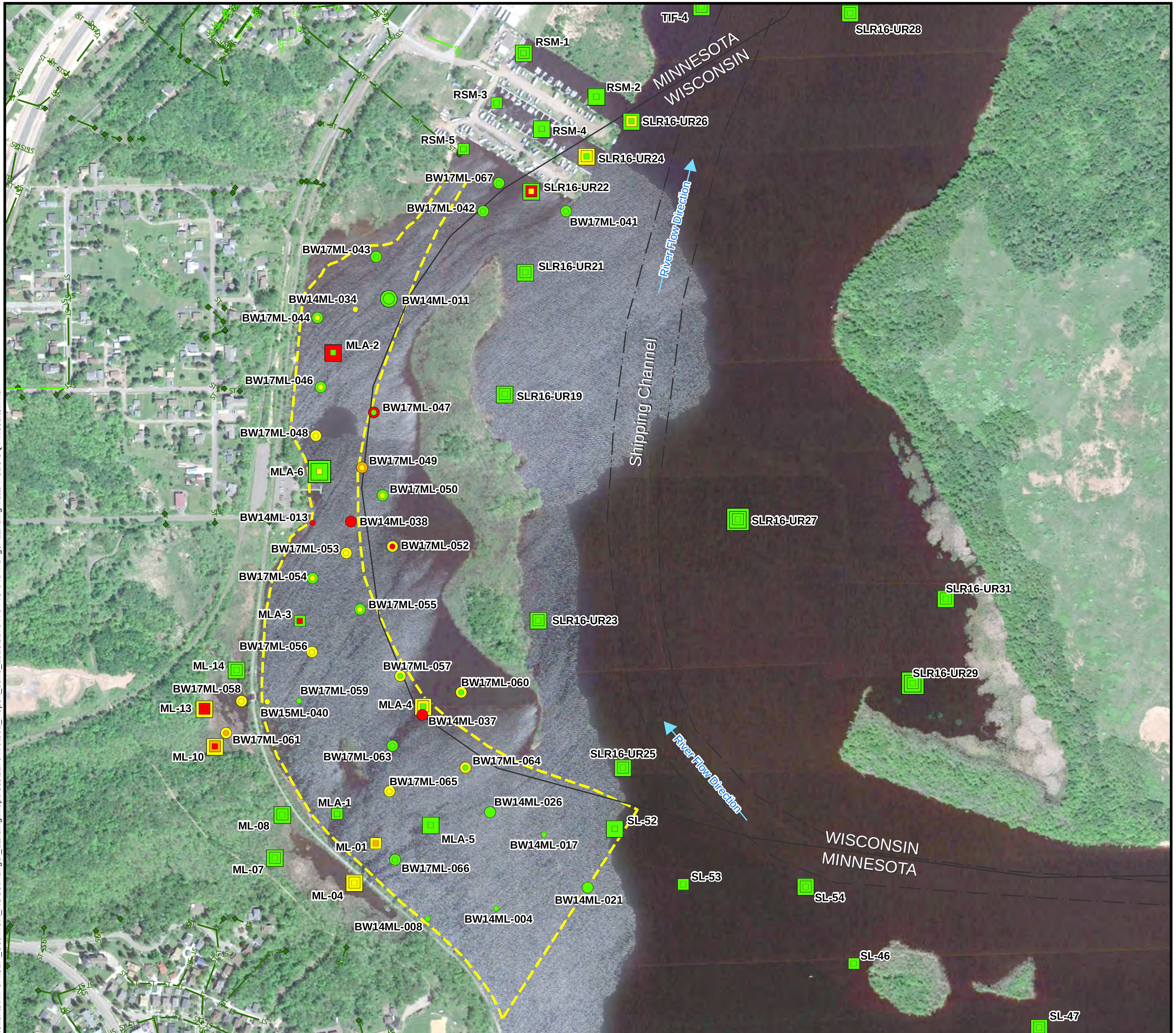


Figure 4D

Munger Landing SR1015
Total PCBs SQT Results

SLR Sediment AOCs

Duluth, MN

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

Sewer Outfall
Sanitary Sewer
Storm Sewer
Shipping Channel
State Border
Munger Landing Site Boundary

Sample Type

Sediment Sample (Bay West)
Sediment Sample (Historical)

Sample Depth

0 - 0.15 m
0.15 - 0.50 m
0.50 - 1.00 m
>1.00 m

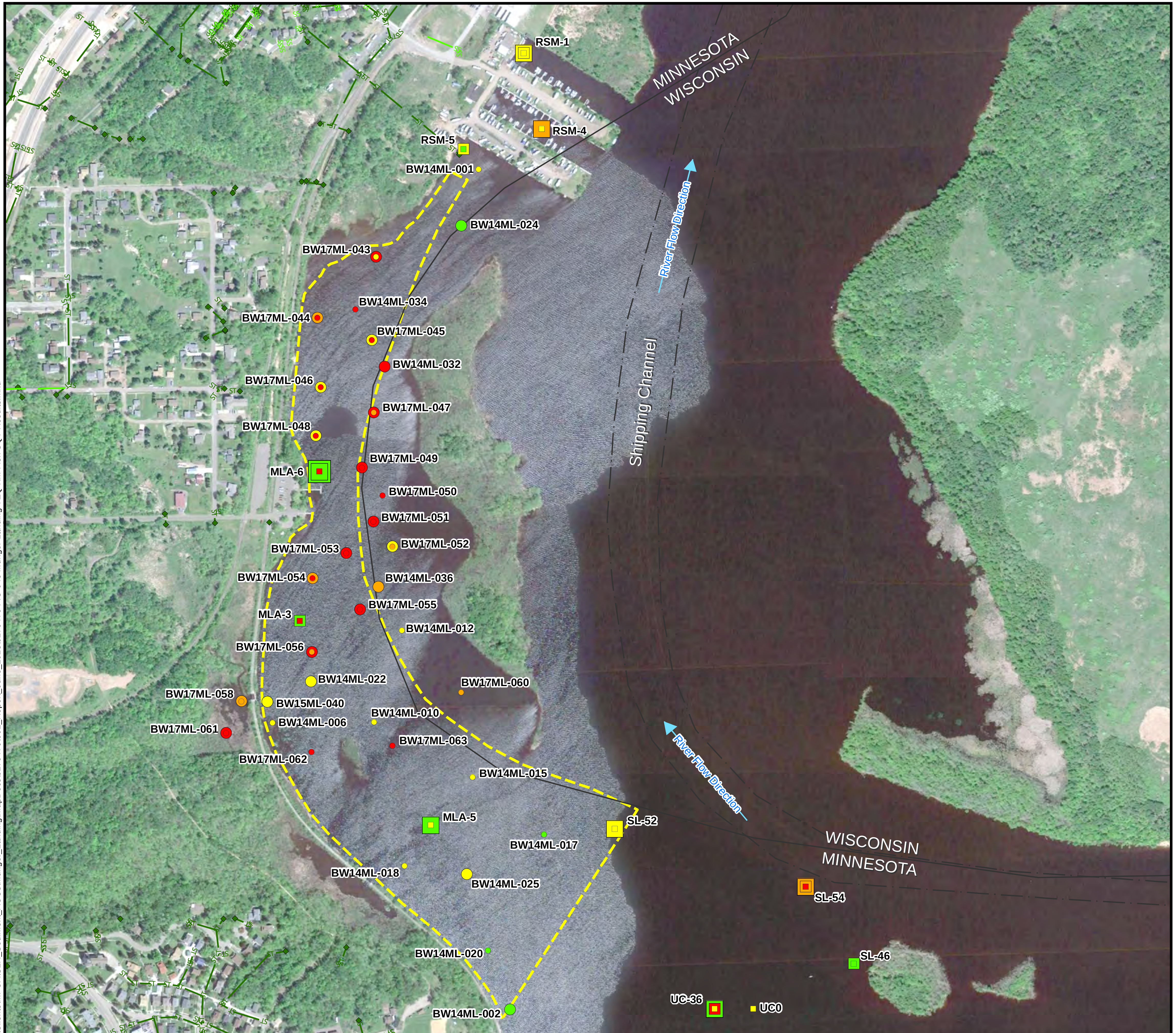
Total PCBs SQT Comparison

Does not exceed Level 1 SQT (60 µg/kg)
Exceeds Level 1 SQT (60 µg/kg)
Exceeds Midpoint SQT (370 µg/kg)
Exceeds Level 2 SQT (680 µg/kg)

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.L. Date Drawn/Revised:6/26/2018 Project No.J170539

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 04d Munger Landing Total PCBs SQT Results.mxd



Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 04e Munger Landing TEQ KM Fish SQT Results.mxd

Figure 4E

Munger Landing SR1015
TEQ KM Fish SQT Results

SLR Sediment AOCs

Duluth, MN

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

Sewer Outfall
SS Sanitary Sewer
ST Storm Sewer
Shipping Channel
State Border
Munger Landing Site Boundary

Sample Type

Sediment Sample (Bay West)
Sediment Sample (Historical)

Sample Depth

0 - 0.15 m
0.15 - 0.50 m
0.50 - 1.00 m
>1.00 m

TEQ KM Fish SQT Comparison

Does not exceed Level 1 SQT (0.85 ng TEQ/kg)
Exceeds Level 1 SQT (0.85 ng TEQ/kg)
Exceeds Midpoint SQT (11.2 ng TEQ/kg)
Exceeds Level 2 SQT (21.5 ng TEQ/kg)

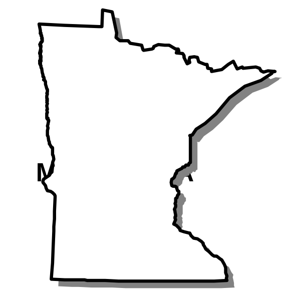
Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.L. Date Drawn/Revised:6/26/2018 Project No.J170539

Figure 5

PCB Human Health Risk Areas

Munger Landing
SLR Sediment AOCs
Duluth, MN



Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet

0 150 300 Meters

1 inch = 450 feet

- Maximum Wading and Swimming Depth – 5.5 feet
- Sewer Outfall
- Intertidal area – 0 feet
- Sanitary Sewer
- Storm Sewer
- Shipping Channel
- State Border
- Bathymetry Elevation Contour
- Munger Landing Site Boundary

Notes
1. Bathymetry and Human Health PCB Human Health Risk Areas based on mean low water datum of 601.1 feet above mean sea level.
2. Maximum Wading and Swimming Depth based on Bonnie Brooks, 2018

Bay West
Customer-Focused Environmental & Industrial Solutions

Date Drawn/Revised:6/26/2018 Project No.J170470

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 05 PCB Human Health Risk Areas.mxd

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 06 Munger Landing Remedial Footprints.mxd

Figure 6

Munger Landing SR1015 Remedial Footprints

SLR Sediment AOCs

Duluth, MN

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

- Sewer Outfall
- Sanitary Sewer
- Storm Sewer
- Shipping Channel
- State Border
- Stream
- Ordinary High Water (OHW) Level at 602.8 ft (Vertical datum of IGLD85)
- Hotspot Remedial Footprint (7.36 Acres)
  - 4.12 Acres Minnesota
  - 3.24 Acres Wisconsin
- Remediation Footprint (38.95 Acres)
  - 33.05 Acres Minnesota
  - 5.90 Acres Wisconsin

Bay West
Customer-Focused Environmental & Industrial Solutions

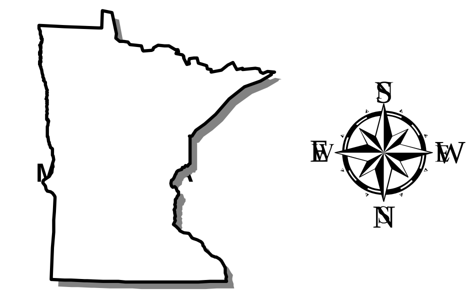
Drawn By: M.L. Date Drawn/Revised:6/26/2018 Project No.J170539

Figure 7

Conceptual Site Model

Munger Landing
SLR Sediment AOCs

Duluth, MN



Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Bing Aerial Imagery WMS (July-September 2011)

DRAWING NOT TO SCALE

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: S.G. | Date Drawn/Revised:6/26/2018 | Project No.J150329

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 07 Munger Landing Conceptual Site Model.mxd

Figure 8

Alternative 2
Monitored Natural Recovery

SLR Sediment AOCs

Duluth, MN

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

Scale: 0 – 500 – 1,000 Feet; 0 – 150 – 300 Meters

- Proposed Sample Locations
- Sewer Outfall
- Sanitary Sewer
- Storm Sewer
- Shipping Channel
- State Border
- Stream
- Ordinary High Water (OHW) Level at 602.8 ft (Vertical datum of IGLD85)

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.L. Date Drawn/Revised:6/26/2018 Project No.J170539

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 08 Munger Landing Alternative 2 Monitored Natural Recovery.mxd

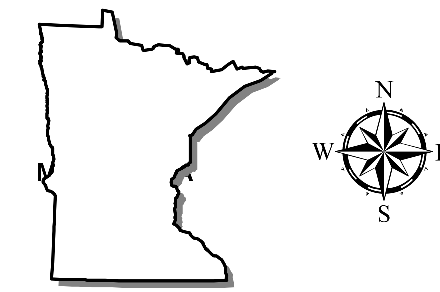
Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170470 FIG 09 Munger Landing Alternative 3 Enhanced MNR with Broadcasted Amendment.mxd

Figure 9

Alternative 3 - Enhanced MNR with Broadcasted Amendment

SLR Sediment AOCs

Duluth, MN



Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

- Proposed Sample Locations
- Sewer Outfall
- Sanitary Sewer
- Storm Sewer
- Shipping Channel
- State Border
- Stream
- Ordinary High Water (OHW) Level at 602.8 ft (Vertical datum of IGLD85)
- Remediation Footprint (38.95 Acres)
  - 33.05 Acres Minnesota
  - 5.90 Acres Wisconsin

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.L. Date Drawn/Revised:6/26/2018 Project No.J170539

Figure 10

Alternative 4 - Enhanced MNR with Thin-Layer Amended Cover

SLR Sediment AOCs

Duluth, MN

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

- Proposed Sample Locations
- Sewer Outfall
- Sanitary Sewer
- Storm Sewer
- Shipping Channel
- State Border
- Stream
- Ordinary High Water (OHW) Level at 602.8 ft (Vertical datum of IGLD85)
- Remediation Footprint (38.95 Acres)
  - 33.05 Acres Minnesota
  - 5.90 Acres Wisconsin

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.L. Date Drawn/Revised:6/26/2018 Project No.J170539

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470002_Report_June_2018\J170539 FIG 10 Munger Landing Alternative 4 Enhanced MNR with Thin Layer Amended Cover.mxd

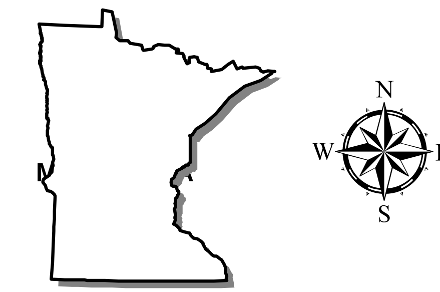
Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470002_Report_June_2018\J170539 FIG 11 Munger Landing Alternative 5.mxd

Figure 11

Alternative 5 - Excavate, Offsite Disposal

SLR Sediment AOCs

Duluth, MN



Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet

0 150 300 Meters

- Sewer Outfall
- Sanitary Sewer
- Storm Sewer
- Shipping Channel
- State Border
- Stream
- Ordinary High Water (OHW) Level at 602.8 ft (Vertical datum of IGLD85)
- Remediation Footprint (38.95 Acres)
  - 33.05 Acres Minnesota
  - 5.90 Acres Wisconsin

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.L. Date Drawn/Revised:6/26/2018 Project No.J170539

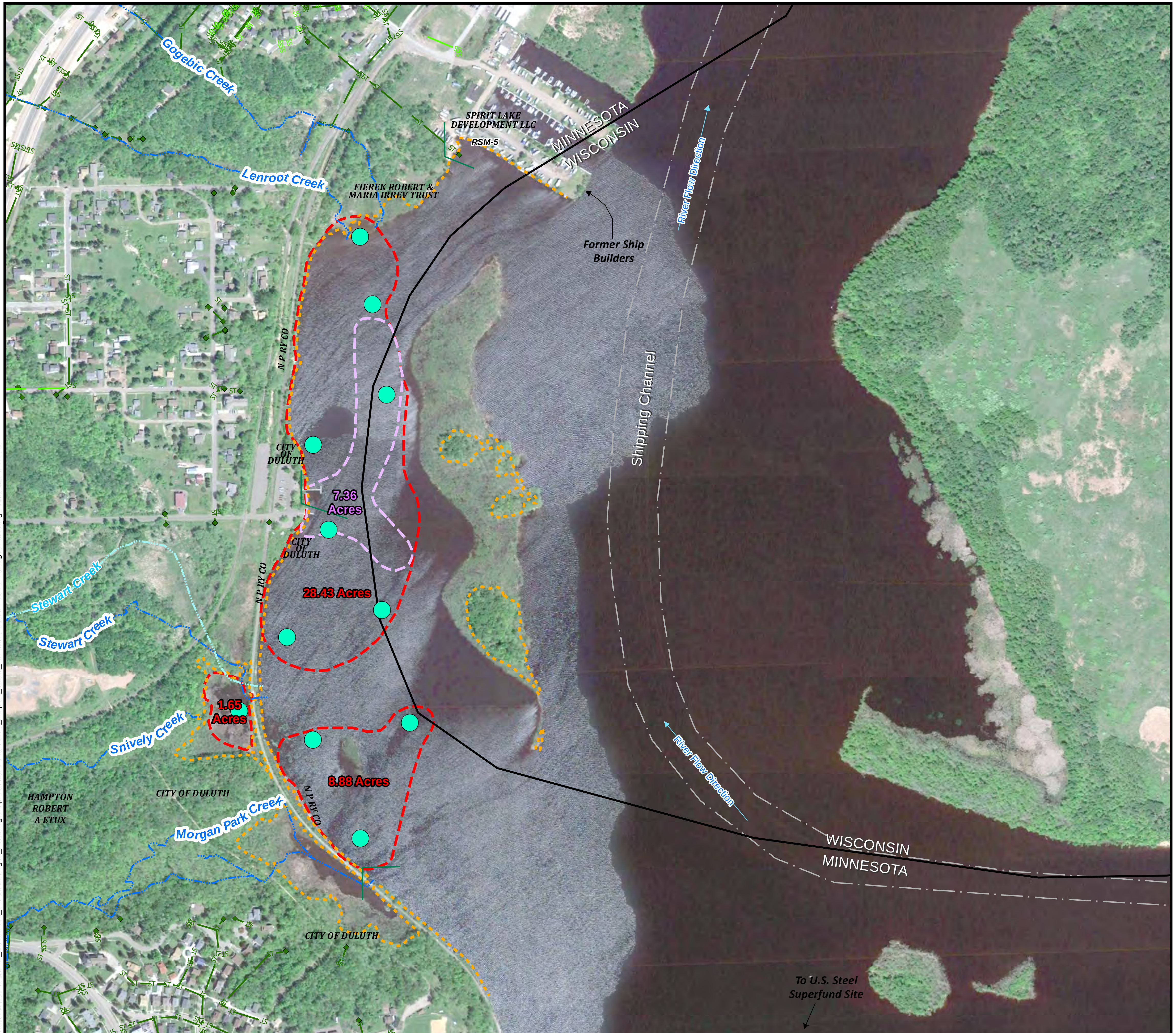


Figure 12

Alternative 6 - Hotpsot dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment

SLR Sediment AOCs

Duluth, MN

Map Projection: NAD 1983 UTM Zone 15 N
Basemap: Google Earth Aerial Imagery, 6/5/2017

0 500 1,000 Feet
0 150 300 Meters

- Proposed Sample Locations
- Sewer Outfall
- Sanitary Sewer
- Storm Sewer
- Shipping Channel
- State Border
- Stream
- Ordinary High Water (OHW) Level at 602.8 ft (Vertical datum of IGLD85)
- Hotspot Remedial Footprint (7.36 Acres)
  - 4.12 Acres Minnesota
  - 3.24 Acres Wisconsin
- Remediation Footprint (38.95 Acres)
  - 33.05 Acres Minnesota
  - 5.90 Acres Wisconsin

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.L. | Date Drawn/Revised:6/26/2018 | Project No.J170539

Y:\Clients\MPCA\SLR_Sediment_AOCs\Munger_Landing\MapDocs\J170470\002_Report_June_2018\J170539 FIG 12 Munger Landing Alternative 6.mxd

Tables

Table 1
Contaminants of Concern Summary
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Chemical	Units	Cleanup Level	Maximum Concentration
Cadmium	mg/kg	3	3.1
Copper	mg/kg	91	140
Lead	mg/kg	83	233
Mercury	mg/kg	0.64	6.3
Nickel	mg/kg	36	52.3
Zinc	mg/kg	290	832
Total PAHs	µg/kg	12,300	35,233
PCBs	µg/kg	370	43,700
Dioxins/Furans	ng TEQ/kg	11.2	85.4

mg/kg - milligrams per kilogram
ng TEQ/kg - nanograms toxic equipvalency per kilogram
µg/kg - micrograms per kilogram

Table 2
Technologies Screening Summary
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Category	Technology	Description	Applicability	Ranking						Retained for Consideration	Rationale
				Effectiveness		Implementablility		Relative Cost			
Institutional Controls	Institutional Controls	Institutional controls in the form of an environmental restrictive covenant or conditions of future permits may be used to prevent exposure and contact with impacted soil or sediment by restricting land uses or disturbances to the material.	May consist of fish consumption advisories, commercial fishing bans, waterway use restricitons, or deed restrictions	○	Effective in meeting RAOs when combined with other remedies.	●	Easily implemented with little distruption to the Site.	$	Minimal but there are long term costs associated with initiating and maintaining institutional controls.	Yes.	Some institutional controls already in place; however, additional controls are expected to be a required component of any remedy.
Monitoring and Evaluation	Monitoring	The collection and analysis chemical, physical, and/or biological data over a sufficient period of time and frequency to determine the status and/or trend in one or more environmental parameters or characteristics.	Monitoring should be conducted to asses compliance with design and performance standards; to assess short-term remedy performance and effectiveness in meeting sediment cleanup levels; and/or to evaluate long-term remedy effectiveness in achieving RAOs and in reducing human health and/or environmental risk.	○	Effective in meeting RAOs when combined with other remedies.	●	Highly implementable with no disturbance to the Site.	$	The main cost is associated with laboratory analysis.	Yes.	Monitoring is expected to be a required component of any remedy.
Natural Recovery	Monitored Natural Recovery	MNR leaves impacted sediment in place and relies on ongoing, naturally occurring processes to isolate, destroy, or reduce exposure or toxicity of impacted sediment.	Burial of contaminated sediments does not appear to be occuring at the Site and depsotion rates are not likely sufficient to isolate COCs in reasonable timeframe and concentrations do not appear to be reducing.	○	Burial may be occuring based on hydrodynamic studies directly upstream and COC reduction unclear due to nearby source (U.S. Steel).	●	Highly implementable with no disturbance to the Site.	$	The main cost of NR is associated with monitoring.	Yes.	Effectiveness at the Site has not been demonstrated but may be possible based on hydrodynamic studies conducted at U.S. Steel Site.
	Enhanced Monitored Natural Recovery	EMNR adds amendments to the sediment to accelerate physical isolation process and facilitates re-establishment of benthic or plant habitat. May include a granular or carbon sorbent cover (over sediments) or biological stimulants (to soil).	Use of an amendment may increase the rate at which sediment contaminant concentrations are reduced/made less available over time. Natural bioturbation processes will assit in mixing amendments into in-situ sediments.	●	Sediment amendments have been used successfully in the past to reduce the availability of contaminants to biota.	◉	Implementable; however, requires site access, staging area, and placement equipment. Impact to Site operation can be minimal with advanced planning.	$$	Greater initial cost than NR due to thin cover or amendment placement, but less expensive than conventional cap or sediment removal.	Yes.	Effectiveness of chemical contaminant sequestration in sediments via addition of amendments has been demonstrated. Allows for remedial action with limited disturbance to established wetland areas.
Capping	Capping	Capping provides a physical barrier and chemical isolation from COCs. Caps may be constructed from clean sediment, sand, gravel, geotextiles, liners, reactive or absorptive material and may consist of multiple layers. Granular sediment caps can provide erosion protection and limit bioturbation.	Cap thickness depends on bioactive zone (BAZ) thickness requirements, which vary by habitat, substrate and water depth. A cap may alter hydrologic conditions and Site use.	◉	Highly effective and proven technology. Solubilility and eventual migration of COCs through capping material is possible. Would reduce water depth significantly in already shallow areas and may turn wetland areas in upland areas.	⊗	Implementable, but would prohibitively disrupt a well established ecosystem.	$$$	Capping costs are generally less than sediment removal, and depend on cap thickness, material, lateral extent and surface water engineering factors. Material costs for a synthetic cap are generally higher than a granular cap.	No.	Would likely turn wetland areas into upland areas and therefore was not retained for consideration.

Table 2
Technologies Screening Summary
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Category	Technology	Description	Applicability	Ranking						Retained for Consideration	Rationale
				Effectiveness		Implementablity		Relative Cost			
Excavation and Removal	Mechanical Dredging	Sediment is lifted to the surface using a mechanical excavator or crane and placed on a barge for transport. Removed sediment has a similar moisture content as the in situ material, requiring dewatering prior to disposal. Residual cover is typically needed to manage remaining impacts.	Mechanical dredging is implementable at the Site but no staging area locations are present in which to stabilize sediments. Sediments must be slurried and pumped to an off-site staging area. Sediment controls expected to be required.	●	Highly effective and proven technology; however, resuspension may limit effectiveness.	○	Requires dredging equipment and upland staging infrastructure for sediment dewatering and transportation. Less staging space required than hydraulic dredging. Would prohibitively disrupt a well established ecosystem.	$$$	Main capital costs include equipment mobilization, staging area devlopment, equipment operation, residual cover materials, and construction and operation of a containment area for dredged material.	Yes.	Suitible for use at the Site, but mechanically dredged sediments must be slurried with water and pumped to an off-site staging area.
	Hydraulic Dredging	Hydraulic dredging captures water with the sediment and removes it by pumping the sediment slurry typically through a pipeline to the dewatering location or final disposal site. High water content of slurry requires significant dewatering. Residual cover is typically needed to manage remaining impacts.	Hydraulic dredging is implementable at the Site. Sediments must be pumped to an off-site staging area. Sediment controls expected to be required.	●	Highly effective and proven technology; however, resuspension may limit effectiveness.	○	Implementable; however, requires large staging area for dewatering equipment, requires more water treatment than mechanical dredging. Would prohibitively disrupt a well established ecosystem.	$$$$	Additional treatment and disposal costs due to greater water content of the slurried sediment.	Yes.	Suitable for use at the Site, but dredged sediments must be pumped to an off-site staging area.
	Mechanical Removal in Dry Conditions	Water is diverted or drained from the excavation area using a containment barrier such as a cofferdam to allow for excavation of dry sediment with conventional equipment (e.g. backhoe). Typically limited to shallow areas.	Well suited for shallow areas and geometry that allows for construction of containment barrier and water diversion.	●	Effective and proven technology. Allows for visual inspection during removal. Minimal resuspension/redeposition. High degree of accuracy.	⊗	Feasible in small-volume removal areas. Site preparation difficult due to water management. Would prohibitively disrupt a well established ecosystem.	$$$	Costs are similar to mechanical dredging, with the added cost to construct diversion or containment structures.	No	Not suitable when compared to mechanical or hydraulic dredging.
Disposal	Off-Site	Removed sediment is transported to an offsite disposal location that will accept the waste. Dewatering of sediments is generally required before transport.	Transportation of large volumes of sediment would create significant truck traffic through the surrounding community for a long duration.	●	Effective at meeting RAOs, low risk of spills during transportation.	◉	Disruption to neighbors during trucking, may result in limited work hours. Seasonal restrictions may also apply.	$$$$	Costs for offsite disposal include dewatering, water treatment, loading and transportation costs and landfill disposal fees. Transportation costs depend on distance to the landfill.	Yes.	Suitable with proper truck routing. Onsite storage facilities are not available.
	Confined Disposal Facility (CDF)	CDFs are engineered structures enclosed by dikes and specifically designed to contain sediment. CDFs may be located either upland (above the water table), near-shore (partially in the water), or completely in the water (island CDFs).	Creation of a CDF would result in destruction of wetland areas.	●	Most widely used method for disposal and has been demonstrated effective.	○	Requires high level of design, detailed knowledge of dredge plans, requires large permanent area for construction, and treatment of discharge.	$$$	Costs for a CDF include engineering and design costs, materials for dikes and suspended solids control, and construction equipment and labor.	No	Based on large dredge volumes, consolidation areas are not feasible.
	On-site Contained Aquatic Disposal (CAD)	Dredged or excavated sediment is disposed within a natural or excavated depression elsewhere in the water body.	A suitable location to accommodate entire sediment volume is not available.	○	Would likely be effective at maintaining COCs if propertly designed.	⊗	A suitable location to accommodate entire sediment volume is not available.	$$$	Specialized equipment for a CAD may be required, especially if the disposal site is in deep water. Dredging to create a CAD would add cost.	No	Based on the Site charateristics, a suitable location is not available at the Site to accommodate the required disposal volume.

Table 2
Technologies Screening Summary
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Category	Technology	Description	Applicability	Ranking						Retained for Consideration	Rationale
				Effectiveness		Implementablility		Relative Cost			
In Situ Treatment	Immobilization	Immobilization treatments add chemicals or cements to reduce the leachability of COCs. Mechanisms include solidification (encapsulation) or stabilization (chemical or absorptive reactions that convert COCs to less toxic or mobile forms).	Implementation at a sediment site is difficult due to submerged work requirement and restricting future Site use.	○	Is effective for COCs. Stabilization of sediments reduces erosion potential. May result in poor environment for benthic community.	⊗	Sediment mixing can be difficult. May require dewatering. Requires equipment for mixing. Solidified sediment would restrict future Site use.	$$$	Costs for solidification or stabilization affected by the quantity and type of reagents added to the waste and the need for specialized equipment for mixing reagents with sediment.	No	Not proven to be effective for sediments. Costly and more difficult to implement than other technologies.
	Enhanced Bioremediation	Microbial degradation by bacteria or fungi is enhanced by adding materials such as oxygen, nitrate, sulfate, hydrogen, nutrients, or microorganisms to the sediment.	Can be effective for COCs.	○	Requires specific geochemical parameters to be successful (temperature, Ph, nutrient availability)	○	Easily implemented with little disruption to the Site.	$$$	Costs of enhanced bioremediation are relatively low, but several treatments and monitoring similar to MNR may be required.	No	Difficult to implement sub aqueously.
	Oxidation/Reduction	Chemicals are injected into sediment to act as an oxidant/electron acceptor to facilitate aerobic decomposition of organic matter.	chemical addition may create toxic conditions.	○	Chemical addition may create toxic conditions.	○	Bench-scale testing and pilot-scale testing required to determine the type, concentration, and quantity of oxidant and amendments required.	$$$	Costs include bench- or pilot-scale tests. Monitoring may be required.	No	Not proven safe for subaqueous conditions.
	Chemical Oxidation	The addition of chemical oxidizers to sediment can cause the rapid and complete chemical destruction of many toxic organic chemicals.	Limited effectiveness for Site COCs.	⊗	Addition of chemicals may form temporarily toxic conditions for benthic or aquatic organisms	◉	Pilot studies would be required to determine the effectiveness of specific oxidants for COCs.	$$$	Costs include bench- or pilot-scale tests to determine effectiveness, oxidants for injection, and a delivery system. Monitoring may also be required.	No	Limited effectiveness. Chemical addition may create toxic conditions.
	Phytoremediation	Phytoremediation uses plant species to remove, transfer, stabilize, and destroy COCs in soil and sediment. Generally limited to sediments in shallow water zones and low concentrations.	Habitat restoration not likely necessary, technology not effective in open water areas of Site.	○	Effective only in shallow contaminated areas, which comprise only 1/3 of the Site area.	●	Implementation involves planting and in some cases harvesting with little disruption to the Site.	$$	Primary costs are purchasing and planting applicable species. Monitoring may also be required.	No	May be implemented for habitat restoration, but not effective alone.
	Adsorption	Adsorbents can be used as sediment amendments for in situ treatment of COCs. Sorption organics can take place simultaneously with a suitable combination of sorbents.	May be useful as EMNR amendment.	◉	Sorption of COCs possible with amendment materials.	◉	Amendments can be delivered to the sediment in the form of pellets or mixed into other media (i.e., sand) to resist re-suspension.	$$	The main costs include the adsorbent material, and a method for depositing it on the surface sediment. Monitoring may also be required.	Yes.	Effectiveness of chemical contaminant sequestration in sediments via addition of amendments has been demonstrated. Allows for remedial action with limited disturbance to established wetland areas.

Table 2
Technologies Screening Summary
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Category	Technology	Description	Applicability	Ranking						Retained for Consideration	Rationale
				Effectiveness		Implementablity		Relative Cost			
Dewatering	Passive Dewatering	Passive dewatering relies on natural evaporation and drainage to remove moisture from the sediment. Drainage may be driven by gravity or assisted with a vacuum pump. Passive dewatering may occur in CDFs, lagoons, tanks, or temporary holding/rehandling facilities.	Could be utilized if sufficient space is available off-site for long-term passive dewatering to take place. Adjacent U.S. Steel Site is currently serving this purpose for Radio Tower Bay sediments.	○	Passively dewatered sediments may not have low enough water content for landfill disposal, so supplemental technologies may be required.	◉	Implementable if adjacent staging area can be located. Time frames for passive dewatering likely longer than for mechanical dewatering.	$$	Costs to consider include construction of a dewatering facility or adequately sized CDF.	Yes.	Appropriate for off-site disposal when used with hydruospoic amendment addition and/or sufficient dewatering timeframe.
	Sediment Reworking	Reworking sediments to promote drainage, and mixing sediments with excavation equipment can enhance passive dewatering.	If a CDF is constructed, sediment reworking could be performed within the CDF.	○	Sediment mixing and reworking would facilitate a timelier and more complete dewatering, but may not be sufficient for off-site disposal.	○	Hydraulically pumped sediments would result in excessive water content for sediment reworking initially. May be feasible after sediments have dewatered for a period of time.	$$	Cost savings are expected over passive dewatering alone due to time saved.	No	Not appropriate for offsite disposal.
	Hydrospoic Amendment Addition	Dredged sediments are mixed with amendments such as slags or cementitious materials to remove moisture and improve strength and stability.	Could be used to enhance dewatering in conjunction with passive dewatering	◉	Effectiveness of amendments depend on the moisture content of removed sediment. Pre-treatment dewatering likely required due to hydraulic dredging for maximum effectiveness and to achieve desired geotechnical properties.	○	Would require staging, mixing, and curing areas. Amendment addition creates a greater volume and mass, which needs to be considered in disposal options. Likely requires pre-treatment dewatering. May not be time and energy efficient for hydraulically pumped sediments.	$$	Costs include amendment materials and mixing equipment. Costs increase with increased moisture content. Both the addition rate and the bulking factor of treated material should be considered when evaluating costs of amendment material.	No	Likely not time and energy efficient for hydraulically pumped sediments due to high water content of dredge slurry.
	Geotextile Tube Dewatering	Sediment slurry from hydraulic dredging is pumped into the geotextile tube and filtered by the geotextile fabric. Sediment is retained within the geotextile tube, while free liquids pass through the exterior of the tube.	Applicable to hydraulically dredged sediments or mechancially dredged sediments if slurried and pumped to dewatering area.	●	Proven technology and widely used for slurried dredge sediments.	◉	Implementable if a nearby dewatering area can be located. Currently, the adjacent U.S. Steel Site is serving this purpose for Radio Tower Bay sediments.	$$$	Costs include flocculent and coagulant materials, cost of geotextile tubes and construction of staging area.	Yes.	Appropriate for slurried dredge sediments and large dredge volume.
	Mechanical Dewatering	Mechanical dewatering technologies include use of plate filters, presses, centrifuges or other equipment to squeeze, press, or draw water from dredged sediment.	Requires homogeneous waste stream provided by hydraulic dredging methods and site sediments.	●	Generally works best with a homogeneous waste stream produced via hydraulic dredging. Selection of specific mechanical dewatering equipment depends on treatment or disposal methods that follow.	◉	Faster than passive dewatering and requires less space. Production rates depend on size and quality of the dewatering device and on the solids content of the input stream.	$$$$	Costs of mechanical dewatering are generally higher than passive dewatering due to the energy and equipment requirement.	No	Likely not cost effective for project dredge volumes.
	Rapid Dewatering Systems	A system that continuously processes the slurry from a hydraulic dredge and separates solids into piles of debris; shells; and gravel, sand, and fines. Includes polymer addition and flocculation, which may remove some COCs.	Applicable to hydraulically dredged sediments or mechancially dredged sediments if slurried and pumped to dewatering area.	●	Highly effective and proven technology but typically utlized for large-scale and long-term dredging operations.	◉	Faster than passive dewatering and requires less space. Production rates depend on size and quality of the dewatering device and on the solids content of the input stream.	$$$$	Costs of mechanical dewatering are generally higher than passive dewatering due to the energy and equipment requirement.	No	Likely not cost effective for project dredge volumes.

Table 2
Technologies Screening Summary
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Category	Technology	Description	Applicability	Ranking						Retained for Consideration	Rationale
				Effectiveness		Implementablility		Relative Cost			
Water Treatment	Filtration	Filters remove solids and sediments from wastewater, also removing absorbed COCs from the waste stream. Flocculants may be added to the waste stream to facilitate solids removal.	Filtration is a standard method for water treatment and would be effective at removing site COCs sorbed to suspended sediments in the waste stream.	○	Filters can be selected based on the required particulate size. Treatability study to determine if filtration is effective at reducing the COC concentration.	◉	Filtration is a widely used method for water treatment. Selection of the filtration methods and type requires engineering design and site specific knowledge of the waste stream. Would require a dewatering area	$$$	Costs depend on change out frequency of filtration material.	Yes.	Effective for COC removal when used in combination with liquid adsorption.
	Liquid Adsorption	Involves pumping water through a vessel containing granular activated carbon (GAC), organoclay, or another adsorbent material; dissolved compounds to adsorb to its surface.	Conventional adsorptive materials would remove COCs.	◉	Sorptive clay vessels are appropriate for treating COCs.	◉	Liquid adsorption systems are widely available, have a relatively small footprint, and require a relatively short timeframe for treatment.	$$$	Costs include media, vessels, and disposal/recyling costs for media. The adsorbent must be recharged or replaced periodically. Power is required for pumping.	Yes.	Effective for COC removal.
	Advanced Oxidation	Advanced oxidation uses UV light and the addition of strong oxidizers to primarily destroy organic constituents in water.	Advanced oxidation is applicable for treating most organics, including COCs.	○	Advanced oxidation is applicable for treating most organics.	◉	Advanced oxidation systems are widely available, have a relatively small footprint, and require a relatively short timeframe for treatment. Handling and storage of oxidizers would require special safety precautions.	$$$$	Costs may be higher because of energy requirements to power UV lights.	No	Cost likely too high.

	Effectiveness	Implementability	Relative Cost
⊗	Not effective at reaching RAOs	Not implementable at the Site	**$$$$ - High**
○	Partially effective for some COCs or Site areas	Difficult to implement	**$$$ - Medium-high**
◉	Effective under certain conditions	Implementable, requires technical knowledge	**$$ - Moderate**
●	Demonstrated effective technology	Readily implemented	**$ - Low**

NA - not applicable

Table 3
Alternatives Summary
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Alternative	Alternative 1: No Action	Alternative 2: MNR	Alternative 3: Enhanced MNR with Broadcasted Amendment	Alternative 4: Enhanced MNR with Thin-Layer Amended Cover	Alternative 5: Excavate, Offsite Disposal	Alternative 6: Hotpsot dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment
Total Present Worth Cost	**$0**	**$244,000**	**$8,252,000**	**$10,733,000**	**$21,216,000**	**$13,388,000**
Broadcast/Cover Area	0 acres	0 acres	38.95 acres (0.01-meter [0.5-inch] broadcast amendment cover	38.95 acres (0.15-meter [6-inch] thin-layer amended cover	38.95 acres (0.15-meter [6-inch] sand dredge cover)	31.55 acres (0.01-meter [0.5-inch] broadcast amendment cover) + 7.4 acres (0.15-meter [6-inch] sand dredge cover)
Dredge Area	0 acres	0 acres	0 acres	0 acres	38.95 acres	7.4 acres
Cover Volume - Sand/Amendment	0 CY Sand / 0 CY Amendment	0 CYSand / 0 CY Amendment	0 CY Sand / 2012 CY Amendment Total = 2012 CY	31420 CY Sand / 2012 CY Amendment Total = 33432 CY	31420 CY Sand / 0 CY Amendment Total = 31420 CY	5969 CY Sand / 1630 CY Amendment Total = 7599 CY
Dredge Volume	0 CY	0 CY	0 CY	0 CY	134000 CY	25300 CY
Construction Timeframe	0 weeks	0 weeks	15 weeks	17 weeks	46 weeks over 2 construction seasons	34 weeks
Monitoring Program	None	Chemical and physical sediment; benthic toxicity and bioaccumulation; fish tissue; bathymetric surveys	Chemical and physical sediment; benthic toxicity and bioaccumulation; fish tissue	Chemical and physical sediment and cover; benthic toxicity and bioaccumulation; fish tissue	None, all contaminated sediment removed	Chemical and physical sediment and cover; benthic toxicity and bioaccumulation; fish tissue

Table 4
Cost Estimate - Alternative 2: Monitored Natural Recovery
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Description	Unit	Estimated Unit Cost	Estimated Quantity	Extended Value	Present Value	Comments
Construction Costs						
No construction costs associated with this alternative						
Long-Term Monitoring						
Implementation Plan Report	Lump Sum	$ 11,000	1	$ 11,000	$ 11,000	Work Plan, Field Sampling Plan, QAPP
Monitoring and Evaluation Report	Each	$ 4,000	6	$ 24,000	$ 8,631	Every 5 years for 30 years
Field Sampling	Event	$ 34,000	6	$ 204,000	$ 73,366	Every 5 years for 30 years
Sample Analysis	Event	$ 35,920	6	$ 216,000	$ 77,509	Every 5 years for 30 years
Bathymetric Survey	Each	$ 10,000	6	$ 60,000	$ 21,578	Every 5 years for 30 years
Institutional Control Review	Each	$ 1,500	6	$ 9,000	$ 3,237	
			TOTAL	$ 524,000	$ 195,321	
			25% Contingency	$ 131,000	$ 48,830	
			LONG-TERM MONITORING GRAND TOTAL	$ 655,000	$ 244,000	
Professional and Technical Services						
No professional and technical services associated with this alternative						
			TOTAL	**$ 655,000**	**$ 244,000**	

Notes:
All values are based on 2016 dollars with an assumed discount rate of 7 percent per year. See Appendix A for present value calculations.
Assumptions are based on professional judgment and experience of specialists at Bay West. Actual project costs will be highly dependent upon final design.

Table 5
Cost Estimate - Alternative 3: Enhanced MNR with Broadcasted Amendment
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Description	Unit	Estimated Unit Cost	Estimated Quantity	Extended Value	Present Value	Comments
Construction Costs						
Mobilization/Demobilization	Lump Sum	$ 189,000	1	$ 189,000	$ 176,636	All construction occurs on Year 1
Rent Hallett Dock #7 for Staging Area	Month	$ 10,000	4	$ 40,000	$ 37,383	
Install and Remove Dolphin Pilings	Lump Sum	$ 95,000	1	$ 95,000	$ 88,785	Required for barge tie-up
Purchase Amendment Materials and Stockpile at Staging Area	CY	$ 2,477	2012	$ 4,983,724	$ 4,657,686	Assumed Sedimite for amendment application
Broadcast Amendment	CY	$ 105.11	2012	$ 211,488	$ 197,652	168 CY per day production rate
Construction Monitoring/CQA and Oversight	Week	$ 13,000	15	$ 195,000	$ 182,243	15 week construction timeframe
Monthly Operating Expenses and Site Security	Month	$ 20,000	4	$ 80,000	$ 74,766	15 week construction timeframe
Implement Institutional Controls	Lump Sum	$ 10,000.00	1	$ 10,000	$ 9,346	Site postings; restrictions
			SUBTOTAL	$ 5,804,212	$ 5,424,497	
Long-Term Monitoring						
Monitoring and Evaluation Report	Each	$ 4,000	6	$ 24,000	$ 8,631	Every 5 years for 30 years
Field Sampling	Event	$ 34,000	6	$ 204,000	$ 73,366	Every 5 years for 30 years
Sample Analysis	Event	$ 35,920	6	$ 215,520	$ 77,509	Every 5 years for 30 years
			SUBTOTAL	$ 443,520	$ 159,506	
			TOTAL	$ 6,247,732	$ 5,584,003	
			25% Contingency	$ 1,561,933	$ 1,396,001	
			CONSTRUCTION GRAND TOTAL	$ 7,809,664	$ 6,980,003	
Professional and Technical Services						
Remedial Design (6%)	Lump Sum	$ 469,000	1	$ 469,000	$ 469,000	Year 0
Project Management and Permitting (5%)	Lump Sum	$ 390,000	1	$ 390,000	$ 364,486	Year 1
Construction Management (6%)	Lump Sum	$ 469,000	1	$ 469,000	$ 438,318	Year 1
			SUBTOTAL	$ 1,328,000	$ 1,271,804	
			TOTAL	**$ 9,138,000**	**$ 8,252,000**	

Notes:
All values are based on 2016 dollars with an assumed discount rate of 7 percent per year. See Appendix A for present value calculations.
Assumptions are based on professional judgment and experience of specialists at Bay West. Actual project costs will be highly dependent upon final design.

Table 6
Cost Estimate - Alternative 4: Enhanced MNR with Thin-Layer Amended Cover
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Description	Unit	Estimated Unit Cost	Estimated Quantity	Extended Value	Present Value	Comments
Construction Costs						
Mobilization/Demobilization	Lump Sum	$ 205,000	1	$ 205,000	$ 191,589	All construction occurs on Year 1
Rent Hallett Dock #7 for Staging Area	Month	$ 10,000.00	5	$ 50,000	$ 46,729	
Install and Remove Dolphin Pilings	Lump Sum	$ 95,000.00	1	$ 95,000	$ 88,785	Required for barge tie-up
Purchase Amendment Materials and Stockpile at Staging Area	CY	$ 2,477.00	2012	$ 4,983,724	$ 4,657,686	Assumed Sedimite for amendment application
Purchase Sand and Stockpile at Staging Area	CY	$ 20.80	31420	$ 653,536	$ 610,781	
Construct Thin-Layer Sand Cover	CY	$ 41.23	31420	$ 1,295,361	$ 1,210,618	462 CY per day production rate
Construction Monitoring/CQA and Oversight	Week	$ 13,000	17	$ 221,000	$ 206,542	17 week construction timeframe
Monthly Operating Expenses and Site Security	Month	$ 20,000	5	$ 100,000	$ 93,458	17 week construction timeframe
Implement Institutional Controls	Lump Sum	$ 10,000	1	$ 10,000	$ 9,346	Site postings; restrictions
			SUBTOTAL	$ 7,613,621	$ 7,115,534	
Long-Term Monitoring						
Monitoring and Evaluation Report	Each	$ 4,000	6	$ 24,000	$ 8,631	Every 5 years for 30 years
Field Sampling	Event	$ 34,000	6	$ 204,000	$ 73,366	Every 5 years for 30 years
Sample Analysis	Event	$ 35,920	6	$ 215,520	$ 77,509	Every 5 years for 30 years
			SUBTOTAL	$ 443,520	$ 159,506	
			TOTAL	$ 8,057,141	$ 7,275,039	
			25% Contingency	$ 2,014,285	$ 1,818,760	
			CONSTRUCTION GRAND TOTAL	$ 10,071,426	$ 9,093,799	
Professional and Technical Services						
Remedial Design (6%)	Lump Sum	$ 604,000	1	$ 604,000	$ 604,000	Year 0
Project Management and Permitting (5%)	Lump Sum	$ 504,000	1	$ 504,000	$ 471,028	Year 1
Construction Management (6%)	Lump Sum	$ 604,000	1	$ 604,000	$ 564,486	Year 1
			SUBTOTAL	$ 1,712,000	$ 1,639,514	
			TOTAL	**$ 11,783,000**	**$ 10,733,000**	

Notes:

All values are based on 2016 dollars with an assumed discount rate of 7 percent per year. See Appendix A for present value calculations.

Assumptions are based on professional judgment and experience of specialists at Bay West. Actual project costs will be highly dependent upon final design.

Table 7
Cost Estimate - Alternative 5: Dredge Offsite Disposal
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Description	Unit	Estimated Unit Cost	Estimated Quantity	Extended Value	Present Value	Comments
Construction Costs						
Mobilization/Demobilization	Lump Sum	$ 593,560	1	$ 593,560	$ 554,729	All construction occurs on Year 1
Rent Hallett Dock #7 for Staging Area	Month	$ 10,000.00	5	$ 50,000	$ 46,729	
Install and Remove Dolphin Pilings	Lump Sum	$ 95,000.00	1	$ 95,000	$ 88,785	Required for barge tie-up
Turbidity Controls	SF	$ 7.60	10280	$ 78,128	$ 73,017	
Debris Removal	Day	$ 44,302.00	3	$ 132,906	$ 124,211	
Dredge, Barge, and Stabilize Sediments	CY	$ 59.93	133973	$ 8,029,317	$ 7,504,035	739.2 CY production rate in 24 hr shift
Sediment Hauling and Landfill Disposal	Ton	$ 17.66	187562	$ 3,311,452	$ 3,094,815	Assumes 1.4 tons/CY
Purchase Sand and Stockpile at Staging Area	CY	$ 20.80	31420	$ 653,536	$ 610,781	
Construct Thin-Layer Cover	CY	$ 41.23	31420	$ 1,295,361	$ 1,210,618	462 CY per day production rate
Construction Quality Assurance Monitoring	Week	$ 13,000	46	$ 598,000	$ 558,879	26 weeks for first construction season, 20 weeks for second construction season
Construction Quality Assurance Sample Analysis	Lump Sum	$ 389,000	1	$ 389,000	$ 363,551	Dredge confirmation sampling
Monthly Operating Expenses and Site Security	Month	$ 20,000	11.5	$ 230,000	$ 214,953	26 weeks for first construction season, 20 weeks for second construction season
Implement Institutional Controls	Lump Sum	$ 10,000	1	$ 10,000	$ 9,346	Site postings; restrictions
			SUBTOTAL	$ 15,466,260	$ 14,454,449	
			TOTAL	$ 15,466,260	$ 14,454,449	
			25% Contingency	$ 3,866,565	$ 3,613,612	
			CONSTRUCTION GRAND TOTAL	$ 19,332,825	$ 18,068,061	
Professional and Technical Services						
Remedial Design (6%)	Lump Sum	$ 1,160,000	1	$ 1,160,000	$ 1,160,000	Year 0
Project Management and Permitting (5%)	Lump Sum	$ 967,000	1	$ 967,000	$ 903,738	Year 1
Construction Management (6%)	Lump Sum	$ 1,160,000	1	$ 1,160,000	$ 1,084,112	Year 1
			SUBTOTAL	$ 3,287,000	$ 3,147,850	
			TOTAL	**$ 22,620,000**	**$ 21,216,000**	

Notes:

All values are based on 2016 dollars with an assumed discount rate of 7 percent per year. See Appendix A for present value calculations.

Assumptions are based on professional judgment and experience of specialists at Bay West. Actual project costs will be highly dependent upon final design.

Table 8
Cost Estimate - Alternative 6: Hotspot Dredge Offsite Disposal Enhanced MNR with Broadcasted Amendment
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Description	Unit	Estimated Unit Cost	Estimated Quantity	Extended Value	Present Value	Comments
Construction Costs						
Mobilization/Demobilization	Lump Sum	$ 296,780	1	$ 296,780	$ 277,364	All construction occurs on Year 1
Rent Hallett Dock #7 for Staging Area	Month	$ 10,000.00	5	$ 50,000	$ 46,729	
Install and Remove Dolphin Pilings	Lump Sum	$ 95,000.00	1	$ 95,000	$ 88,785	Required for barge tie-up
Turbidity Controls	SF	$ 7.60	10280	$ 78,128	$ 73,017	
Debris Removal	Day	$ 44,302.00	2	$ 88,604	$ 82,807	
Dredge, Barge, and Stabilize Sediments	CY	$ 59.93	25316	$ 1,517,227	$ 1,417,969	352.8 CY production rate in 12 hrs shift
Sediment Hauling and Landfill Disposal	Ton	$ 17.66	133973	$ 2,365,325	$ 2,210,584	Assumes 1.4 tons/CY
Purchase Sand and Stockpile at Staging Area	CY	$ 20.80	5969	$ 124,155	$ 116,033	
Construct Dredge Cover	CY	$ 41.23	5969	$ 246,086	$ 229,987	462 CY per day production rate
Purchase Amendment Materials and Stockpile at Staging Area	CY	$ 2,477	1630	$ 4,037,510	$ 3,773,374	Assumed Sedimite for amendment application
Broadcast Amendment	CY	$ 105.11	1630	$ 171,334	$ 160,126	168 CY per day production rate
Construction Quality Assurance Monitoring	Week	$ 13,000	34	$ 442,000	$ 413,084	34 week construction timeframe
Construction Quality Assurance Sample Analysis	Lump Sum	$ 54,000	1	$ 54,000	$ 50,467	Dredge confirmation sampling
Monthly Operating Expenses and Site Security	Month	$ 20,000	8.5	$ 170,000	$ 158,879	34 week construction timeframe
Implement Institutional Controls	Lump Sum	$ 10,000	1	$ 10,000	$ 9,346	Site postings; restrictions
			SUBTOTAL	$ 9,746,149	$ 9,108,550	
			TOTAL	$ 9,746,149	$ 9,108,550	
Long-Term Monitoring						
Monitoring and Evaluation Report	Each	$ 4,000	6	$ 24,000	$ 8,631	Every 5 years for 30 years
Field Sampling	Event	$ 34,000	6	$ 204,000	$ 73,366	Every 5 years for 30 years
Sample Analysis	Event	$ 35,920	6	$ 215,520	$ 77,509	Every 5 years for 30 years
			SUBTOTAL	$ 443,520	$ 159,506	
			TOTAL	$ 10,189,669	$ 9,268,056	
			25% Contingency	$ 2,547,417	$ 2,277,138	
			CONSTRUCTION GRAND TOTAL	$ 12,293,566	$ 11,385,688	
Professional and Technical Services						
Remedial Design (6%)	Lump Sum	$ 738,000	1	$ 738,000	$ 738,000	Year 0
Project Management and Permitting (5%)	Lump Sum	$ 615,000	1	$ 615,000	$ 574,766	Year 1
Construction Management (6%)	Lump Sum	$ 738,000	1	$ 738,000	$ 689,720	Year 1
			SUBTOTAL	$ 2,091,000	$ 2,002,486	
			TOTAL	**$ 14,385,000**	**$ 13,388,000**	

Notes:
All values are based on 2016 dollars with an assumed discount rate of 7 percent per year. See Appendix A for present value calculations.
Assumptions are based on professional judgment and experience of specialists at Bay West. Actual project costs will be highly dependent upon final design.

Table 9
Comparative Analysis Summary - Threshold, Balancing, and Modifying Criteria
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Evaluation Criteria	Alternative 1: No Action	Alternative 2: MNR	Alternative 3: Enhanced MNR with Broadcasted Amendment	Alternative 4: Enhanced MNR with Thin-Layer Amended Cover	Alternative 5: Excavate, Offsite Disposal	Alternative 6: Hotspot dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment
			Threshold Criteria			
Overall Protection of Human Health & Environment	Provides **no achievement** of protection of Human Health and the Environment as contaminant concentrations remain with minimal controls to prevent exposure.	Provides **low achievement** of protection of Human Health and the Environment as contaminant concentrations remain with minimal controls to prevent exposure; however RAOs would be achieved over time.	Provides a **moderate achievement** of protection of Human Health and the Environment. Sediment contaminants would be reduced through addition of an amendment material and controlled by providing an amendment layer between contaminated sediments and the water column. May require monitoring to ensure effectiveness and future additions of amendment material.	Provides a **moderate to high achievement** of protection of Human Health and the Environment. Sediment contaminants would be reduced through addition of an amendment material and controlled by providing an amendment layer between contaminated sediments and the water column. May require monitoring to ensure effectiveness and future additions of amendment material.	Provides a **high achievement** of protection of Human Health and the Environment. Sediment contaminants would be completely removed from the remedial footprint and disposed of off-site.	Provides a **moderate to high achievement** of protection of Human Health and the Environment. The most contaminated sediments would be removed from the remedial footprint and the remaining sediment contaminants would be reduced through addition of an amendment material and controlled by providing an amendment layer between contaminated sediments and the water column. May require monitoring to ensure effectiveness and future additions of amendment material.
ARARs	Provides **no achievement** of ARARs since chemical-specific TBCs are not met for sediment. Location and action-specific ARAR s do not apply to this alternative.	Provides a **low achievement** of ARARs; however, COCs may not be reduced to concentrations less than RAOs in a reasonable time frame.	Provides a **moderate achievement** of ARARs if implemented properly; however, COCs may not be reduced to concentrations less than RAOs in a reasonable time frame.	Provides a **moderate to high achievement** of ARARs if implemented properly; however, COCs may not be reduced to concentrations less than RAOs in a reasonable time frame.	Provides a **high achievement** of ARARs if implemented properly.	Provides a **moderate to high achievement** of ARARs if implemented properly; however, COCs outside the hotspot area may not be reduced to concentrations less than RAOs in a reasonable time frame.
			Primary Balancing Criteria			
Long-term Effectiveness and Permanence	Provides **no achievement** of long-term effectiveness and remedy is not long-term effective or permanent.	Provides a **low achievement** of long-term effectiveness and permanence because sediment contaminants would eventually be sequestered and degraded by natural processes and rendered unavailable to biota within the most biologically active zone; however, natural processes may not occur at rates to achieve RAOs in a reasonable timeframe.	Provides a **moderate achievement** of long-term effectiveness and permanence because sediment contaminants would eventually be sequestered by amendment materials and rendered unavailable to biota within the most biologically active zone; however, sequestration of contaminants at deeper intervals may not occur and monitoring and possible reapplication of amendment material may be necessary as contaminants would remain in place.	Provides a **moderate achievement** of long-term effectiveness and permanence because sediment contaminants would eventually be sequestered by amendment materials and rendered unavailable to biota within the most biologically active zone; however, sequestration of contaminants at deeper intervals may not occur and monitoring and possible reapplication of amendment material may be necessary as contaminants would remain in place.	Provides a **high achievement** of long-term effectiveness and permanence because sediment contaminants would eventually be sequestered by amendment materials and rendered unavailable to biota within the most biologically active zone; however, sequestration of contaminants at deeper intervals may not occur and monitoring and possible reapplication of amendment material may be necessary as contaminants would remain in place.	Provides a **moderate to high achievement** of long-term effectiveness and permanence because sediment contaminants in the hotspot area would be completely removed and remaining sediment contaminants would eventually be sequestered by amendment materials and rendered unavailable to biota within the most biologically active zone; however, sequestration of contaminants at deeper intervals may not occur and monitoring and possible reapplication of amendment material may be necessary as contaminants would remain in place.
Reduction of Toxicity, Mobility or Volume through Treatment	Provides a **no achievement** of this criterion as no reduction in toxicity, mobility, or volume through treatment is provided.	Provides a **no achievement** of this criterion as no reduction in toxicity, mobility, or volume through treatment is provided.	Provides a **moderate to high achievement** of this criterion as the toxicity and mobility of sediment contaminants would be reduced through addition of an amendment material near the sediment surface; however, it is possible that deeper sediment contamination could remain in place indefinitely.	Provides a **moderate to high achievement** of this criterion as the toxicity and mobility of sediment contaminants would be reduced through addition of an amendment material near the sediment surface; however, it is possible that deeper sediment contamination could remain in place indefinitely.	Provides a **low achievement** of this criterion as the toxicity and mobility of sediment contaminants would not be reduced through treatment; however, the volume of contaminated sediment would be reduced through the complete removal of contaminated sediment in the remedial footprint.	Provides a **high achievement** of this criterion as the toxicity and mobility of sediment contaminants would be reduced through addition of an amendment material near the sediment surface; however, it is possible that deeper sediment contamination could remain in place indefinitely. Though not through treatment, the volume of contaminated sediment would also be reduced through the removal of the hotspot area.
Short-term effectiveness	Provides a **high achievement** of this criterion as no actions are implemented, so no risks to the community would result from remedy implementation; however, receptors would continue to be exposed to contaminated sediment.	Provides a **high achievement** of this criterion as no remedial actions are implemented, so no risks to the community would result from remedy implementation and risk to workers is low; however, receptors would continue to be exposed to contaminated sediment.	Provides a **high achievement** of this criterion since cover placement would only minimally displace the benthic community with the additional of broadcast amendment. Risks to workers is low.	Provides a **moderate to high achievement** of this criterion since cover placement would temporarily displace the benthic community. Risks to workers is low.	Provides a **low achievement** of this criterion since excavation of all contaminated sediment within the remedial footprint would also remove the entire plant and benthic community, resulting in the longest recovery time of all the alternatives. The risk to site workers is relatively high due to the removal of sediments and associated transport to a landfill.	Provides a **moderate achievement** of this criterion since excavation of all contaminated sediment within the hotspot would also remove the entire plant and benthic community in that area; however, the rest of the remedial footprint would be minimally impacted with the addition of broadcast amendment. The risk to site workers is relatively high due to the removal of sediments and associated transport to a landfill.
Implementability	Provides a **high achievement** of this criterion as no actions would be implemented.	Provides a **high achievement** of this criterion as only monitoring would be required.	Provides a **moderate to high achievement** of implementability since it only requires placement of cover material using proven methods with a low to moderate level of complexity.	Provides a **moderate to high achievment** of implementability since it only requires placement of cover material using proven methods with a low to moderate level of complexity; however, Alternative 4 requires the placement of more material than Alternative 3, making it more complicated.	Provides a **low to moderate achievement** of implementability since it is a more complex alternative to execute due to the coordination of dredging sediments and placement of sand cover.	Provides a **low achievement** of implementability since it involves complexities of both dredging and broadcasting amendment.
Cost (1)	$0	$244,000	$8,252,000	$10,733,000	$21,216,000	$13,388,000
			Modifying Criteria			
State Support / Agency Acceptance	TBD	TBD	TBD	TBD	TBD	TBD
Community Acceptance	TBD	TBD	TBD	TBD	TBD	TBD

Notes
(1) Cost are presented as Present Value.
M = Million
** Not included in numerical comparison on (Table 5-2).*
TBD = To Be Determined

Table 10
Comparative Analysis Summary - Green Sustainable Remediation Criteria
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Evaluation Criteria	Alternative 1: No Action	Alternative 2: MNR	Alternative 3: Enhanced MNR with Broadcasted Amendment	Alternative 4: Enhanced MNR with Thin-Layer Amended Cover	Alternative 5: Excavate, Offsite Disposal	Alternative 6: Hotspot dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment
Green Sustainable Remediation (GSR) Criteria*						
Green House Gas (GHG) Emissions	None.	None.	Total GHG emissions produced during cover material delivery and placement and equipment mobilization related to sampling activities.	Total GHG emissions produced during cover material delivery and placement and equipment mobilization related to sampling activities.	Total GHG emissions produced during dredging, hauling and cover material delivery equipment mobilization related to sampling activities.	Total GHG emissions produced during dredging, hauling and cover material delivery equipment mobilization related to sampling activities.
Toxic Chemical Usage and Disposal	None.	No toxic chemicals are used or disposed.	No toxic chemicals are used or disposed.	No toxic chemicals are used or disposed.	No toxic chemicals are used or disposed.	No toxic chemicals are used or disposed.
Energy Consumption	None.	Fossil fuels are limited to the equipment mobilization for sampling activities.	Fossil fuels are limited to the equipment mobilization for sampling activities and cover placement operations.	Fossil fuels are limited to the equipment mobilization for sampling activities and cover placement operations.	Fossil fuels are limited to the equipment mobilization for sampling activities, dredging operations, and cover placement operations.	Fossil fuels are limited to the equipment mobilization for sampling activities, dredging operations, and cover placement operations.
Use of Alternative Fuels	None.	None.	Alternative fuels could be used to run heavy construction equipment.	Alternative fuels could be used to run heavy construction equipment.	Alternative fuels could be used to run heavy construction equipment.	Alternative fuels could be used to run heavy construction equipment.
Water Consumption	None.	No water consumption is necessary.	No water consumption is necessary.	Little water consumption is necessary.	Little water consumption is necessary.	Little water consumption is necessary.
Waste Generation	None.	No waste generation.	No waste generation.	No waste generation.	Contaminated sediments from the remedial footprint would be removed and disposed of at a landfill.	Contaminated sediments from the hotspot area would be removed and disposed of at a landfill.
GSR Criteria Summary	Provides a **high achievement** of the GSR criterion.	Provides a **high achievement** of the GSR criterion.	Provides a **moderate to high achievement** of the GSR criterion.	Provides a **moderate to high achievement** of the GSR criterion.	Provides a **low achievement** of the GSR criterion.	Provides a **moderate achievement** of the GSR criterion.

Notes
(1) Cost are presented as Present Value.
M = Million
** Not included in numerical comparison on (Table 5-2).*
TBD = To Be Determined

Table 11
Numerical Comparative Analysis Summary
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Evaluation Criteria	Alternative 1: No Action	Alternative 2: MNR	Alternative 3: Enhanced MNR with Broadcasted Amendment	Alternative 4: Enhanced MNR with Thin-Layer Amended Cover	**Alternative 5: Excavate, Offsite Disposal**	**Alternative 6: Hotpsot dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment**
Overall Protection of Human Health & Environment	0	1	2	2	3	2.5
ARARs	0	1	2	2.5	3	2.5
Long-term Effectiveness and Permanence	0	1	2	2	3	2.5
Reduction of Toxicity, Mobility or Volume through Treatment	0	0	2.5	2.5	1	3
Short-term effectiveness	3	3	3	2.5	1	2
Implementability	3	3	2.5	2.5	1.5	1
Cost (1)	3	3	2.5	2	1	2
State Support / Agency Acceptance	TBD	TBD	TBD	TBD	TBD	TBD
Community Acceptance	TBD	TBD	TBD	TBD	TBD	TBD
Total Numerical Value	**9**	**12**	**16.5**	**16**	**13.5**	**15.5**

Notes

(1) Cost are presented as Present Value.

Ratings are based on achievement of criterion: no achievement, low achievement; moderate achievement; and high achievement.

Scores are based on 0 = no achievement; 1 = low achievement; 2 = moderate achievement; and 3 = high achievement.

Scoring for cost are based on the following cost breakpoints: > $20 million = low achievement; $10-20 Million = moderate achievement; and < $10 million = high achievement.

GSR criteria not included in this numerical comparison.

See Table 6 for a discussion of each criterion.

Appendix A

2015 and 2017 Laboratory Reports and Data Tables

Appendix A: Table 1
Sample Location Coordinates
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Sample Location	Sample Name	Start Depth (meters)	End Depth (meters)	Sample Interval (meters)	Longitude	Latitude	Northing	Easting
BW17ML-041	BW17ML-041-0.0-0.15	0	0.15	0-0.15	-92.201962	46.705025	561004.2687	5172694.636
BW17ML-041	BW17ML-041-0.15-0.43	0.15	0.43	0.15-0.5	-92.201962	46.705025	561004.2687	5172694.636
BW17ML-042	BW17ML-042-0.0-0.15	0	0.15	0-0.15	-92.203644	46.705036	560875.6809	5172694.636
BW17ML-042	BW17ML-042-0.15-0.36	0.15	0.36	0.15-0.5	-92.203644	46.705036	560875.6809	5172694.636
BW17ML-043	BW17ML-043-0.0-0.15	0	0.15	0-0.15	-92.205826	46.704416	560709.6225	5172624.055
BW17ML-043	BW17ML-043-0.15-0.46	0.15	0.46	0.15-0.5	-92.205826	46.704416	560709.6225	5172624.055
BW17ML-044	BW17ML-044-0.0-0.15	0	0.15	0-0.15	-92.20703	46.703574	560618.5055	5172529.535
BW17ML-044	BW17ML-044-0.15-0.45	0.15	0.45	0.15-0.5	-92.20703	46.703574	560618.5055	5172529.535
BW17ML-045	BW17ML-045-0.0-0.15	0	0.15	0-0.15	-92.205934	46.703256	560702.6295	5172495.034
BW17ML-045	BW17ML-045-0.15-0.41	0.15	0.41	0.15-0.5	-92.205934	46.703256	560702.6295	5172495.034
BW17ML-046	BW17ML-046-0.0-0.15	0	0.15	0-0.15	-92.206977	46.702607	560623.6457	5172422.1
BW17ML-046	BW17ML-046-0.15-0.31	0.15	0.31	0.15-0.5	-92.206977	46.702607	560623.6457	5172422.1
BW17ML-047	BW17ML-047-0.0-0.15	0	0.15	0-0.15	-92.205904	46.702247	560706.0495	5172382.947
BW17ML-047	BW17ML-047-0.15-0.36	0.15	0.36	0.15-0.5	-92.205904	46.702247	560706.0495	5172382.947
BW17ML-048	BW17ML-048-0.0-0.15	0	0.15	0-0.15	-92.207084	46.70193	560616.2423	5172346.825
BW17ML-048	BW17ML-048-0.15-0.26	0.15	0.26	0.15-0.5	-92.207084	46.70193	560616.2423	5172346.825
BW17ML-049	BW17ML-049-0.0-0.15	0	0.15	0-0.15	-92.206158	46.701481	560687.5193	5172297.659
BW17ML-049	BW17ML-049-0.15-0.39	0.15	0.39	0.15-0.5	-92.206158	46.701481	560687.5193	5172297.659
BW17ML-050	BW17ML-050-0.0-0.15	0	0.15	0-0.15	-92.205742	46.701086	560719.7799	5172254.1
BW17ML-050	BW17ML-050-0.15-0.44	0.15	0.44	0.15-0.5	-92.205742	46.701086	560719.7799	5172254.1
BW17ML-051	BW17ML-051-0.0-0.15	0	0.15	0-0.15	-92.205937	46.700723	560705.2347	5172213.545
BW17ML-051	BW17ML-051-0.15-0.36	0.15	0.36	0.15-0.5	-92.205937	46.700723	560705.2347	5172213.545
BW17ML-052	BW17ML-052-0.0-0.15	0	0.15	0-0.15	-92.205556	46.700372	560734.7383	5172174.889
BW17ML-052	BW17ML-052-0.15-0.44	0.15	0.44	0.15-0.5	-92.205556	46.700372	560734.7383	5172174.889
BW17ML-053	BW17ML-053-0.0-0.15	0	0.15	0-0.15	-92.206496	46.700291	560663.0269	5172165.085
BW17ML-053	BW17ML-053-0.15-0.39	0.15	0.39	0.15-0.5	-92.206496	46.700291	560663.0269	5172165.085
BW17ML-054	BW17ML-054-0.0-0.15	0	0.15	0-0.15	-92.207181	46.699942	560611.0247	5172125.782
BW17ML-054	BW17ML-054-0.15-0.40	0.15	0.4	0.15-0.5	-92.207181	46.699942	560611.0247	5172125.782
BW17ML-055	BW17ML-055-0.0-0.15	0	0.15	0-0.15	-92.206226	46.699498	560684.5295	5172077.267
BW17ML-055	BW17ML-055-0.15-0.40	0.15	0.4	0.15-0.5	-92.206226	46.699498	560684.5295	5172077.267
BW17ML-056	BW17ML-056-0.0-0.15	0	0.15	0-0.15	-92.207211	46.698914	560609.8597	5172011.56
BW17ML-056	BW17ML-056-0.15-0.34	0.15	0.34	0.15-0.5	-92.207211	46.698914	560609.8597	5172011.56
BW17ML-057	BW17ML-057-0.0-0.15	0	0.15	0-0.15	-92.205423	46.698567	560746.9879	5171974.394
BW17ML-057	BW17ML-057-0.15-0.38	0.15	0.38	0.15-0.5	-92.205423	46.698567	560746.9879	5171974.394
BW17ML-058	BW17ML-058-0.0-0.15	0	0.15	0-0.15	-92.208651	46.698235	560500.5323	5171935.017
BW17ML-058	BW17ML-058-0.15-0.45	0.15	0.45	0.15-0.5	-92.208651	46.698235	560500.5323	5171935.017
BW17ML-059	BW17ML-059-0.0-0.15	0	0.15	0-0.15	-92.207482	46.698234	560589.9303	5171935.809
BW17ML-060	BW17ML-060-0.0-0.15	0	0.15	0-0.15	-92.20419	46.698332	560841.4533	5171949.183
BW17ML-060	BW17ML-060-0.15-0.41	0.15	0.41	0.15-0.5	-92.20419	46.698332	560841.4533	5171949.183
BW17ML-061	BW17ML-061-0.0-0.15	0	0.15	0-0.15	-92.208966	46.697795	560476.9227	5171885.909
BW17ML-061	BW17ML-061-0.15-0.39	0.15	0.39	0.15-0.5	-92.208966	46.697795	560476.9227	5171885.909
BW17ML-062	BW17ML-062-0.0-0.15	0	0.15	0-0.15	-92.207241	46.69752	560609.1359	5171856.633
BW17ML-063	BW17ML-063-0.0-0.15	0	0.15	0-0.15	-92.205597	46.697593	560734.7383	5171866.077
BW17ML-063	BW17ML-063-0.15-0.42	0.15	0.42	0.15-0.5	-92.205597	46.697593	560734.7383	5171866.077
BW17ML-064	BW17ML-064-0.0-0.15	0	0.15	0-0.15	-92.204116	46.697278	560848.3657	5171832.195
BW17ML-064	BW17ML-064-0.15-0.38	0.15	0.38	0.15-0.5	-92.204116	46.697278	560848.3657	5171832.195
BW17ML-065	BW17ML-065-0.0-0.15	0	0.15	0-0.15	-92.205667	46.696958	560730.1379	5171795.413
BW17ML-065	BW17ML-065-0.15-0.50	0.15	0.5	0.15-0.5	-92.205667	46.696958	560730.1379	5171795.413
BW17ML-066	BW17ML-066-0.0-0.15	0	0.15	0-0.15	-92.205568	46.696002	560738.7689	5171689.29
BW17ML-066	BW17ML-066-0.15-0.32	0.15	0.32	0.15-0.5	-92.205568	46.696002	560738.7689	5171689.29
BW17ML-067	BW17ML-067-0.0-0.10	0	0.15	0-0.15	-92.20332	46.705427	560900.0297	5172738.256
BW17ML-067	BW17ML-067-0.15-0.39	0.15	0.39	0.15-0.5	-92.20332	46.705427	560900.0297	5172738.256

Notes
Eastings and Northings in UTM meters Zone 15 North, NAD 1983 Conus

Appendix A: Table 2
Total Organic Carbon Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Sample Name	Sample Depth Start (m)	Sample Depth End (m)	Result (mg/kg)	Results Qualifier
BW17ML-41-0.0-0.15	0	0.15	15,200	
BW17ML-41-0.15-0.43	0.15	0.43	51,800	
BW17ML-42-0.0-0.15	0	0.15	12,200	
BW17ML-42-0.15-0.36	0.15	0.36	19,500	
BW17ML-043-0.0-0.15	0.0	0.15	25,600	
BW17ML-043-0.15-0.46	0.2	0.46	29,800	
BW17ML-044-0.0-0.15	0.0	0.15	34,700	
BW17ML-044-0.15-0.45	0.15	0.45	24,300	
BW17ML-045-0.0-0.15	0	0.15	52,900	
BW17ML-045-0.15-0.41	0.15	0.41	37,000	
BW17ML-046-0.0-0.15	0	0.15	56,300	
BW17ML-046-0.15-0.31	0.15	0.31	50,200	
BW17ML-047-0.0-0.15	0	0.15	41,700	
BW17ML-047-0.15-0.36	0.15	0.36	40,900	
BW17ML-048-0.0-0.15	0	0.15	78,300	
BW17ML-048-0.15-0.26	0.15	0.26	28,700	
BW17ML-049-0.0-0.15	0	0.15	42,300	
BW17ML-049-0.15-0.39	0.15	0.39	43,000	
BW17ML-050-0.0-0.15	0	0.15	32,600	
BW17ML-050-0.15-0.44	0.15	0.44	21,300	
BW17ML-051-0.0-0.15	0	0.15	25,200	
BW17ML-051-0.15-0.36	0.15	0.36	19,800	
BW17ML-052-0.0-0.15	0	0.15	32,300	
BW17ML-052-0.15-0.44	0.15	0.44	19,500	
BW17ML-053-0.0-0.15	0	0.15	50,600	
BW17ML-053-0.15-0.39	0.15	0.39	50,700	
BW17ML-054-0.0-0.15	0	0.15	36,900	
BW17ML-054-0.15-0.40	0.15	0.4	16,800	
BW17ML-055-0.0-0.15	0	0.15	35,800	
BW17ML-055-0.15-0.40	0.15	0.4	49,500	
BW17ML-056-0.0-0.15	0	0.15	23,900	
BW17ML-056-0.15-0.34	0.15	0.34	20,500	
BW17ML-057-0.0-0.15	0	0.15	54,100	
BW17ML-057-0.15-0.38	0.15	0.38	43,400	
BW17ML-058-0.0-0.15	0	0.15	36,100	
BW17ML-058-0.15-0.45	0.15	0.45	85,100	
BW17ML-059-0.0-0.15	0	0.15	32,300	
BW17ML-060-0.0-0.15	0	0.15	16,300	

Appendix A: Table 2
Total Organic Carbon Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Sample Name	Sample Depth Start (m)	Sample Depth End (m)	Result (mg/kg)	Results Qualifier
BW17ML-060-0.15-0.41	0.15	0.41	54,400	
BW17ML-061-0.0-0.15	0	0.15	101,000	
BW17ML-061-0.15-0.39	0.15	0.39	83,800	
BW17ML-062-0.0-0.15	0	0.15	118,000	
BW17ML-063-0.0-0.15	0	0.15	34,200	
BW17ML-063-0.15-0.42	0.15	0.42	14,600	
BW17ML-064-0.0-0.15	0	0.15	32,400	
BW17ML-064-0.15-0.38	0.15	0.38	24,600	
BW17ML-065-0.0-0.15	0	0.15	119,000	
BW17ML-065-0.15-0.50	0.15	0.5	189,000	
BW17ML-066-0.0-0.15	0	0.15	24,100	
BW17ML-066-0.15-0.32	0.15	0.32	33,000	
BW17ML-67-0.0-0.10	0	0.1	19,300	
BW17ML-67-0.15-0.39	0.15	0.39	29,000	

Notes:
TOC - Total organic carbon
J - estimated value
U - indicates non-detect because of TOC contamination in the method blank
m - meters
TOC analyzed by EPA Method SW9060

Appendix A: Table 3
Dioxin/Furan Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Chemical	Sample Name				BW17ML-043-0.0-0.15		BW17ML-043-0.15-0.46		BW17ML-044-0.0-0.15		BW17ML-044-0.15-0.45		BW17ML-045-0.0-0.15		BW17ML-045-0.15-0.41		BW17ML-046-0.0-0.15		BW17ML-046-0.15-0.31		BW17ML-047-0.0-0.15		BW17ML-047-0.15-0.36		BW17ML-048-0.0-0.15		BW17ML-048-0.15-0.26	
	Sample Depth Start (meters)				0		0.15		0		0.15		0		0.15		0		0.15		0		0.15		0		0.15	
	Sample Depth End (meters)				0.15		0.46		0.15		0.45		0.15		0.41		0.15		0.31		0.15		0.36		0.15		0.26	
	Sample Interval (meters)				0-0.15		0.15-0.50		0-0.15		0.15-0.50		0-0.15		0.15-0.50		0-0.15		0.15-0.50		0-0.15		0.15-0.50		0-0.15		0.15-0.50	
	SQT Level I	SQT Midpoint	SQT Level II	Result unit	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
1,2,3,4,6,7,8-HpCDD	NE	NE	NE	ng/Kg	102		619		1490		85.9		3770		35.4		1090		44.1		326		1820		299		38.3	
1,2,3,4,6,7,8-HpCDF	NE	NE	NE	ng/Kg	81.1		1560		2030		530		11000		201		3150		168		487		3540		627		93.7	
1,2,3,4,7,8,9-HpCDF	NE	NE	NE	ng/Kg	2.37	J	15.4		44.8		5.53		102		2.59	J	38.3		2.15	J	8.48	J	46.6		22.7		2.47	J
1,2,3,4,7,8-HxCDD	NE	NE	NE	ng/Kg	1.48	J	13.0		27.9		1.70	J	53.9		0.489	J	16.8		1.10		3.42	J	21.4		4.26		0.639	J
1,2,3,4,7,8-HxCDF	NE	NE	NE	ng/Kg	2.53	J	25.4		57.3		8.61		131		5.84		56.4		3.89	J	8.28	J	55.6		22.8		3.3	J
1,2,3,6,7,8-HxCDD	NE	NE	NE	ng/Kg	5.53		55.9		98.9		11.4		309		3.03	J	98.0		4.08	J	22.0	J	138		23.3		3.52	J
1,2,3,6,7,8-HxCDF	NE	NE	NE	ng/Kg	3.75	J	41.1		83.3		15.0		290		6.15		85.9		5.71		16.1	J	98.9		29.3		4.24	J
1,2,3,7,8,9-HxCDD	NE	NE	NE	ng/Kg	3.35	J	33.6		50.1		5.12		196		1.11	J	57.9		1.63	J	12.0		87.1		13.2		2.21	J
1,2,3,7,8,9-HxCDF	NE	NE	NE	ng/Kg	0.133	J	1.08	J	2.29	J	0.332	J	5.66		0.0945	J	2.00	J	0.100	J	0.779	U	2.59		1.02		0.157	J
1,2,3,7,8-PeCDD	NE	NE	NE	ng/Kg	1.32	J	14.4		20.4		1.86	J	65.4		0.561	J	20.6		1.25	J	3.67	J	29.9		4.99		0.886	J
1,2,3,7,8-PeCDF	NE	NE	NE	ng/Kg	0.534	J	3.10	J	6.37		0.850	J	14.5		0.501	J	5.34		0.573	J	1.60	J	6.83		3.34		0.533	J
2,3,4,6,7,8-HxCDF	NE	NE	NE	ng/Kg	1.27	J	11.2		18.2		3.81	J	43.6		1.92	J	18.1		1.57	J	4.47	J	18.4		5.31		0.975	J
2,3,4,7,8-PeCDF	NE	NE	NE	ng/Kg	1.30	J	5.85		10.7		1.89	J	21.6		1.96	J	10.7		1.06	J	3.38	J	11.7		5.55		1.06	J
2,3,7,8-TCDD	NE	NE	NE	ng/Kg	0.482	J	3.43		6.72		0.493	J	17.6		0.208	J	6.36		0.377		1.96		11.3		2.06		0.446	J
2,3,7,8-TCDF	NE	NE	NE	ng/Kg	1.16		3.20		13.0		0.403	J	16.3		0.372	J	7.75		0.365	J	4.20		19.4		5.64		1	
OCDD	NE	NE	NE	ng/Kg	865		3400		10300		542		25100		391		7770		299		2870		14400		2630		316	
OCDF	NE	NE	NE	ng/Kg	62.1		523		870		162		3290		68.2		1050		58.5		221		1480		372		42.6	
Total HpCDD	NE	NE	NE	ng/Kg	273		1620		3870		205		10700		117		2690		106		916		4740		754		95.4	
Total HpCDF	NE	NE	NE	ng/Kg	213		3120		4320		1000		23400		424		6080		349		1210		6990		1310		190	
Total HxCDD	NE	NE	NE	ng/Kg	48.9		540		842		78.3		3220		38.9		918		36.6		228		1130		209		31.9	
Total HxCDF	NE	NE	NE	ng/Kg	68.3		955		1420		290		6060		112		1970		96.1		302		2140		465		67	
Total PeCDD	NE	NE	NE	ng/Kg	10.3		108		158		20.6		507		10.5		159		12.4		44.3		256		60.6		12.4	
Total PeCDF	NE	NE	NE	ng/Kg	39.6		241		332		53.1		904		33.0		295		26.9		92.4		393		183		27.7	
Total TCDD	NE	NE	NE	ng/Kg	7.25		43.8		64.9		13.3		185		13.3		69.2		12.0		26.9		82.8		29		8.92	
Total TCDF	NE	NE	NE	ng/Kg	28.2		88.3		162		15.8		230		14.7		116		12.0		59.2		149		114		17.7	
TEQ KM Fish	0.85	11.2	21.5	ng TEQ/Kg	5.16	J	53.11		88.34		12.66		292.00		5.60		93.02		5.72		18.16	J	118.14		25.71		4.22	J

Appendix A: Table 3
Dioxin/Furan Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Chemical				Sample Name	BW17ML-049-0.0-0.15		BW17ML-049-0.15-0.39		BW17ML-050-0.0-0.15		BW17ML-051-0.0-0.15		BW17ML-051-0.15-0.36		BW17ML-052-0.0-0.15		BW17ML-052-0.15-0.44		BW17ML-053-0.0-0.15		BW17ML-053-0.15-0.39		BW17ML-054-0.0-0.15	
				Sample Depth Start (meters)	0		0.15		0		0		0.15		0		0.15		0		0.15		0	
				Sample Depth End (meters)	0.15		0.39		0.15		0.15		0.36		0.15		0.44		0.15		0.39		0.15	
				Sample Interval (meters)	**0-0.15**		**0.15-0.50**		**0-0.15**		**0-0.15**		**0.15-0.50**		**0-0.15**		**0.15-0.50**		**0-0.15**		**0.15-0.50**		**0-0.15**	
	SQT Level I	SQT Midpoint	SQT Level II	Result unit	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
1,2,3,4,6,7,8-HpCDD	NE	NE	NE	ng/Kg	416		2470		687		2910		381		197		81.6		614		840		1240	
1,2,3,4,6,7,8-HpCDF	NE	NE	NE	ng/Kg	528		7620		2560		4990		2310		373		148	J	562		2580		2230	
1,2,3,4,7,8,9-HpCDF	NE	NE	NE	ng/Kg	10.5		70.9		20.7		54.8		14.7		7.6		2.96	J	15.9		28.9		70.4	
1,2,3,4,7,8-HxCDD	NE	NE	NE	ng/Kg	4.49	J	34.3	J	9.37		37.8		5.27		2.44	J	1.2	J	6.44		10.3	J	14.6	
1,2,3,4,7,8-HxCDF	NE	NE	NE	ng/Kg	11.1		99.6		31.5		72.6		22.2		8.15		3.19	J	16.9		42.3		76.1	
1,2,3,6,7,8-HxCDD	NE	NE	NE	ng/Kg	24.7		222		69.6		216		46		14.3		5.67		34.1		79.7		90.1	
1,2,3,6,7,8-HxCDF	NE	NE	NE	ng/Kg	20.3		213		66		118		47.1		15.8		7.07		21.5		98.6		75	
1,2,3,7,8,9-HxCDD	NE	NE	NE	ng/Kg	13.6		124		39.7		152		23		8.66		3.39	J	16.8		46.3		60.3	
1,2,3,7,8,9-HxCDF	NE	NE	NE	ng/Kg	0.589	J	5.41	J	1.46		2.77		1.05	J	0.457	J	0.189	J	0.752	J	1.63	J	2.55	J
1,2,3,7,8-PeCDD	NE	NE	NE	ng/Kg	4.77	J	42.2	J	13.4		48.1		7.52		2.7	J	1.11	J	5.83		13.5		17.2	
1,2,3,7,8-PeCDF	NE	NE	NE	ng/Kg	2.15	J	12	J	3.8		8.26		2.38	J	1.46	J	0.574	J	2.69	J	1.63		6.81	
2,3,4,6,7,8-HxCDF	NE	NE	NE	ng/Kg	3.9	J	33.8	J	13.2		23		9.14		2.68	J	1.12	J	4.83		12.5	J	14.8	
2,3,4,7,8-PeCDF	NE	NE	NE	ng/Kg	3.75	J	21.1	J	7.48		13.5		4.58	J	2	J	0.788	J	5.59		7.50		12.4	
2,3,7,8-TCDD	NE	NE	NE	ng/Kg	2.41		12.1		3.34		17.5		1.45		1.15		0.438		3.79		4.65		7.08	
2,3,7,8-TCDF	NE	NE	NE	ng/Kg	6.46		15.4		3.43		22.2		0.732	J	2.36		0.784	J	10.4		5.79		15.2	
OCDD	NE	NE	NE	ng/Kg	3800		18600		5660		21700		3660		1690		665		5570		5680		11100	
OCDF	NE	NE	NE	ng/Kg	279		3060		857		2110		715		179		71.2	J	381		942		1180	
Total HpCDD	NE	NE	NE	ng/Kg	949		5790		1770		6770		1090		476		190		1570		2070		3040	
Total HpCDF	NE	NE	NE	ng/Kg	1110		15000		4740		9620		4200		719		293		1300		4840		4620	
Total HxCDD	NE	NE	NE	ng/Kg	214		1850		571		1860		374		128		52		292		495		656	
Total HxCDF	NE	NE	NE	ng/Kg	330		4060	J	1440		2960		1220		218		85.8		421		1370		1370	
Total PeCDD	NE	NE	NE	ng/Kg	57.7		351		130		420		58.6		32.2		15.4		55.9		117		160	
Total PeCDF	NE	NE	NE	ng/Kg	105		667		231		468		151		65.8		24.3		144		239		358	
Total TCDD	NE	NE	NE	ng/Kg	27.9		116		43.7		133		28.6		15.3		8.68		35.6		50.5		52.9	
Total TCDF	NE	NE	NE	ng/Kg	70.1		189		70.5		182		31.9		35.5		12.3		101		67.5		179	
TEQ KM Fish	0.85	11.2	21.5	ng TEQ/Kg	21.91		203.56		64.98		173.83		46.76		13.39		5.52	J	28.18		71.78		82.7015	

Appendix A: Table 3
Dioxin/Furan Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Chemical				Sample Name	BW17ML-054-0.15-0.40		BW17ML-055-0.0-0.15		BW17ML-055-0.15-0.40		BW17ML-056-0.0-0.15		BW17ML-056-0.15-0.34		BW17ML-058-0.0-0.15		BW17ML-058-0.15-0.45		BW17ML-060-0.0-0.15		BW17ML-061-0.0-0.15		BW17ML-061-0.15-0.39		BW17ML-062-0.0-0.15		BW17ML-063-0.0-0.15	
				Sample Depth Start (meters)	0.15		0		0.15		0		0.15		0		0.15		0		0		0.15		0		0	
				Sample Depth End (meters)	0.4		0.15		0.4		0.15		0.34		0.15		0.45		0.15		0.15		0.39		0.15		0.15	
				Sample Interval (meters)	0.15-0.50		0-0.15		0.15-0.50		0-0.15		0.15-0.50		0-0.15		0.15-0.50		0-0.15		0-0.15		0.15-0.50		0-0.15		0-0.15	
	SQT Level I	SQT Midpoint	SQT Level II	Result unit	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
1,2,3,4,6,7,8-HpCDD	NE	NE	NE	ng/Kg	162		647		883		333		787		295		194		466		315		228		393		313	
1,2,3,4,6,7,8-HpCDF	NE	NE	NE	ng/Kg	594		1070		2850		317		1490		171		278		397		331		330		424		726	
1,2,3,4,7,8,9-HpCDF	NE	NE	NE	ng/Kg	4.64		18.2		31.3		16.2		20.1		10.9		12.5		9.51		17.6		13.2		15.9		9.10	J
1,2,3,4,7,8-HxCDD	NE	NE	NE	ng/Kg	2.67	J	8.61	J	11.9		3.76	J	11.5		3.14	J	2.84	J	4.67		6.77		4.46	J	5.5		6.44	J
1,2,3,4,7,8-HxCDF	NE	NE	NE	ng/Kg	7.28		24.3		47.4		14.7		25.6		12.1		15.5		9.90		20.2		16.0		17.8		13.0	J
1,2,3,6,7,8-HxCDD	NE	NE	NE	ng/Kg	17.2		47.7		82.6		19.2		63.2		16.3		14.9		24.5		21.5		17.7		27.4		28.3	
1,2,3,6,7,8-HxCDF	NE	NE	NE	ng/Kg	12.6		36.4		69.3		18		42		13.1		16.2		17.7		23.4		20.8		25.2		23.6	
1,2,3,7,8,9-HxCDD	NE	NE	NE	ng/Kg	10.7		29.4		50.9		11.6		43		8.81		8.82		11.0		14.2		12.0		16.4		15.3	
1,2,3,7,8,9-HxCDF	NE	NE	NE	ng/Kg	0.27	J	0.826	J	1.66	J	0.712	J	1.03	J	0.638	J	0.573		0.517	J	1.09	J	0.919	J	1.07	J	0.616	J
1,2,3,7,8-PeCDD	NE	NE	NE	ng/Kg	3.3	J	10.1		15.0		3.57	J	14.2		3.03	J	3.53	J	4.18	J	6.13		4.90		6.21		6.12	
1,2,3,7,8-PeCDF	NE	NE	NE	ng/Kg	0.778	J	2.87	J	4.31	J	2.53	J	3.1	J	3.45	J	2.89		1.93	J	6.21		4.48	J	5.39		2.10	J
2,3,4,6,7,8-HxCDF	NE	NE	NE	ng/Kg	3.2	J	6.13	J	14.0		3.8	J	9.79		4.72	J	5.43		3.30	J	8.16		6.85		7.57		6.30	J
2,3,4,7,8-PeCDF	NE	NE	NE	ng/Kg	1.54	J	5.38		8.90		5.35		6.16		9.04		7.11		3.80	J	19.2		13.6		15.5		4.18	J
2,3,7,8-TCDD	NE	NE	NE	ng/Kg	0.876		3.90		4.22		2.01		4.45		1.41		1.39		2.73		2.08		1.52		2.66		1.74	
2,3,7,8-TCDF	NE	NE	NE	ng/Kg	0.759	J	6.79		5.11		7.04		6.12		6.36		4.27		7.65		11.5		8.26		13		2.86	
OCDD	NE	NE	NE	ng/Kg	1130		5450		7490		3100		5540		2410		1550		4390		1890		1300		2990		2310	
OCDF	NE	NE	NE	ng/Kg	209		486		952		260		602		169		181		251		214		166		260		271	
Total HpCDD	NE	NE	NE	ng/Kg	389		1750		2460		864		2070		653		426		1200		709		505		880		927	
Total HpCDF	NE	NE	NE	ng/Kg	1170		2300		5510		768		2910		393		565		860		727		712		868		1390	
Total HxCDD	NE	NE	NE	ng/Kg	146		346		608		183		590		131		122		253		205		165		238		213	
Total HxCDF	NE	NE	NE	ng/Kg	313		647		1550		254		906		190		248		286		342		308		382		421	
Total PeCDD	NE	NE	NE	ng/Kg	21.8		70.8		122		41.5		128		32.2		34.4		47.8		45.4		34.2		66.4		46.9	
Total PeCDF	NE	NE	NE	ng/Kg	53.1		158		240		148		227		222		214		105		430		317		367		119	
Total TCDD	NE	NE	NE	ng/Kg	16.2		38.2		39.3		21.1		43.6		15.4		14.3		33.6		20.8		16.7		27.7		26.7	
Total TCDF	NE	NE	NE	ng/Kg	15.9		84.7		60.0		121		87.8		183		131		86.0		361		255		331		60.7	
TEQ KM Fish	0.85	11.2	21.5	ng TEQ/Kg	15.2542		41.14		75.20		18.6437		53.35		16.6993		17.5326		20.12		31.73		24.65		31.0085		26.13	

Appendix A: Table 3
Dioxin/Furan Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Notes:
Q - Qualifier
J - estimated value
NE - Not estabilshed
NA- Not established
ng TEQ/kg - nanograms of dioxin toxicity equivalency per kilogram
ng/kg - nanograms per kilogram
SQT - Sediment Quality Target
TEQ - dioxin toxicity equivalency
U - concentration did not exceed laboratory reporting limit
Values highlighted in yellow indicate concentration exceeding SQT Level I
Values highlighted in orange indicate concentration exceeding the midpoint between SQT Level I and SQT Level II
Values highlighted in red indicate concentration exceeding SQT Level II
TEQ values calculated using the US EPA Advanced Kaplan Meier TEQ Calculator
Dioxins analyzed by EPA Method SW8290

Appendix A: Table 4
PCB Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Chemical	Sample Name				BW17ML-041-0.0-0.15		BW17ML-041-0.15-0.43		BW17ML-042-0.0-0.15		BW17ML-042-0.15-0.36		BW17ML-043-0.0-0.15		BW17ML-043-0.15-0.46		BW17ML-044-0.0-0.15		BW17ML-044-0.15-0.45		BW17ML 0.1
	Sample Depth Start (meters)				0		0.15		0		0.15		0		0.15		0		0.15		0
	Sample Depth End (meters)				0.15		0.43		0.15		0.36		0.15		0.46		0.15		0.45		0.1
	Sample Interval (meters)				0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0
	SQT Level I	SQT Midpoint	SQT Level II	Results Unit	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result
PCB 1262	NE	NE	NE	ug/Kg	70.4	U	67.8	U	44.1	U	43.5	U	53.7	U	48.5	U	73.2	U	56.8	U	76.2
PCB 1268	NE	NE	NE	ug/Kg	70.4	U	67.8	U	44.1	U	43.5	U	53.7	U	48.5	U	73.2	U	56.8	U	76.2
PCB-1016	NE	NE	NE	ug/Kg	70.4	U	67.8	U	44.1	U	43.5	U	53.7	U	48.5	U	73.2	U	56.8	U	76.2
PCB-1221	NE	NE	NE	ug/Kg	70.4	U	67.8	U	44.1	U	43.5	U	53.7	U	48.5	U	73.2	U	56.8	U	76.2
PCB-1232	NE	NE	NE	ug/Kg	70.4	U	67.8	U	44.1	U	43.5	U	53.7	U	48.5	U	73.2	U	56.8	U	76.2
PCB-1242	NE	NE	NE	ug/Kg	70.4	U	67.8	U	44.1	U	43.5	U	53.7	U	48.5	U	73.2	U	56.8	U	76.2
PCB-1248	NE	NE	NE	ug/Kg	70.4	U	67.8	U	44.1	U	43.5	U	53.7	U	48.5	U	73.2	U	56.8	U	76.2
PCB-1254	NE	NE	NE	ug/Kg	70.4	U	67.8	U	44.1	U	43.5	U	53.7	U	48.5	U	73.2	U	56.8	U	76.2
PCB-1260	NE	NE	NE	ug/Kg	70.4	U	67.8	U	44.1	U	43.5	U	53.7	U	48.5	U	273		56.8	U	80.0
Total PCBs	60	370	680	ug/Kg	35.2	U	33.9	U	22.05	U	21.75	U	26.85	U	24.25	U	273		28.4	U	80.0

Chemical	Sample Name				-046-0.0-15	BW17ML-046-0.15-0.31		BW17ML-047-0.0-0.15		BW17ML-047-0.15-0.36		BW17ML-048-0.0-0.15		BW17ML-048-0.15-0.26		BW17ML-049-0.0-0.15		BW17ML-049-0.15-0.39		BW17ML-050-0.0-0.15	
	Sample Depth Start (meters)				)	0.15		0		0.15		0		0.15		0		0.15		0	
	Sample Depth End (meters)				15	0.31		0.15		0.36		0.15		0.26		0.15		0.39		0.15	
	Sample Interval (meters)				.15	0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15	
	SQT Level I	SQT Midpoint	SQT Level II	Results Unit	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 1262	NE	NE	NE	ug/Kg	U	59.5	U	79.0	U	77.5	U	83.3	U	58.7	U	79.7	U	80.0	U	58.7	U
PCB 1268	NE	NE	NE	ug/Kg	U	59.5	U	79.0	U	77.5	U	83.3	U	58.7	U	79.7	U	80.0	U	58.7	U
PCB-1016	NE	NE	NE	ug/Kg	U	59.5	U	79.0	U	77.5	U	83.3	U	58.7	U	79.7	U	80.0	U	58.7	U
PCB-1221	NE	NE	NE	ug/Kg	U	59.5	U	79.0	U	77.5	U	83.3	U	58.7	U	79.7	U	80.0	U	58.7	U
PCB-1232	NE	NE	NE	ug/Kg	U	59.5	U	79.0	U	77.5	U	83.3	U	58.7	U	79.7	U	80.0	U	58.7	U
PCB-1242	NE	NE	NE	ug/Kg	U	59.5	U	79.0	U	77.5	U	83.3	U	58.7	U	79.7	U	80.0	U	58.7	U
PCB-1248	NE	NE	NE	ug/Kg	U	59.5	U	79.0	U	77.5	U	83.3	U	58.7	U	79.7	U	80.0	U	58.7	U
PCB-1254	NE	NE	NE	ug/Kg	U	59.5	U	79.0	U	77.5	U	83.3	U	58.7	U	79.7	U	80.0	U	58.7	U
PCB-1260	NE	NE	NE	ug/Kg		59.5	U	79.0	U	956		149		64.0		320		381		126	
Total PCBs	60	370	680	ug/Kg		29.75	U	39.5	U	956		149		64.0		320		381		126	

Appendix A: Table 4
PCB Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Chemical	Sample Name				BW17ML-050-0.15-0.44		BW17ML-052-0.0-0.15		BW17ML-052-0.15-0.44		BW17ML-053-0.0-0.15		BW17ML-053-0.15-0.39		BW17ML-054-0.0-0.15		BW17ML-054-0.15-0.40		BW17ML-055-0.0-0.15		BW17ML 0.
	Sample Depth Start (meters)				0.15		0		0.15		0		0.15		0		0.15		0		0.
	Sample Depth End (meters)				0.44		0.15		0.44		0.15		0.39		0.15		0.4		0.15		0
	Sample Interval (meters)				0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15
	SQT Level I	SQT Midpoint	SQT Level II	Results Unit	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result
PCB 1262	NE	NE	NE	ug/Kg	57.3	U	55.0	U	50.0	U	87.4	U	75.7	U	74.1	U	57.5	U	72.4	U	65.5
PCB 1268	NE	NE	NE	ug/Kg	57.3	U	55.0	U	50.0	U	87.4	U	75.7	U	74.1	U	57.5	U	72.4	U	65.5
PCB-1016	NE	NE	NE	ug/Kg	57.3	U	55.0	U	50.0	U	87.4	U	75.7	U	74.1	U	57.5	U	72.4	U	65.5
PCB-1221	NE	NE	NE	ug/Kg	57.3	U	55.0	U	50.0	U	87.4	U	75.7	U	74.1	U	57.5	U	72.4	U	65.5
PCB-1232	NE	NE	NE	ug/Kg	57.3	U	55.0	U	50.0	U	87.4	U	75.7	U	74.1	U	57.5	U	72.4	U	65.5
PCB-1242	NE	NE	NE	ug/Kg	57.3	U	55.0	U	50.0	U	87.4	U	75.7	U	74.1	U	57.5	U	72.4	U	65.5
PCB-1248	NE	NE	NE	ug/Kg	57.3	U	55.0	U	50.0	U	87.4	U	75.7	U	74.1	U	57.5	U	72.4	U	65.5
PCB-1254	NE	NE	NE	ug/Kg	57.3	U	55.0	U	50.0	U	87.4	U	75.7	U	74.1	U	57.5	U	72.4	U	65.5
PCB-1260	NE	NE	NE	ug/Kg	57.3	U	5770		207		185		343		184		57.5	U	117		65.5
Total PCBs	60	370	680	ug/Kg	28.65	U	5770		207		185		343		184		28.75	U	117		32.75

Appendix A: Table 4
PCB Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Chemical	Sample Name				-055-0.15-40	BW17ML-056-0.0-0.15		BW17ML-056-0.15-0.34		BW17ML-057-0.0-0.15		BW17ML-057-0.15-0.38		BW17ML-058-0.0-0.15		BW17ML-058-0.15-0.45		BW17ML-059-0.0-0.15		BW17ML-060-0.0-0.15	
	Sample Depth Start (meters)				15	0		0.15		0		0.15		0		0.15		0		0	
	Sample Depth End (meters)				4	0.15		0.34		0.15		0.38		0.15		0.45		0.15		0.15	
	Sample Interval (meters)				-0.5	0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15		0-0.15	
	SQT Level I	SQT Midpoint	SQT Level II	Results Unit	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
PCB 1262	NE	NE	NE	ug/Kg	U	73.5	U	61.2	U	91.2	U	72.0	U	73.1	U	65.6	U	66.9	U	81.1	U
PCB 1268	NE	NE	NE	ug/Kg	U	73.5	U	61.2	U	91.2	U	72.0	U	73.1	U	65.6	U	66.9	U	81.1	U
PCB-1016	NE	NE	NE	ug/Kg	U	73.5	U	61.2	U	91.2	U	72.0	U	73.1	U	65.6	U	66.9	U	81.1	U
PCB-1221	NE	NE	NE	ug/Kg	U	73.5	U	61.2	U	91.2	U	72.0	U	73.1	U	65.6	U	66.9	U	81.1	U
PCB-1232	NE	NE	NE	ug/Kg	U	73.5	U	61.2	U	91.2	U	72.0	U	73.1	U	65.6	U	66.9	U	81.1	U
PCB-1242	NE	NE	NE	ug/Kg	U	73.5	U	61.2	U	91.2	U	72.0	U	73.1	U	65.6	U	66.9	U	81.1	U
PCB-1248	NE	NE	NE	ug/Kg	U	73.5	U	61.2	U	91.2	U	72.0	U	73.1	U	65.6	U	66.9	U	81.1	U
PCB-1254	NE	NE	NE	ug/Kg	U	73.5	U	61.2	U	91.2	U	72.0	U	73.1	U	65.6	U	66.9	U	81.1	U
PCB-1260	NE	NE	NE	ug/Kg	U	76.9		81.8		91.2	U	101		226		224		66.9	U	81.1	U
Total PCBs	60	370	680	ug/Kg	U	76.9		81.8		45.6	U	101		226		224		33.45	U	40.55	U

Appendix A: Table 4
PCB Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Chemical	Sample Name				BW17ML-060-0.15-0.41		BW17ML-061-0.0-0.15		BW17ML-061-0.15-0.39		BW17ML-063-0.0-0.15		BW17ML-063-0.15-0.42		BW17ML-064-0.0-0.15		BW17ML-064-0.15-0.38		BW17ML-065-0.0-0.15		BW17ML 0.
	Sample Depth Start (meters)				0.15		0		0.15		0		0.15		0		0.15		0		0.
	Sample Depth End (meters)				0.41		0.15		0.39		0.15		0.42		0.15		0.38		0.15		0
	Sample Interval (meters)				0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5		0-0.15		0.15
	SQT Level I	SQT Midpoint	SQT Level II	Results Unit	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result
PCB 1262	NE	NE	NE	ug/Kg	80.2	U	98.1	U	76.9	U	101	U	45.6	U	84.6	U	81.1	U	141	U	150
PCB 1268	NE	NE	NE	ug/Kg	80.2	U	98.1	U	76.9	U	101	U	45.6	U	84.6	U	81.1	U	141	U	150
PCB-1016	NE	NE	NE	ug/Kg	80.2	U	98.1	U	76.9	U	101	U	45.6	U	84.6	U	81.1	U	141	U	150
PCB-1221	NE	NE	NE	ug/Kg	80.2	U	98.1	U	76.9	U	101	U	45.6	U	84.6	U	81.1	U	141	U	150
PCB-1232	NE	NE	NE	ug/Kg	80.2	U	98.1	U	76.9	U	101	U	45.6	U	84.6	U	81.1	U	141	U	150
PCB-1242	NE	NE	NE	ug/Kg	80.2	U	98.1	U	76.9	U	101	U	45.6	U	84.6	U	81.1	U	141	U	150
PCB-1248	NE	NE	NE	ug/Kg	80.2	U	98.1	U	76.9	U	101	U	45.6	U	84.6	U	81.1	U	141	U	150
PCB-1254	NE	NE	NE	ug/Kg	80.2	U	98.1	U	76.9	U	101	U	45.6	U	84.6	U	81.1	U	141	U	150
PCB-1260	NE	NE	NE	ug/Kg	187		502		142		101	U	45.6	U	84.6	U	91.9		161		217
Total PCBs	60	370	680	ug/Kg	187		502		142		50.5	U	22.8	U	42.3	U	91.9		161		217

Appendix A: Table 4
PCB Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Chemical	SQT Level I	SQT Midpoint	SQT Level II	Results Unit	-065-0.15-50		BW17ML-066-0.0-0.15		BW17ML-066-0.15-0.32		BW17ML-067-0.0-0.10		BW17ML-067-0.15-0.39	
Sample Depth Start (meters)					15		0		0.15		0		0.15	
Sample Depth End (meters)					5		0.15		0.32		0.1		0.39	
Sample Interval (meters)					-0.5		0-0.15		0.15-0.5		0-0.15		0.15-0.5	
					Q		Result	Q	Result	Q	Result	Q	Result	Q
PCB 1262	NE	NE	NE	ug/Kg	U		86.0	U	61.2	U	58.9	U	48.8	U
PCB 1268	NE	NE	NE	ug/Kg	U		86.0	U	61.2	U	58.9	U	48.8	U
PCB-1016	NE	NE	NE	ug/Kg	U		86.0	U	61.2	U	58.9	U	48.8	U
PCB-1221	NE	NE	NE	ug/Kg	U		86.0	U	61.2	U	58.9	U	48.8	U
PCB-1232	NE	NE	NE	ug/Kg	U		86.0	U	61.2	U	58.9	U	48.8	U
PCB-1242	NE	NE	NE	ug/Kg	U		86.0	U	61.2	U	58.9	U	48.8	U
PCB-1248	NE	NE	NE	ug/Kg	U		86.0	U	61.2	U	58.9	U	48.8	U
PCB-1254	NE	NE	NE	ug/Kg	U		86.0	U	61.2	U	58.9	U	48.8	U
PCB-1260	NE	NE	NE	ug/Kg			86.0	U	61.2	U	58.9	U	48.8	U
Total PCBs	60	370	680	ug/Kg			43	U	30.6	U	29.45	U	24.4	U

Appendix A: Table 4
PCB Results
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Notes:
Q - Qualifier
J - estimated value
NE - Not estabilshed
NA- Not established
ug/kg - micrograms per kilogram
SQT - Sediment Quality Target
U - concentration did not exceed laboratory reporting limit
Values highlighted in yellow indicate concentration exceeding SQT Level I
Values highlighted in orange indicate concentration exceeding the midpoint between SQT Level I and SQT Level II
Values highlighted in red indicate concentration exceeding SQT Level II
PCBs analyzed by EPA Method SW8082A
Only aroclor PCB-1260 was detected at concentrations exceeding laboratory reporting limits; therefore, the Total PCB value is either equal to the PCB-1260 value, or 1/2 the detection limit of PCB-1260 if PCB-1260 was flagged with U.

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

October 30, 2017

Nancy McDonald
Bay West Inc
5 Empire Drive
Saint Paul, MN 55103

RE: Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Dear Nancy McDonald:

Enclosed are the analytical results for sample(s) received by the laboratory on October 13, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Oyeyemi Odujole
oyeyemi.odujole@pacelabs.com
(612)607-6402
Project Manager

Enclosures

cc: Jonna Bjelland, Bay West, Inc.
Joe Erjavec, Bay West LLC
Paul Raymaker, Bay West
Jeff Smith, Pace Analytical Services, Inc

CERTIFICATIONS

Project:	J170470 SLR Sediment AOCs
Pace Project No.:	10407134

Minnesota Certification IDs

1700 Elm Street SE, Suite 200, Minneapolis, MN 55414-2485
A2LA Certification #: 2926.01
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014
Arkansas Certification #: 88-0680
California Certification #: 2929
CNMI Saipan Certification #:MP0003
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605
Georgia Certification #: 959
Guam EPA Certification #: MN00064
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: 03086
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064
Maryland Certification #: 322
Massachusetts Certification #: M-MN064
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: MN00064
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081
New Jersey Certification #: MN002
New York Certification #: 11647
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon NwTPH Certification #: MN300001
Oregon Secondary Certification #: MN200001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Virginia Certification #: 460163
Washington Certification #: C486
West Virginia DW Certification #: 9952 C
West Virginia DEP Certification #: 382
Wisconsin Certification #: 999407970

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE SUMMARY

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10407134001	**BW17ML-42-0.0-0.15**	Solid	10/12/17 08:40	10/13/17 15:54
10407134002	**BW17ML-67-0.0-0.10**	Solid	10/12/17 09:00	10/13/17 15:54
10407134003	**BW17ML-67-0.15-0.39**	Solid	10/12/17 09:00	10/13/17 15:54
10407134004	**BW17ML-167-0.15-0.39**	Solid	10/12/17 09:00	10/13/17 15:54
10407134005	**BW17ML-41-0.0-0.15**	Solid	10/12/17 09:30	10/13/17 15:54
10407134006	**BW17ML-41-0.15-0.43**	Solid	10/12/17 09:30	10/13/17 15:54
10407134007	**BW17ML-055-0.0-0.15**	Solid	10/12/17 10:00	10/13/17 15:54
10407134008	**BW17ML-055-0.15-0.40**	Solid	10/12/17 10:00	10/13/17 15:54
10407134009	**BW17ML-043-0.0-0.15**	Solid	10/12/17 10:30	10/13/17 15:54
10407134010	**BW17ML-043-0.15-0.46**	Solid	10/12/17 10:30	10/13/17 15:54
10407134011	**BW17ML-143-0.15-0.46**	Solid	10/12/17 10:50	10/13/17 15:54
10407134012	**BW17ML-044-0.0-0.15**	Solid	10/12/17 11:00	10/13/17 15:54
10407134013	**BW17ML-044-0.15-0.45**	Solid	10/12/17 11:00	10/13/17 15:54
10407134014	**BW17ML-42-0.15-0.36**	Solid	10/12/17 08:40	10/13/17 15:54
10407134015	**BW17ML-053-0.0-0.15**	Solid	10/12/17 11:15	10/13/17 15:54
10407134016	**BW17ML-053-0.15-0.39**	Solid	10/12/17 11:15	10/13/17 15:54
10407134017	**BW17ML-061-0.0-0.15**	Solid	10/12/17 11:30	10/13/17 15:54
10407134018	**BW17ML-061-0.15-0.39**	Solid	10/12/17 11:30	10/13/17 15:54
10407134019	**BW17ML-063-0.0-0.15**	Solid	10/12/17 11:45	10/13/17 15:54
10407134020	**BW17ML-063-0.15-0.42**	Solid	10/12/17 11:45	10/13/17 15:54
10407134021	**BW17ML-163-0.15-0.42**	Solid	10/12/17 11:45	10/13/17 15:54
10407134022	**BW17ML-160-0.15-0.41**	Solid	10/12/17 12:30	10/13/17 15:54
10407134023	**BW17ML-060-0.0-0.15**	Solid	10/12/17 12:15	10/13/17 15:54
10407134024	**BW17ML-060-0.15-0.41**	Solid	10/12/17 12:15	10/13/17 15:54
10407134025	**BW17ML-046-0.0-0.15**	Solid	10/12/17 12:45	10/13/17 15:54
10407134026	**BW17ML-046-0.15-0.31**	Solid	10/12/17 12:45	10/13/17 15:54
10407134027	**BW17ML-047-0.0-0.15**	Solid	10/12/17 01:20	10/13/17 15:54
10407134028	**BW17ML-047-0.15-0.36**	Solid	10/12/17 01:20	10/13/17 15:54
10407134029	**BW17ML-048-0.0-0.15**	Solid	10/12/17 13:45	10/13/17 15:54
10407134030	**BW17ML-048-0.15-0.26**	Solid	10/12/17 13:45	10/13/17 15:54
10407134031	**BW17ML-049-0.0-0.15**	Solid	10/12/17 14:00	10/13/17 15:54
10407134032	**BW17ML-049-0.15-0.39**	Solid	10/12/17 14:00	10/13/17 15:54
10407134033	**BW17ML-149-0.15-0.39**	Solid	10/12/17 14:15	10/13/17 15:54
10407134034	**BW17ML-050-0.0-0.15**	Solid	10/12/17 14:30	10/13/17 15:54
10407134035	**BW17ML-050-0.15-0.44**	Solid	10/12/17 14:30	10/13/17 15:54
10407134036	**BW17ML-150-0.15-0.44**	Solid	10/12/17 14:45	10/13/17 15:54
10407134037	**BW17ML-052-0.0-0.15**	Solid	10/12/17 15:15	10/13/17 15:54

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE SUMMARY

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10407134038	**BW17ML-052-0.15-0.44**	Solid	10/12/17 15:15	10/13/17 15:54
10407134039	**BW17ML-054-0.0-0.15**	Solid	10/12/17 15:30	10/13/17 15:54
10407134040	**BW17ML-054-0.15-0.40**	Solid	10/12/17 15:30	10/13/17 15:54
10407134041	**BW17ML-056-0.0-0.15**	Solid	10/12/17 15:45	10/13/17 15:54
10407134042	**BW17ML-056-0.15-0.34**	Solid	10/12/17 15:45	10/13/17 15:54
10407134043	**BW17ML-058-0.0-0.15**	Solid	10/12/17 16:00	10/13/17 15:54
10407134044	**BW17ML-058-0.15-0.45**	Solid	10/12/17 16:00	10/13/17 15:54
10407134045	**BW17ML-057-0.0-0.15**	Solid	10/12/17 16:30	10/13/17 15:54
10407134046	**BW17ML-057-0.15-0.38**	Solid	10/12/17 16:30	10/13/17 15:54
10407134047	**BW17ML-059-0.0-0.15**	Solid	10/12/17 16:40	10/13/17 15:54
10407134048	**BW17ML-064-0.0-0.15**	Solid	10/12/17 16:45	10/13/17 15:54
10407134049	**BW17ML-064-0.15-0.38**	Solid	10/12/17 16:45	10/13/17 15:54
10407134050	**BW17ML-065-0.0-0.15**	Solid	10/12/17 17:00	10/13/17 15:54
10407134051	**BW17ML-065-0.15-0.50**	Solid	10/12/17 17:00	10/13/17 15:54
10407134052	**BW17ML-066-0.0-0.15**	Solid	10/12/17 17:15	10/13/17 15:54
10407134053	**BW17ML-066-0.15-0.32**	Solid	10/12/17 17:15	10/13/17 15:54
10407134054	**RB-20171010**	Water	10/10/17 10:00	10/13/17 15:54

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE ANALYTE COUNT

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Lab ID	Sample ID	Method	Analysts	Analytes Reported
10407134001	**BW17ML-42-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134002	**BW17ML-67-0.0-0.10**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134003	**BW17ML-67-0.15-0.39**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134004	**BW17ML-167-0.15-0.39**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134005	**BW17ML-41-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134006	**BW17ML-41-0.15-0.43**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134007	**BW17ML-055-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134008	**BW17ML-055-0.15-0.40**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134009	**BW17ML-043-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134010	**BW17ML-043-0.15-0.46**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134011	**BW17ML-143-0.15-0.46**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134012	**BW17ML-044-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134013	**BW17ML-044-0.15-0.45**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134014	**BW17ML-42-0.15-0.36**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134015	**BW17ML-053-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134016	**BW17ML-053-0.15-0.39**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134017	**BW17ML-061-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134018	**BW17ML-061-0.15-0.39**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134019	**BW17ML-063-0.0-0.15**	EPA 8082A	SNG	11

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE ANALYTE COUNT

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Lab ID	Sample ID	Method	Analysts	Analytes Reported
		ASTM D2974	JDL	1
10407134020	**BW17ML-063-0.15-0.42**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134021	**BW17ML-163-0.15-0.42**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134022	**BW17ML-160-0.15-0.41**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134023	**BW17ML-060-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134024	**BW17ML-060-0.15-0.41**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134025	**BW17ML-046-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134026	**BW17ML-046-0.15-0.31**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134027	**BW17ML-047-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134028	**BW17ML-047-0.15-0.36**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134029	**BW17ML-048-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134030	**BW17ML-048-0.15-0.26**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134031	**BW17ML-049-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134032	**BW17ML-049-0.15-0.39**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134033	**BW17ML-149-0.15-0.39**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134034	**BW17ML-050-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134035	**BW17ML-050-0.15-0.44**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134036	**BW17ML-150-0.15-0.44**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134037	**BW17ML-052-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE ANALYTE COUNT

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Lab ID	Sample ID	Method	Analysts	Analytes Reported
10407134038	**BW17ML-052-0.15-0.44**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134039	**BW17ML-054-0.0-0.15**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134040	**BW17ML-054-0.15-0.40**	EPA 8082A	SNG	11
		ASTM D2974	JDL	1
10407134041	**BW17ML-056-0.0-0.15**	EPA 8082A	RAG	9
		ASTM D2974	JDL	1
10407134042	**BW17ML-056-0.15-0.34**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134043	**BW17ML-058-0.0-0.15**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134044	**BW17ML-058-0.15-0.45**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134045	**BW17ML-057-0.0-0.15**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134046	**BW17ML-057-0.15-0.38**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134047	**BW17ML-059-0.0-0.15**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134048	**BW17ML-064-0.0-0.15**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134049	**BW17ML-064-0.15-0.38**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134050	**BW17ML-065-0.0-0.15**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134051	**BW17ML-065-0.15-0.50**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134052	**BW17ML-066-0.0-0.15**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134053	**BW17ML-066-0.15-0.32**	EPA 8082A	RAG	11
		ASTM D2974	JDL	1
10407134054	**RB-20171010**	EPA 8082A	RAG	11

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

PROJECT NARRATIVE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Method: **EPA 8082A**
Description: 8082A GCS PCB
Client: Bay West, Inc.
Date: October 30, 2017

General Information:
54 samples were analyzed for EPA 8082A. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Sample Preparation:
The samples were prepared in accordance with EPA Mod. 3510C with any exceptions noted below.
The samples were prepared in accordance with EPA 3550 with any exceptions noted below.

Initial Calibrations (including MS Tune as applicable):
All criteria were within method requirements with any exceptions noted below.

Continuing Calibration:
All criteria were within method requirements with any exceptions noted below.

Surrogates:
All surrogates were within QC limits with any exceptions noted below.

QC Batch: 503222

S0: Surrogate recovery outside laboratory control limits.
- BLANK (Lab ID: 2735256)
  - Tetrachloro-m-xylene (S)

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-42-0.0-0.15 **Lab ID: 10407134001** Collected: 10/12/17 08:40 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	44.1	10.7	1	10/23/17 11:48	10/25/17 11:56	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	44.1	11.4	1	10/23/17 11:48	10/25/17 11:56	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	44.1	14.7	1	10/23/17 11:48	10/25/17 11:56	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	44.1	12.8	1	10/23/17 11:48	10/25/17 11:56	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	44.1	12.6	1	10/23/17 11:48	10/25/17 11:56	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	44.1	11.7	1	10/23/17 11:48	10/25/17 11:56	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	44.1	8.5	1	10/23/17 11:48	10/25/17 11:56	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	44.1	14.0	1	10/23/17 11:48	10/25/17 11:56	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	44.1	8.6	1	10/23/17 11:48	10/25/17 11:56	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	81	%.	41-135		1	10/23/17 11:48	10/25/17 11:56	877-09-8	
Decachlorobiphenyl (S)	76	%.	45-144		1	10/23/17 11:48	10/25/17 11:56	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**25.4**	%	0.10	0.10	1		10/18/17 14:24		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-67-0.0-0.10 **Lab ID: 10407134002** Collected: 10/12/17 09:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	58.9	14.3	1	10/23/17 11:48	10/25/17 12:43	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	58.9	15.3	1	10/23/17 11:48	10/25/17 12:43	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	58.9	19.6	1	10/23/17 11:48	10/25/17 12:43	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	58.9	17.2	1	10/23/17 11:48	10/25/17 12:43	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	58.9	16.9	1	10/23/17 11:48	10/25/17 12:43	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	58.9	15.7	1	10/23/17 11:48	10/25/17 12:43	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	58.9	11.4	1	10/23/17 11:48	10/25/17 12:43	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	58.9	18.7	1	10/23/17 11:48	10/25/17 12:43	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	58.9	11.4	1	10/23/17 11:48	10/25/17 12:43	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	68	%.	41-135		1	10/23/17 11:48	10/25/17 12:43	877-09-8	
Decachlorobiphenyl (S)	64	%.	45-144		1	10/23/17 11:48	10/25/17 12:43	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**44.1**	%	0.10	0.10	1		10/18/17 14:25		

Pace Analytical www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-67-0.15-0.39 **Lab ID: 10407134003** Collected: 10/12/17 09:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	48.8	11.8	1	10/23/17 11:48	10/25/17 12:59	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	48.8	12.6	1	10/23/17 11:48	10/25/17 12:59	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	48.8	16.3	1	10/23/17 11:48	10/25/17 12:59	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	48.8	14.2	1	10/23/17 11:48	10/25/17 12:59	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	48.8	14.0	1	10/23/17 11:48	10/25/17 12:59	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	48.8	13.0	1	10/23/17 11:48	10/25/17 12:59	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	48.8	9.4	1	10/23/17 11:48	10/25/17 12:59	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	48.8	15.5	1	10/23/17 11:48	10/25/17 12:59	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	48.8	9.5	1	10/23/17 11:48	10/25/17 12:59	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	59	%.	41-135		1	10/23/17 11:48	10/25/17 12:59	877-09-8	
Decachlorobiphenyl (S)	68	%.	45-144		1	10/23/17 11:48	10/25/17 12:59	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**32.5**	%	0.10	0.10	1		10/18/17 14:25		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407134

Sample: BW17ML-167-0.15-0.39 **Lab ID: 10407134004** Collected: 10/12/17 09:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	48.2	11.7	1	10/23/17 11:48	10/25/17 13:15	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	48.2	12.5	1	10/23/17 11:48	10/25/17 13:15	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	48.2	16.1	1	10/23/17 11:48	10/25/17 13:15	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	48.2	14.0	1	10/23/17 11:48	10/25/17 13:15	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	48.2	13.8	1	10/23/17 11:48	10/25/17 13:15	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	48.2	12.8	1	10/23/17 11:48	10/25/17 13:15	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	48.2	9.3	1	10/23/17 11:48	10/25/17 13:15	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	48.2	15.3	1	10/23/17 11:48	10/25/17 13:15	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	48.2	9.4	1	10/23/17 11:48	10/25/17 13:15	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	54	%.	41-135		1	10/23/17 11:48	10/25/17 13:15	877-09-8	
Decachlorobiphenyl (S)	51	%.	45-144		1	10/23/17 11:48	10/25/17 13:15	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**31.6**	%	0.10	0.10	1		10/18/17 14:25		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-41-0.0-0.15 **Lab ID: 10407134005** Collected: 10/12/17 09:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	70.4	17.1	1	10/23/17 11:48	10/25/17 13:31	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	70.4	18.2	1	10/23/17 11:48	10/25/17 13:31	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	70.4	23.5	1	10/23/17 11:48	10/25/17 13:31	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	70.4	20.5	1	10/23/17 11:48	10/25/17 13:31	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	70.4	20.2	1	10/23/17 11:48	10/25/17 13:31	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	70.4	18.7	1	10/23/17 11:48	10/25/17 13:31	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	70.4	13.6	1	10/23/17 11:48	10/25/17 13:31	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	70.4	22.4	1	10/23/17 11:48	10/25/17 13:31	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	70.4	13.7	1	10/23/17 11:48	10/25/17 13:31	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	77	%.	41-135		1	10/23/17 11:48	10/25/17 13:31	877-09-8	
Decachlorobiphenyl (S)	71	%.	45-144		1	10/23/17 11:48	10/25/17 13:31	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**53.3**	%	0.10	0.10	1		10/18/17 14:26		

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-41-0.15-0.43 **Lab ID: 10407134006** Collected: 10/12/17 09:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	67.8	16.4	1	10/23/17 11:48	10/25/17 13:46	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	67.8	17.6	1	10/23/17 11:48	10/25/17 13:46	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	67.8	22.6	1	10/23/17 11:48	10/25/17 13:46	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	67.8	19.7	1	10/23/17 11:48	10/25/17 13:46	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	67.8	19.4	1	10/23/17 11:48	10/25/17 13:46	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	67.8	18.0	1	10/23/17 11:48	10/25/17 13:46	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	67.8	13.1	1	10/23/17 11:48	10/25/17 13:46	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	67.8	21.6	1	10/23/17 11:48	10/25/17 13:46	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	67.8	13.2	1	10/23/17 11:48	10/25/17 13:46	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	72	%.	41-135		1	10/23/17 11:48	10/25/17 13:46	877-09-8	
Decachlorobiphenyl (S)	63	%.	45-144		1	10/23/17 11:48	10/25/17 13:46	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**51.3**	%	0.10	0.10	1		10/18/17 14:26		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-055-0.0-0.15 **Lab ID: 10407134007** Collected: 10/12/17 10:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	72.4	17.6	1	10/23/17 11:48	10/25/17 14:02	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	72.4	18.8	1	10/23/17 11:48	10/25/17 14:02	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	72.4	24.1	1	10/23/17 11:48	10/25/17 14:02	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	72.4	21.1	1	10/23/17 11:48	10/25/17 14:02	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	72.4	20.7	1	10/23/17 11:48	10/25/17 14:02	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	72.4	19.3	1	10/23/17 11:48	10/25/17 14:02	11097-69-1	
PCB-1260 (Aroclor 1260)	**117**	ug/kg	72.4	13.9	1	10/23/17 11:48	10/25/17 14:02	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	72.4	23.0	1	10/23/17 11:48	10/25/17 14:02	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	72.4	14.1	1	10/23/17 11:48	10/25/17 14:02	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	66	%.	41-135		1	10/23/17 11:48	10/25/17 14:02	877-09-8	
Decachlorobiphenyl (S)	60	%.	45-144		1	10/23/17 11:48	10/25/17 14:02	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**54.5**	%	0.10	0.10	1		10/18/17 14:26		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-055-0.15-0.40 **Lab ID: 10407134008** Collected: 10/12/17 10:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	65.5	15.9	1	10/23/17 11:48	10/25/17 14:18	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	65.5	17.0	1	10/23/17 11:48	10/25/17 14:18	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	65.5	21.8	1	10/23/17 11:48	10/25/17 14:18	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	65.5	19.1	1	10/23/17 11:48	10/25/17 14:18	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	65.5	18.7	1	10/23/17 11:48	10/25/17 14:18	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	65.5	17.4	1	10/23/17 11:48	10/25/17 14:18	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	65.5	12.6	1	10/23/17 11:48	10/25/17 14:18	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	65.5	20.8	1	10/23/17 11:48	10/25/17 14:18	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	65.5	12.7	1	10/23/17 11:48	10/25/17 14:18	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	77	%.	41-135		1	10/23/17 11:48	10/25/17 14:18	877-09-8	
Decachlorobiphenyl (S)	72	%.	45-144		1	10/23/17 11:48	10/25/17 14:18	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**49.6**	%	0.10	0.10	1		10/18/17 14:26		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-043-0.0-0.15 **Lab ID: 10407134009** Collected: 10/12/17 10:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	53.7	13.0	1	10/23/17 11:48	10/25/17 14:34	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	53.7	13.9	1	10/23/17 11:48	10/25/17 14:34	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	53.7	17.9	1	10/23/17 11:48	10/25/17 14:34	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	53.7	15.6	1	10/23/17 11:48	10/25/17 14:34	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	53.7	15.4	1	10/23/17 11:48	10/25/17 14:34	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	53.7	14.3	1	10/23/17 11:48	10/25/17 14:34	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	53.7	10.4	1	10/23/17 11:48	10/25/17 14:34	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	53.7	17.1	1	10/23/17 11:48	10/25/17 14:34	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	53.7	10.4	1	10/23/17 11:48	10/25/17 14:34	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	67	%.	41-135		1	10/23/17 11:48	10/25/17 14:34	877-09-8	
Decachlorobiphenyl (S)	62	%.	45-144		1	10/23/17 11:48	10/25/17 14:34	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**38.8**	%	0.10	0.10	1		10/18/17 14:26		

REPORT OF LABORATORY ANALYSIS

Pace Analytical www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-043-0.15-0.46 **Lab ID: 10407134010** Collected: 10/12/17 10:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	48.5	11.8	1	10/23/17 11:48	10/25/17 14:49	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	48.5	12.6	1	10/23/17 11:48	10/25/17 14:49	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	48.5	16.2	1	10/23/17 11:48	10/25/17 14:49	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	48.5	14.1	1	10/23/17 11:48	10/25/17 14:49	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	48.5	13.9	1	10/23/17 11:48	10/25/17 14:49	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	48.5	12.9	1	10/23/17 11:48	10/25/17 14:49	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	48.5	9.3	1	10/23/17 11:48	10/25/17 14:49	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	48.5	15.4	1	10/23/17 11:48	10/25/17 14:49	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	48.5	9.4	1	10/23/17 11:48	10/25/17 14:49	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	65	%.	41-135		1	10/23/17 11:48	10/25/17 14:49	877-09-8	
Decachlorobiphenyl (S)	59	%.	45-144		1	10/23/17 11:48	10/25/17 14:49	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**32.0**	%	0.10	0.10	1		10/18/17 14:27		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-143-0.15-0.46 **Lab ID: 10407134011** Collected: 10/12/17 10:50 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	50.7	12.3	1	10/23/17 11:48	10/25/17 15:05	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	50.7	13.1	1	10/23/17 11:48	10/25/17 15:05	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	50.7	16.9	1	10/23/17 11:48	10/25/17 15:05	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	50.7	14.8	1	10/23/17 11:48	10/25/17 15:05	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	50.7	14.5	1	10/23/17 11:48	10/25/17 15:05	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	50.7	13.5	1	10/23/17 11:48	10/25/17 15:05	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	50.7	9.8	1	10/23/17 11:48	10/25/17 15:05	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	50.7	16.1	1	10/23/17 11:48	10/25/17 15:05	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	50.7	9.9	1	10/23/17 11:48	10/25/17 15:05	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	132	%.	41-135		1	10/23/17 11:48	10/25/17 15:05	877-09-8	
Decachlorobiphenyl (S)	117	%.	45-144		1	10/23/17 11:48	10/25/17 15:05	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**35.1**	%	0.10	0.10	1		10/18/17 14:27		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-044-0.0-0.15 **Lab ID: 10407134012** Collected: 10/12/17 11:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	73.2	17.8	1	10/23/17 11:48	10/25/17 15:21	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	73.2	19.0	1	10/23/17 11:48	10/25/17 15:21	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	73.2	24.4	1	10/23/17 11:48	10/25/17 15:21	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	73.2	21.3	1	10/23/17 11:48	10/25/17 15:21	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	73.2	21.0	1	10/23/17 11:48	10/25/17 15:21	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	73.2	19.5	1	10/23/17 11:48	10/25/17 15:21	11097-69-1	
PCB-1260 (Aroclor 1260)	**273**	ug/kg	73.2	14.1	1	10/23/17 11:48	10/25/17 15:21	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	73.2	23.3	1	10/23/17 11:48	10/25/17 15:21	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	73.2	14.2	1	10/23/17 11:48	10/25/17 15:21	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	69	%.	41-135		1	10/23/17 11:48	10/25/17 15:21	877-09-8	
Decachlorobiphenyl (S)	62	%.	45-144		1	10/23/17 11:48	10/25/17 15:21	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**55.0**	%	0.10	0.10	1		10/18/17 14:27		

Pace Analytical www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-044-0.15-0.45 **Lab ID: 10407134013** Collected: 10/12/17 11:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	56.8	13.8	1	10/23/17 11:48	10/25/17 15:37	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	56.8	14.7	1	10/23/17 11:48	10/25/17 15:37	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	56.8	18.9	1	10/23/17 11:48	10/25/17 15:37	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	56.8	16.5	1	10/23/17 11:48	10/25/17 15:37	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	56.8	16.3	1	10/23/17 11:48	10/25/17 15:37	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	56.8	15.1	1	10/23/17 11:48	10/25/17 15:37	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	56.8	10.9	1	10/23/17 11:48	10/25/17 15:37	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	56.8	18.1	1	10/23/17 11:48	10/25/17 15:37	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	56.8	11.0	1	10/23/17 11:48	10/25/17 15:37	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	68	%.	41-135		1	10/23/17 11:48	10/25/17 15:37	877-09-8	
Decachlorobiphenyl (S)	62	%.	45-144		1	10/23/17 11:48	10/25/17 15:37	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**42.1**	%	0.10	0.10	1		10/18/17 14:28		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-42-0.15-0.36 **Lab ID: 10407134014** Collected: 10/12/17 08:40 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	43.5	10.6	1	10/23/17 11:48	10/25/17 15:53	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	43.5	11.3	1	10/23/17 11:48	10/25/17 15:53	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	43.5	14.5	1	10/23/17 11:48	10/25/17 15:53	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	43.5	12.7	1	10/23/17 11:48	10/25/17 15:53	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	43.5	12.5	1	10/23/17 11:48	10/25/17 15:53	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	43.5	11.6	1	10/23/17 11:48	10/25/17 15:53	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	43.5	8.4	1	10/23/17 11:48	10/25/17 15:53	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	43.5	13.8	1	10/23/17 11:48	10/25/17 15:53	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	43.5	8.5	1	10/23/17 11:48	10/25/17 15:53	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	62	%.	41-135		1	10/23/17 11:48	10/25/17 15:53	877-09-8	
Decachlorobiphenyl (S)	58	%.	45-144		1	10/23/17 11:48	10/25/17 15:53	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**24.2**	%	0.10	0.10	1		10/18/17 14:28		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407134

Sample: BW17ML-053-0.0-0.15 **Lab ID: 10407134015** Collected: 10/12/17 11:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	87.4	21.2	1	10/23/17 11:48	10/25/17 16:09	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	87.4	22.6	1	10/23/17 11:48	10/25/17 16:09	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	87.4	29.1	1	10/23/17 11:48	10/25/17 16:09	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	87.4	25.4	1	10/23/17 11:48	10/25/17 16:09	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	87.4	25.0	1	10/23/17 11:48	10/25/17 16:09	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	87.4	23.2	1	10/23/17 11:48	10/25/17 16:09	11097-69-1	
PCB-1260 (Aroclor 1260)	**185**	ug/kg	87.4	16.8	1	10/23/17 11:48	10/25/17 16:09	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	87.4	27.8	1	10/23/17 11:48	10/25/17 16:09	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	87.4	17.0	1	10/23/17 11:48	10/25/17 16:09	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	72	%.	41-135		1	10/23/17 11:48	10/25/17 16:09	877-09-8	
Decachlorobiphenyl (S)	68	%.	45-144		1	10/23/17 11:48	10/25/17 16:09	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**62.3**	%	0.10	0.10	1		10/18/17 14:28		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-053-0.15-0.39 **Lab ID: 10407134016** Collected: 10/12/17 11:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	75.7	18.4	1	10/23/17 11:48	10/25/17 16:56	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	75.7	19.6	1	10/23/17 11:48	10/25/17 16:56	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	75.7	25.2	1	10/23/17 11:48	10/25/17 16:56	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	75.7	22.1	1	10/23/17 11:48	10/25/17 16:56	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	75.7	21.7	1	10/23/17 11:48	10/25/17 16:56	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	75.7	20.2	1	10/23/17 11:48	10/25/17 16:56	11097-69-1	
PCB-1260 (Aroclor 1260)	**343**	ug/kg	75.7	14.6	1	10/23/17 11:48	10/25/17 16:56	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	75.7	24.1	1	10/23/17 11:48	10/25/17 16:56	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	75.7	14.7	1	10/23/17 11:48	10/25/17 16:56	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	76	%.	41-135		1	10/23/17 11:48	10/25/17 16:56	877-09-8	
Decachlorobiphenyl (S)	70	%.	45-144		1	10/23/17 11:48	10/25/17 16:56	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**56.5**	%	0.10	0.10	1		10/18/17 14:28		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-061-0.0-0.15 **Lab ID: 10407134017** Collected: 10/12/17 11:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	98.1	23.8	1	10/23/17 11:48	10/25/17 17:12	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	98.1	25.4	1	10/23/17 11:48	10/25/17 17:12	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	98.1	32.7	1	10/23/17 11:48	10/25/17 17:12	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	98.1	28.6	1	10/23/17 11:48	10/25/17 17:12	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	98.1	28.1	1	10/23/17 11:48	10/25/17 17:12	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	98.1	26.1	1	10/23/17 11:48	10/25/17 17:12	11097-69-1	
PCB-1260 (Aroclor 1260)	**502**	ug/kg	98.1	18.9	1	10/23/17 11:48	10/25/17 17:12	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	98.1	31.2	1	10/23/17 11:48	10/25/17 17:12	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	98.1	19.1	1	10/23/17 11:48	10/25/17 17:12	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	77	%.	41-135		1	10/23/17 11:48	10/25/17 17:12	877-09-8	
Decachlorobiphenyl (S)	75	%.	45-144		1	10/23/17 11:48	10/25/17 17:12	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**66.4**	%	0.10	0.10	1		10/18/17 14:28		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407134

Sample: BW17ML-061-0.15-0.39 **Lab ID: 10407134018** Collected: 10/12/17 11:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	76.9	18.7	1	10/23/17 11:48	10/25/17 17:28	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	76.9	19.9	1	10/23/17 11:48	10/25/17 17:28	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	76.9	25.6	1	10/23/17 11:48	10/25/17 17:28	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	76.9	22.4	1	10/23/17 11:48	10/25/17 17:28	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	76.9	22.0	1	10/23/17 11:48	10/25/17 17:28	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	76.9	20.5	1	10/23/17 11:48	10/25/17 17:28	11097-69-1	
PCB-1260 (Aroclor 1260)	**142**	ug/kg	76.9	14.8	1	10/23/17 11:48	10/25/17 17:28	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	76.9	24.5	1	10/23/17 11:48	10/25/17 17:28	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	76.9	14.9	1	10/23/17 11:48	10/25/17 17:28	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	69	%.	41-135		1	10/23/17 11:48	10/25/17 17:28	877-09-8	
Decachlorobiphenyl (S)	65	%.	45-144		1	10/23/17 11:48	10/25/17 17:28	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**57.1**	%	0.10	0.10	1		10/18/17 14:29		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-063-0.0-0.15 **Lab ID: 10407134019** Collected: 10/12/17 11:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	101	24.6	1	10/23/17 11:48	10/25/17 17:43	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	101	26.3	1	10/23/17 11:48	10/25/17 17:43	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	101	33.8	1	10/23/17 11:48	10/25/17 17:43	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	101	29.5	1	10/23/17 11:48	10/25/17 17:43	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	101	29.1	1	10/23/17 11:48	10/25/17 17:43	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	101	27.0	1	10/23/17 11:48	10/25/17 17:43	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	101	19.6	1	10/23/17 11:48	10/25/17 17:43	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	101	32.3	1	10/23/17 11:48	10/25/17 17:43	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	101	19.7	1	10/23/17 11:48	10/25/17 17:43	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	76	%.	41-135		1	10/23/17 11:48	10/25/17 17:43	877-09-8	
Decachlorobiphenyl (S)	73	%.	45-144		1	10/23/17 11:48	10/25/17 17:43	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**67.6**	%	0.10	0.10	1		10/18/17 14:29		

REPORT OF LABORATORY ANALYSIS

Pace Analytical www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-063-0.15-0.42 **Lab ID: 10407134020** Collected: 10/12/17 11:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	45.6	11.1	1	10/23/17 11:48	10/25/17 17:59	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	45.6	11.8	1	10/23/17 11:48	10/25/17 17:59	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	45.6	15.2	1	10/23/17 11:48	10/25/17 17:59	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	45.6	13.3	1	10/23/17 11:48	10/25/17 17:59	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	45.6	13.1	1	10/23/17 11:48	10/25/17 17:59	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	45.6	12.1	1	10/23/17 11:48	10/25/17 17:59	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	45.6	8.8	1	10/23/17 11:48	10/25/17 17:59	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	45.6	14.5	1	10/23/17 11:48	10/25/17 17:59	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	45.6	8.9	1	10/23/17 11:48	10/25/17 17:59	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	56	%.	41-135		1	10/23/17 11:48	10/25/17 17:59	877-09-8	
Decachlorobiphenyl (S)	55	%.	45-144		1	10/23/17 11:48	10/25/17 17:59	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**27.8**	%	0.10	0.10	1		10/18/17 14:29		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-163-0.15-0.42 **Lab ID: 10407134021** Collected: 10/12/17 11:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	49.2	11.9	1	10/24/17 11:43	10/26/17 08:37	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	49.2	12.7	1	10/24/17 11:43	10/26/17 08:37	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	49.2	16.4	1	10/24/17 11:43	10/26/17 08:37	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	49.2	14.3	1	10/24/17 11:43	10/26/17 08:37	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	49.2	14.1	1	10/24/17 11:43	10/26/17 08:37	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	49.2	13.1	1	10/24/17 11:43	10/26/17 08:37	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	49.2	9.5	1	10/24/17 11:43	10/26/17 08:37	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	49.2	15.7	1	10/24/17 11:43	10/26/17 08:37	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	49.2	9.6	1	10/24/17 11:43	10/26/17 08:37	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	81	%.	41-135		1	10/24/17 11:43	10/26/17 08:37	877-09-8	
Decachlorobiphenyl (S)	76	%.	45-144		1	10/24/17 11:43	10/26/17 08:37	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**33.2**	%	0.10	0.10	1		10/18/17 14:52		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-160-0.15-0.41 **Lab ID: 10407134022** Collected: 10/12/17 12:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	80.3	19.5	1	10/24/17 11:43	10/26/17 09:24	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	80.3	20.8	1	10/24/17 11:43	10/26/17 09:24	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	80.3	26.8	1	10/24/17 11:43	10/26/17 09:24	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	80.3	23.4	1	10/24/17 11:43	10/26/17 09:24	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	80.3	23.0	1	10/24/17 11:43	10/26/17 09:24	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	80.3	21.4	1	10/24/17 11:43	10/26/17 09:24	11097-69-1	
PCB-1260 (Aroclor 1260)	**238**	ug/kg	80.3	15.5	1	10/24/17 11:43	10/26/17 09:24	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	80.3	25.5	1	10/24/17 11:43	10/26/17 09:24	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	80.3	15.6	1	10/24/17 11:43	10/26/17 09:24	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	76	%.	41-135		1	10/24/17 11:43	10/26/17 09:24	877-09-8	
Decachlorobiphenyl (S)	63	%.	45-144		1	10/24/17 11:43	10/26/17 09:24	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**59.0**	%	0.10	0.10	1		10/18/17 14:52		

Pace Analytical www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-060-0.0-0.15 **Lab ID: 10407134023** Collected: 10/12/17 12:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	81.1	19.7	1	10/24/17 11:43	10/26/17 09:40	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	81.1	21.0	1	10/24/17 11:43	10/26/17 09:40	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	81.1	27.0	1	10/24/17 11:43	10/26/17 09:40	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	81.1	23.6	1	10/24/17 11:43	10/26/17 09:40	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	81.1	23.2	1	10/24/17 11:43	10/26/17 09:40	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	81.1	21.6	1	10/24/17 11:43	10/26/17 09:40	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	81.1	15.6	1	10/24/17 11:43	10/26/17 09:40	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	81.1	25.8	1	10/24/17 11:43	10/26/17 09:40	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	81.1	15.8	1	10/24/17 11:43	10/26/17 09:40	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	82	%.	41-135		1	10/24/17 11:43	10/26/17 09:40	877-09-8	
Decachlorobiphenyl (S)	78	%.	45-144		1	10/24/17 11:43	10/26/17 09:40	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**59.7**	%	0.10	0.10	1		10/18/17 14:52		

Pace Analytical www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-060-0.15-0.41 **Lab ID: 10407134024** Collected: 10/12/17 12:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	80.2	19.5	1	10/24/17 11:43	10/26/17 09:56	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	80.2	20.8	1	10/24/17 11:43	10/26/17 09:56	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	80.2	26.7	1	10/24/17 11:43	10/26/17 09:56	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	80.2	23.4	1	10/24/17 11:43	10/26/17 09:56	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	80.2	23.0	1	10/24/17 11:43	10/26/17 09:56	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	80.2	21.3	1	10/24/17 11:43	10/26/17 09:56	11097-69-1	
PCB-1260 (Aroclor 1260)	**187**	ug/kg	80.2	15.5	1	10/24/17 11:43	10/26/17 09:56	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	80.2	25.5	1	10/24/17 11:43	10/26/17 09:56	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	80.2	15.6	1	10/24/17 11:43	10/26/17 09:56	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	76	%.	41-135		1	10/24/17 11:43	10/26/17 09:56	877-09-8	
Decachlorobiphenyl (S)	67	%.	45-144		1	10/24/17 11:43	10/26/17 09:56	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**59.0**	%	0.10	0.10	1		10/18/17 14:53		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-046-0.0-0.15 **Lab ID: 10407134025** Collected: 10/12/17 12:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	76.2	18.5	1	10/24/17 11:43	10/26/17 10:12	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	76.2	19.7	1	10/24/17 11:43	10/26/17 10:12	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	76.2	25.4	1	10/24/17 11:43	10/26/17 10:12	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	76.2	22.2	1	10/24/17 11:43	10/26/17 10:12	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	76.2	21.8	1	10/24/17 11:43	10/26/17 10:12	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	76.2	20.3	1	10/24/17 11:43	10/26/17 10:12	11097-69-1	
PCB-1260 (Aroclor 1260)	**80.0**	ug/kg	76.2	14.7	1	10/24/17 11:43	10/26/17 10:12	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	76.2	24.3	1	10/24/17 11:43	10/26/17 10:12	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	76.2	14.8	1	10/24/17 11:43	10/26/17 10:12	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	77	%.	41-135		1	10/24/17 11:43	10/26/17 10:12	877-09-8	
Decachlorobiphenyl (S)	72	%.	45-144		1	10/24/17 11:43	10/26/17 10:12	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**56.9**	%	0.10	0.10	1		10/18/17 14:53		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-046-0.15-0.31 **Lab ID: 10407134026** Collected: 10/12/17 12:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	59.5	14.4	1	10/24/17 11:43	10/26/17 10:28	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	59.5	15.4	1	10/24/17 11:43	10/26/17 10:28	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	59.5	19.8	1	10/24/17 11:43	10/26/17 10:28	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	59.5	17.3	1	10/24/17 11:43	10/26/17 10:28	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	59.5	17.0	1	10/24/17 11:43	10/26/17 10:28	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	59.5	15.8	1	10/24/17 11:43	10/26/17 10:28	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	59.5	11.5	1	10/24/17 11:43	10/26/17 10:28	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	59.5	18.9	1	10/24/17 11:43	10/26/17 10:28	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	59.5	11.6	1	10/24/17 11:43	10/26/17 10:28	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	75	%.	41-135		1	10/24/17 11:43	10/26/17 10:28	877-09-8	
Decachlorobiphenyl (S)	71	%.	45-144		1	10/24/17 11:43	10/26/17 10:28	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**44.7**	%	0.10	0.10	1		10/18/17 14:53		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-047-0.0-0.15 **Lab ID: 10407134027** Collected: 10/12/17 01:20 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	79.0	19.2	1	10/24/17 11:43	10/26/17 10:43	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	79.0	20.5	1	10/24/17 11:43	10/26/17 10:43	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	79.0	26.3	1	10/24/17 11:43	10/26/17 10:43	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	79.0	23.0	1	10/24/17 11:43	10/26/17 10:43	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	79.0	22.6	1	10/24/17 11:43	10/26/17 10:43	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	79.0	21.0	1	10/24/17 11:43	10/26/17 10:43	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	79.0	15.2	1	10/24/17 11:43	10/26/17 10:43	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	79.0	25.1	1	10/24/17 11:43	10/26/17 10:43	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	79.0	15.3	1	10/24/17 11:43	10/26/17 10:43	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	83	%.	41-135		1	10/24/17 11:43	10/26/17 10:43	877-09-8	
Decachlorobiphenyl (S)	80	%.	45-144		1	10/24/17 11:43	10/26/17 10:43	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**58.5**	%	0.10	0.10	1		10/18/17 14:53		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-047-0.15-0.36 **Lab ID: 10407134028** Collected: 10/12/17 01:20 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	77.5	18.8	1	10/24/17 11:43	10/26/17 10:59	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	77.5	20.1	1	10/24/17 11:43	10/26/17 10:59	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	77.5	25.8	1	10/24/17 11:43	10/26/17 10:59	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	77.5	22.6	1	10/24/17 11:43	10/26/17 10:59	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	77.5	22.2	1	10/24/17 11:43	10/26/17 10:59	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	77.5	20.6	1	10/24/17 11:43	10/26/17 10:59	11097-69-1	
PCB-1260 (Aroclor 1260)	**956**	ug/kg	77.5	14.9	1	10/24/17 11:43	10/26/17 10:59	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	77.5	24.7	1	10/24/17 11:43	10/26/17 10:59	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	77.5	15.1	1	10/24/17 11:43	10/26/17 10:59	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	65	%.	41-135		1	10/24/17 11:43	10/26/17 10:59	877-09-8	
Decachlorobiphenyl (S)	50	%.	45-144		1	10/24/17 11:43	10/26/17 10:59	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**57.5**	%	0.10	0.10	1		10/18/17 14:53		

Pace Analytical www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-048-0.0-0.15 **Lab ID: 10407134029** Collected: 10/12/17 13:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	83.3	20.2	1	10/24/17 11:43	10/26/17 11:15	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	83.3	21.6	1	10/24/17 11:43	10/26/17 11:15	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	83.3	27.8	1	10/24/17 11:43	10/26/17 11:15	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	83.3	24.3	1	10/24/17 11:43	10/26/17 11:15	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	83.3	23.9	1	10/24/17 11:43	10/26/17 11:15	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	83.3	22.2	1	10/24/17 11:43	10/26/17 11:15	11097-69-1	
PCB-1260 (Aroclor 1260)	**149**	ug/kg	83.3	16.1	1	10/24/17 11:43	10/26/17 11:15	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	83.3	26.5	1	10/24/17 11:43	10/26/17 11:15	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	83.3	16.2	1	10/24/17 11:43	10/26/17 11:15	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	85	%.	41-135		1	10/24/17 11:43	10/26/17 11:15	877-09-8	
Decachlorobiphenyl (S)	78	%.	45-144		1	10/24/17 11:43	10/26/17 11:15	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**60.5**	%	0.10	0.10	1		10/18/17 14:54		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-048-0.15-0.26 **Lab ID: 10407134030** Collected: 10/12/17 13:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	58.7	14.3	1	10/24/17 11:43	10/26/17 11:31	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	58.7	15.2	1	10/24/17 11:43	10/26/17 11:31	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	58.7	19.6	1	10/24/17 11:43	10/26/17 11:31	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	58.7	17.1	1	10/24/17 11:43	10/26/17 11:31	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	58.7	16.8	1	10/24/17 11:43	10/26/17 11:31	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	58.7	15.6	1	10/24/17 11:43	10/26/17 11:31	11097-69-1	
PCB-1260 (Aroclor 1260)	**64.0**	ug/kg	58.7	11.3	1	10/24/17 11:43	10/26/17 11:31	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	58.7	18.7	1	10/24/17 11:43	10/26/17 11:31	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	58.7	11.4	1	10/24/17 11:43	10/26/17 11:31	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	65	%.	41-135		1	10/24/17 11:43	10/26/17 11:31	877-09-8	
Decachlorobiphenyl (S)	62	%.	45-144		1	10/24/17 11:43	10/26/17 11:31	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**44.1**	%	0.10	0.10	1		10/18/17 14:54		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-049-0.0-0.15 **Lab ID: 10407134031** Collected: 10/12/17 14:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	79.7	19.3	1	10/24/17 11:43	10/26/17 11:47	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	79.7	20.6	1	10/24/17 11:43	10/26/17 11:47	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	79.7	26.6	1	10/24/17 11:43	10/26/17 11:47	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	79.7	23.2	1	10/24/17 11:43	10/26/17 11:47	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	79.7	22.8	1	10/24/17 11:43	10/26/17 11:47	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	79.7	21.2	1	10/24/17 11:43	10/26/17 11:47	11097-69-1	
PCB-1260 (Aroclor 1260)	**320**	ug/kg	79.7	15.4	1	10/24/17 11:43	10/26/17 11:47	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	79.7	25.4	1	10/24/17 11:43	10/26/17 11:47	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	79.7	15.5	1	10/24/17 11:43	10/26/17 11:47	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	86	%.	41-135		1	10/24/17 11:43	10/26/17 11:47	877-09-8	
Decachlorobiphenyl (S)	78	%.	45-144		1	10/24/17 11:43	10/26/17 11:47	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**58.7**	%	0.10	0.10	1		10/18/17 14:54		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-049-0.15-0.39 **Lab ID: 10407134032** Collected: 10/12/17 14:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	80.0	19.4	1	10/24/17 11:43	10/26/17 12:02	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	80.0	20.7	1	10/24/17 11:43	10/26/17 12:02	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	80.0	26.7	1	10/24/17 11:43	10/26/17 12:02	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	80.0	23.3	1	10/24/17 11:43	10/26/17 12:02	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	80.0	22.9	1	10/24/17 11:43	10/26/17 12:02	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	80.0	21.3	1	10/24/17 11:43	10/26/17 12:02	11097-69-1	
PCB-1260 (Aroclor 1260)	**381**	ug/kg	80.0	15.4	1	10/24/17 11:43	10/26/17 12:02	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	80.0	25.5	1	10/24/17 11:43	10/26/17 12:02	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	80.0	15.5	1	10/24/17 11:43	10/26/17 12:02	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	71	%.	41-135		1	10/24/17 11:43	10/26/17 12:02	877-09-8	
Decachlorobiphenyl (S)	59	%.	45-144		1	10/24/17 11:43	10/26/17 12:02	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**58.8**	%	0.10	0.10	1		10/18/17 14:54		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-149-0.15-0.39 **Lab ID: 10407134033** Collected: 10/12/17 14:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	78.2	19.0	1	10/24/17 11:43	10/26/17 12:18	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	78.2	20.3	1	10/24/17 11:43	10/26/17 12:18	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	78.2	26.1	1	10/24/17 11:43	10/26/17 12:18	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	78.2	22.8	1	10/24/17 11:43	10/26/17 12:18	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	78.2	22.4	1	10/24/17 11:43	10/26/17 12:18	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	78.2	20.8	1	10/24/17 11:43	10/26/17 12:18	11097-69-1	
PCB-1260 (Aroclor 1260)	**337**	ug/kg	78.2	15.1	1	10/24/17 11:43	10/26/17 12:18	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	78.2	24.9	1	10/24/17 11:43	10/26/17 12:18	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	78.2	15.2	1	10/24/17 11:43	10/26/17 12:18	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	85	%.	41-135		1	10/24/17 11:43	10/26/17 12:18	877-09-8	
Decachlorobiphenyl (S)	74	%.	45-144		1	10/24/17 11:43	10/26/17 12:18	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**58.1**	%	0.10	0.10	1		10/18/17 14:55		

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-050-0.0-0.15 **Lab ID: 10407134034** Collected: 10/12/17 14:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	58.7	14.3	1	10/24/17 11:43	10/26/17 12:34	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	58.7	15.2	1	10/24/17 11:43	10/26/17 12:34	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	58.7	19.6	1	10/24/17 11:43	10/26/17 12:34	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	58.7	17.1	1	10/24/17 11:43	10/26/17 12:34	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	58.7	16.8	1	10/24/17 11:43	10/26/17 12:34	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	58.7	15.6	1	10/24/17 11:43	10/26/17 12:34	11097-69-1	
PCB-1260 (Aroclor 1260)	**126**	ug/kg	58.7	11.3	1	10/24/17 11:43	10/26/17 12:34	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	58.7	18.7	1	10/24/17 11:43	10/26/17 12:34	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	58.7	11.4	1	10/24/17 11:43	10/26/17 12:34	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	79	%.	41-135		1	10/24/17 11:43	10/26/17 12:34	877-09-8	
Decachlorobiphenyl (S)	72	%.	45-144		1	10/24/17 11:43	10/26/17 12:34	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**44.3**	%	0.10	0.10	1		10/18/17 14:55		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407134

Sample: BW17ML-050-0.15-0.44 **Lab ID: 10407134035** Collected: 10/12/17 14:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	57.3	13.9	1	10/24/17 11:43	10/26/17 12:50	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	57.3	14.9	1	10/24/17 11:43	10/26/17 12:50	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	57.3	19.1	1	10/24/17 11:43	10/26/17 12:50	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	57.3	16.7	1	10/24/17 11:43	10/26/17 12:50	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	57.3	16.4	1	10/24/17 11:43	10/26/17 12:50	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	57.3	15.3	1	10/24/17 11:43	10/26/17 12:50	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	57.3	11.0	1	10/24/17 11:43	10/26/17 12:50	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	57.3	18.2	1	10/24/17 11:43	10/26/17 12:50	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	57.3	11.1	1	10/24/17 11:43	10/26/17 12:50	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	72	%.	41-135		1	10/24/17 11:43	10/26/17 12:50	877-09-8	
Decachlorobiphenyl (S)	69	%.	45-144		1	10/24/17 11:43	10/26/17 12:50	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**43.0**	%	0.10	0.10	1		10/18/17 14:55		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-150-0.15-0.44 **Lab ID: 10407134036** Collected: 10/12/17 14:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	49.1	11.9	1	10/24/17 11:43	10/26/17 13:37	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	49.1	12.7	1	10/24/17 11:43	10/26/17 13:37	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	49.1	16.4	1	10/24/17 11:43	10/26/17 13:37	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	49.1	14.3	1	10/24/17 11:43	10/26/17 13:37	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	49.1	14.1	1	10/24/17 11:43	10/26/17 13:37	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	49.1	13.1	1	10/24/17 11:43	10/26/17 13:37	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	49.1	9.5	1	10/24/17 11:43	10/26/17 13:37	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	49.1	15.6	1	10/24/17 11:43	10/26/17 13:37	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	49.1	9.5	1	10/24/17 11:43	10/26/17 13:37	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	68	%.	41-135		1	10/24/17 11:43	10/26/17 13:37	877-09-8	
Decachlorobiphenyl (S)	65	%.	45-144		1	10/24/17 11:43	10/26/17 13:37	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**32.9**	%	0.10	0.10	1		10/18/17 14:55		

REPORT OF LABORATORY ANALYSIS

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-052-0.0-0.15 **Lab ID: 10407134037** Collected: 10/12/17 15:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	55.0	13.3	1	10/24/17 11:43	10/26/17 13:53	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	55.0	14.2	1	10/24/17 11:43	10/26/17 13:53	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	55.0	18.3	1	10/24/17 11:43	10/26/17 13:53	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	55.0	16.0	1	10/24/17 11:43	10/26/17 13:53	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	55.0	15.7	1	10/24/17 11:43	10/26/17 13:53	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	55.0	14.6	1	10/24/17 11:43	10/26/17 13:53	11097-69-1	
PCB-1260 (Aroclor 1260)	**5770**	ug/kg	275	53.0	5	10/24/17 11:43	10/27/17 07:55	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	55.0	17.5	1	10/24/17 11:43	10/26/17 13:53	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	55.0	10.7	1	10/24/17 11:43	10/26/17 13:53	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	80	%.	41-135		1	10/24/17 11:43	10/26/17 13:53	877-09-8	
Decachlorobiphenyl (S)	74	%.	45-144		1	10/24/17 11:43	10/26/17 13:53	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**40.2**	%	0.10	0.10	1		10/18/17 14:55		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-052-0.15-0.44 **Lab ID: 10407134038** Collected: 10/12/17 15:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	50.0	12.1	1	10/24/17 11:43	10/26/17 14:09	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	50.0	12.9	1	10/24/17 11:43	10/26/17 14:09	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	50.0	16.7	1	10/24/17 11:43	10/26/17 14:09	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	50.0	14.6	1	10/24/17 11:43	10/26/17 14:09	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	50.0	14.3	1	10/24/17 11:43	10/26/17 14:09	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	50.0	13.3	1	10/24/17 11:43	10/26/17 14:09	11097-69-1	
PCB-1260 (Aroclor 1260)	**207**	ug/kg	50.0	9.6	1	10/24/17 11:43	10/26/17 14:09	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	50.0	15.9	1	10/24/17 11:43	10/26/17 14:09	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	50.0	9.7	1	10/24/17 11:43	10/26/17 14:09	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	65	%.	41-135		1	10/24/17 11:43	10/26/17 14:09	877-09-8	
Decachlorobiphenyl (S)	60	%.	45-144		1	10/24/17 11:43	10/26/17 14:09	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**34.3**	%	0.10	0.10	1		10/18/17 14:56		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-054-0.0-0.15 **Lab ID: 10407134039** Collected: 10/12/17 15:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	74.1	18.0	1	10/24/17 11:43	10/26/17 14:25	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	74.1	19.2	1	10/24/17 11:43	10/26/17 14:25	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	74.1	24.7	1	10/24/17 11:43	10/26/17 14:25	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	74.1	21.6	1	10/24/17 11:43	10/26/17 14:25	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	74.1	21.2	1	10/24/17 11:43	10/26/17 14:25	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	74.1	19.7	1	10/24/17 11:43	10/26/17 14:25	11097-69-1	
PCB-1260 (Aroclor 1260)	**184**	ug/kg	74.1	14.3	1	10/24/17 11:43	10/26/17 14:25	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	74.1	23.6	1	10/24/17 11:43	10/26/17 14:25	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	74.1	14.4	1	10/24/17 11:43	10/26/17 14:25	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	80	%.	41-135		1	10/24/17 11:43	10/26/17 14:25	877-09-8	
Decachlorobiphenyl (S)	75	%.	45-144		1	10/24/17 11:43	10/26/17 14:25	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**55.5**	%	0.10	0.10	1		10/18/17 14:56		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-054-0.15-0.40 **Lab ID: 10407134040** Collected: 10/12/17 15:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	57.5	14.0	1	10/24/17 11:43	10/26/17 14:40	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	57.5	14.9	1	10/24/17 11:43	10/26/17 14:40	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	57.5	19.2	1	10/24/17 11:43	10/26/17 14:40	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	57.5	16.7	1	10/24/17 11:43	10/26/17 14:40	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	57.5	16.5	1	10/24/17 11:43	10/26/17 14:40	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	57.5	15.3	1	10/24/17 11:43	10/26/17 14:40	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	57.5	11.1	1	10/24/17 11:43	10/26/17 14:40	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	57.5	18.3	1	10/24/17 11:43	10/26/17 14:40	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	57.5	11.2	1	10/24/17 11:43	10/26/17 14:40	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	71	%.	41-135		1	10/24/17 11:43	10/26/17 14:40	877-09-8	
Decachlorobiphenyl (S)	67	%.	45-144		1	10/24/17 11:43	10/26/17 14:40	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**42.7**	%	0.10	0.10	1		10/18/17 14:56		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-056-0.0-0.15 **Lab ID: 10407134041** Collected: 10/12/17 15:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	73.5	17.8	1	10/24/17 13:40	10/26/17 11:18	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	73.5	19.0	1	10/24/17 13:40	10/26/17 11:18	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	73.5	24.5	1	10/24/17 13:40	10/26/17 11:18	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	73.5	21.4	1	10/24/17 13:40	10/26/17 11:18	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	73.5	21.0	1	10/24/17 13:40	10/26/17 11:18	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	73.5	19.6	1	10/24/17 13:40	10/26/17 11:18	11097-69-1	
PCB-1260 (Aroclor 1260)	**76.9**	ug/kg	73.5	14.2	1	10/24/17 13:40	10/26/17 11:18	11096-82-5	
Surrogates									
Tetrachloro-m-xylene (S)	91	%.	41-135		1	10/24/17 13:40	10/26/17 11:18	877-09-8	
Decachlorobiphenyl (S)	95	%.	45-144		1	10/24/17 13:40	10/26/17 11:18	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**55.2**	%	0.10	0.10	1		10/18/17 15:31		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-056-0.15-0.34 **Lab ID: 10407134042** Collected: 10/12/17 15:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	61.2	14.9	1	10/24/17 13:40	10/26/17 12:03	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	61.2	15.9	1	10/24/17 13:40	10/26/17 12:03	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	61.2	20.4	1	10/24/17 13:40	10/26/17 12:03	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	61.2	17.8	1	10/24/17 13:40	10/26/17 12:03	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	61.2	17.5	1	10/24/17 13:40	10/26/17 12:03	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	61.2	16.3	1	10/24/17 13:40	10/26/17 12:03	11097-69-1	
PCB-1260 (Aroclor 1260)	**81.8**	ug/kg	61.2	11.8	1	10/24/17 13:40	10/26/17 12:03	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	61.2	19.5	1	10/24/17 13:40	10/26/17 12:03	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	61.2	11.9	1	10/24/17 13:40	10/26/17 12:03	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	75	%.	41-135		1	10/24/17 13:40	10/26/17 12:03	877-09-8	
Decachlorobiphenyl (S)	81	%.	45-144		1	10/24/17 13:40	10/26/17 12:03	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**46.2**	%	0.10	0.10	1		10/18/17 15:31		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-058-0.0-0.15 **Lab ID: 10407134043** Collected: 10/12/17 16:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	73.1	17.7	1	10/24/17 13:40	10/26/17 12:18	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	73.1	18.9	1	10/24/17 13:40	10/26/17 12:18	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	73.1	24.4	1	10/24/17 13:40	10/26/17 12:18	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	73.1	21.3	1	10/24/17 13:40	10/26/17 12:18	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	73.1	20.9	1	10/24/17 13:40	10/26/17 12:18	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	73.1	19.4	1	10/24/17 13:40	10/26/17 12:18	11097-69-1	
PCB-1260 (Aroclor 1260)	**226**	ug/kg	73.1	14.1	1	10/24/17 13:40	10/26/17 12:18	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	73.1	23.2	1	10/24/17 13:40	10/26/17 12:18	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	73.1	14.2	1	10/24/17 13:40	10/26/17 12:18	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	79	%.	41-135		1	10/24/17 13:40	10/26/17 12:18	877-09-8	
Decachlorobiphenyl (S)	83	%.	45-144		1	10/24/17 13:40	10/26/17 12:18	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**55.0**	%	0.10	0.10	1		10/18/17 15:32		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-058-0.15-0.45 **Lab ID: 10407134044** Collected: 10/12/17 16:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	65.6	15.9	1	10/24/17 13:40	10/26/17 12:33	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	65.6	17.0	1	10/24/17 13:40	10/26/17 12:33	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	65.6	21.9	1	10/24/17 13:40	10/26/17 12:33	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	65.6	19.1	1	10/24/17 13:40	10/26/17 12:33	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	65.6	18.8	1	10/24/17 13:40	10/26/17 12:33	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	65.6	17.5	1	10/24/17 13:40	10/26/17 12:33	11097-69-1	
PCB-1260 (Aroclor 1260)	**224**	ug/kg	65.6	12.6	1	10/24/17 13:40	10/26/17 12:33	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	65.6	20.9	1	10/24/17 13:40	10/26/17 12:33	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	65.6	12.7	1	10/24/17 13:40	10/26/17 12:33	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	74	%.	41-135		1	10/24/17 13:40	10/26/17 12:33	877-09-8	
Decachlorobiphenyl (S)	78	%.	45-144		1	10/24/17 13:40	10/26/17 12:33	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**50.0**	%	0.10	0.10	1		10/18/17 15:32		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-057-0.0-0.15 **Lab ID: 10407134045** Collected: 10/12/17 16:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	91.2	22.1	1	10/24/17 13:40	10/26/17 12:49	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	91.2	23.6	1	10/24/17 13:40	10/26/17 12:49	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	91.2	30.4	1	10/24/17 13:40	10/26/17 12:49	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	91.2	26.6	1	10/24/17 13:40	10/26/17 12:49	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	91.2	26.1	1	10/24/17 13:40	10/26/17 12:49	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	91.2	24.3	1	10/24/17 13:40	10/26/17 12:49	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	91.2	17.6	1	10/24/17 13:40	10/26/17 12:49	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	91.2	29.0	1	10/24/17 13:40	10/26/17 12:49	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	91.2	17.7	1	10/24/17 13:40	10/26/17 12:49	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	85	%.	41-135		1	10/24/17 13:40	10/26/17 12:49	877-09-8	
Decachlorobiphenyl (S)	90	%.	45-144		1	10/24/17 13:40	10/26/17 12:49	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**64.1**	%	0.10	0.10	1		10/18/17 15:32		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-057-0.15-0.38 **Lab ID: 10407134046** Collected: 10/12/17 16:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	72.0	17.5	1	10/24/17 13:40	10/26/17 13:04	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	72.0	18.7	1	10/24/17 13:40	10/26/17 13:04	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	72.0	24.0	1	10/24/17 13:40	10/26/17 13:04	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	72.0	21.0	1	10/24/17 13:40	10/26/17 13:04	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	72.0	20.6	1	10/24/17 13:40	10/26/17 13:04	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	72.0	19.2	1	10/24/17 13:40	10/26/17 13:04	11097-69-1	
PCB-1260 (Aroclor 1260)	**101**	ug/kg	72.0	13.9	1	10/24/17 13:40	10/26/17 13:04	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	72.0	22.9	1	10/24/17 13:40	10/26/17 13:04	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	72.0	14.0	1	10/24/17 13:40	10/26/17 13:04	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	91	%.	41-135		1	10/24/17 13:40	10/26/17 13:04	877-09-8	
Decachlorobiphenyl (S)	98	%.	45-144		1	10/24/17 13:40	10/26/17 13:04	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**54.4**	%	0.10	0.10	1		10/18/17 15:32		

Pace Analytical www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-059-0.0-0.15 **Lab ID: 10407134047** Collected: 10/12/17 16:40 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	66.9	16.2	1	10/24/17 13:40	10/26/17 13:19	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	66.9	17.3	1	10/24/17 13:40	10/26/17 13:19	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	66.9	22.3	1	10/24/17 13:40	10/26/17 13:19	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	66.9	19.5	1	10/24/17 13:40	10/26/17 13:19	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	66.9	19.2	1	10/24/17 13:40	10/26/17 13:19	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	66.9	17.8	1	10/24/17 13:40	10/26/17 13:19	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	66.9	12.9	1	10/24/17 13:40	10/26/17 13:19	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	66.9	21.3	1	10/24/17 13:40	10/26/17 13:19	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	66.9	13.0	1	10/24/17 13:40	10/26/17 13:19	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	69	%.	41-135		1	10/24/17 13:40	10/26/17 13:19	877-09-8	
Decachlorobiphenyl (S)	73	%.	45-144		1	10/24/17 13:40	10/26/17 13:19	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**50.8**	%	0.10	0.10	1		10/18/17 15:32		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-064-0.0-0.15 **Lab ID: 10407134048** Collected: 10/12/17 16:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	84.6	20.5	1	10/24/17 13:40	10/26/17 13:34	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	84.6	21.9	1	10/24/17 13:40	10/26/17 13:34	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	84.6	28.2	1	10/24/17 13:40	10/26/17 13:34	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	84.6	24.6	1	10/24/17 13:40	10/26/17 13:34	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	84.6	24.2	1	10/24/17 13:40	10/26/17 13:34	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	84.6	22.5	1	10/24/17 13:40	10/26/17 13:34	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	84.6	16.3	1	10/24/17 13:40	10/26/17 13:34	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	84.6	26.9	1	10/24/17 13:40	10/26/17 13:34	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	84.6	16.4	1	10/24/17 13:40	10/26/17 13:34	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	89	%.	41-135		1	10/24/17 13:40	10/26/17 13:34	877-09-8	
Decachlorobiphenyl (S)	94	%.	45-144		1	10/24/17 13:40	10/26/17 13:34	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**61.4**	%	0.10	0.10	1		10/18/17 15:33		

REPORT OF LABORATORY ANALYSIS

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-064-0.15-0.38 **Lab ID: 10407134049** Collected: 10/12/17 16:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	81.1	19.7	1	10/24/17 13:40	10/26/17 13:49	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	81.1	21.0	1	10/24/17 13:40	10/26/17 13:49	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	81.1	27.0	1	10/24/17 13:40	10/26/17 13:49	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	81.1	23.6	1	10/24/17 13:40	10/26/17 13:49	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	81.1	23.2	1	10/24/17 13:40	10/26/17 13:49	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	81.1	21.6	1	10/24/17 13:40	10/26/17 13:49	11097-69-1	
PCB-1260 (Aroclor 1260)	**91.9**	ug/kg	81.1	15.6	1	10/24/17 13:40	10/26/17 13:49	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	81.1	25.8	1	10/24/17 13:40	10/26/17 13:49	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	81.1	15.8	1	10/24/17 13:40	10/26/17 13:49	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	88	%.	41-135		1	10/24/17 13:40	10/26/17 13:49	877-09-8	
Decachlorobiphenyl (S)	96	%.	45-144		1	10/24/17 13:40	10/26/17 13:49	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**59.3**	%	0.10	0.10	1		10/18/17 15:33		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-065-0.0-0.15 **Lab ID: 10407134050** Collected: 10/12/17 17:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	141	34.3	1	10/24/17 13:40	10/26/17 14:04	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	141	36.6	1	10/24/17 13:40	10/26/17 14:04	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	141	47.1	1	10/24/17 13:40	10/26/17 14:04	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	141	41.1	1	10/24/17 13:40	10/26/17 14:04	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	141	40.5	1	10/24/17 13:40	10/26/17 14:04	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	141	37.6	1	10/24/17 13:40	10/26/17 14:04	11097-69-1	
PCB-1260 (Aroclor 1260)	**161**	ug/kg	141	27.2	1	10/24/17 13:40	10/26/17 14:04	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	141	45.0	1	10/24/17 13:40	10/26/17 14:04	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	141	27.4	1	10/24/17 13:40	10/26/17 14:04	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	91	%.	41-135		1	10/24/17 13:40	10/26/17 14:04	877-09-8	
Decachlorobiphenyl (S)	97	%.	45-144		1	10/24/17 13:40	10/26/17 14:04	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**76.8**	%	0.10	0.10	1		10/18/17 15:33		

Pace Analytical www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-065-0.15-0.50 **Lab ID: 10407134051** Collected: 10/12/17 17:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	150	36.5	1	10/24/17 13:40	10/26/17 14:19	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	150	39.0	1	10/24/17 13:40	10/26/17 14:19	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	150	50.2	1	10/24/17 13:40	10/26/17 14:19	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	150	43.8	1	10/24/17 13:40	10/26/17 14:19	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	150	43.1	1	10/24/17 13:40	10/26/17 14:19	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	150	40.0	1	10/24/17 13:40	10/26/17 14:19	11097-69-1	
PCB-1260 (Aroclor 1260)	**217**	ug/kg	150	29.0	1	10/24/17 13:40	10/26/17 14:19	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	150	47.9	1	10/24/17 13:40	10/26/17 14:19	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	150	29.2	1	10/24/17 13:40	10/26/17 14:19	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	87	%.	41-135		1	10/24/17 13:40	10/26/17 14:19	877-09-8	
Decachlorobiphenyl (S)	94	%.	45-144		1	10/24/17 13:40	10/26/17 14:19	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**78.2**	%	0.10	0.10	1		10/18/17 15:33		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: BW17ML-066-0.0-0.15 **Lab ID: 10407134052** Collected: 10/12/17 17:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	86.0	20.9	1	10/24/17 13:40	10/26/17 14:35	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	86.0	22.3	1	10/24/17 13:40	10/26/17 14:35	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	86.0	28.7	1	10/24/17 13:40	10/26/17 14:35	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	86.0	25.0	1	10/24/17 13:40	10/26/17 14:35	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	86.0	24.6	1	10/24/17 13:40	10/26/17 14:35	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	86.0	22.9	1	10/24/17 13:40	10/26/17 14:35	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	86.0	16.6	1	10/24/17 13:40	10/26/17 14:35	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	86.0	27.4	1	10/24/17 13:40	10/26/17 14:35	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	86.0	16.7	1	10/24/17 13:40	10/26/17 14:35	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	95	%.	41-135		1	10/24/17 13:40	10/26/17 14:35	877-09-8	
Decachlorobiphenyl (S)	101	%.	45-144		1	10/24/17 13:40	10/26/17 14:35	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**61.7**	%	0.10	0.10	1		10/18/17 15:34		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407134

Sample: BW17ML-066-0.15-0.32 **Lab ID: 10407134053** Collected: 10/12/17 17:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	61.2	14.9	1	10/24/17 13:40	10/26/17 14:50	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	61.2	15.9	1	10/24/17 13:40	10/26/17 14:50	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	61.2	20.4	1	10/24/17 13:40	10/26/17 14:50	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	61.2	17.8	1	10/24/17 13:40	10/26/17 14:50	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	61.2	17.5	1	10/24/17 13:40	10/26/17 14:50	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	61.2	16.3	1	10/24/17 13:40	10/26/17 14:50	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/kg	61.2	11.8	1	10/24/17 13:40	10/26/17 14:50	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	61.2	19.5	1	10/24/17 13:40	10/26/17 14:50	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	61.2	11.9	1	10/24/17 13:40	10/26/17 14:50	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	90	%.	41-135		1	10/24/17 13:40	10/26/17 14:50	877-09-8	
Decachlorobiphenyl (S)	94	%.	45-144		1	10/24/17 13:40	10/26/17 14:50	2051-24-3	
Dry Weight / %M by ASTM D2974	Analytical Method: ASTM D2974								
Percent Moisture	**46.4**	%	0.10	0.10	1		10/18/17 15:34		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Sample: RB-20171010 **Lab ID: 10407134054** Collected: 10/10/17 10:00 Received: 10/13/17 15:54 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA Mod. 3510C								
PCB-1016 (Aroclor 1016)	ND	ug/L	0.10	0.048	1	10/18/17 12:48	10/26/17 09:46	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/L	0.10	0.043	1	10/18/17 12:48	10/26/17 09:46	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/L	0.10	0.036	1	10/18/17 12:48	10/26/17 09:46	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/L	0.10	0.048	1	10/18/17 12:48	10/26/17 09:46	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/L	0.10	0.044	1	10/18/17 12:48	10/26/17 09:46	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/L	0.10	0.046	1	10/18/17 12:48	10/26/17 09:46	11097-69-1	
PCB-1260 (Aroclor 1260)	ND	ug/L	0.10	0.045	1	10/18/17 12:48	10/26/17 09:46	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/L	0.10	0.033	1	10/18/17 12:48	10/26/17 09:46	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/L	0.10	0.031	1	10/18/17 12:48	10/26/17 09:46	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	42	%.	30-125		1	10/18/17 12:48	10/26/17 09:46	877-09-8	
Decachlorobiphenyl (S)	49	%.	30-150		1	10/18/17 12:48	10/26/17 09:46	2051-24-3	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

QC Batch: 503071 | Analysis Method: ASTM D2974
QC Batch Method: ASTM D2974 | Analysis Description: Dry Weight / %M by ASTM D2974

Associated Lab Samples: 10407134001, 10407134002, 10407134003, 10407134004, 10407134005, 10407134006, 10407134007, 10407134008, 10407134009, 10407134010, 10407134011, 10407134012, 10407134013, 10407134014, 10407134015, 10407134016, 10407134017, 10407134018, 10407134019, 10407134020

SAMPLE DUPLICATE: 2734789

Parameter	Units	10407134001 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	25.4	28.2	11	30	

SAMPLE DUPLICATE: 2734790

Parameter	Units	10407134011 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	35.1	35.7	2	30	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

QC Batch: 503072 | Analysis Method: ASTM D2974
QC Batch Method: ASTM D2974 | Analysis Description: Dry Weight / %M by ASTM D2974

Associated Lab Samples: 10407134021, 10407134022, 10407134023, 10407134024, 10407134025, 10407134026, 10407134027, 10407134028, 10407134029, 10407134030, 10407134031, 10407134032, 10407134033, 10407134034, 10407134035, 10407134036, 10407134037, 10407134038, 10407134039, 10407134040

SAMPLE DUPLICATE: 2734791

Parameter	Units	10407134021 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	33.2	34.1	3	30	

SAMPLE DUPLICATE: 2734792

Parameter	Units	10407134031 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	58.7	59.7	2	30	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

QC Batch: 503073 Analysis Method: ASTM D2974
QC Batch Method: ASTM D2974 Analysis Description: Dry Weight / %M by ASTM D2974
Associated Lab Samples: 10407134041, 10407134042, 10407134043, 10407134044, 10407134045, 10407134046, 10407134047, 10407134048, 10407134049, 10407134050, 10407134051, 10407134052, 10407134053

SAMPLE DUPLICATE: 2734793

Parameter	Units	10407134041 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	55.2	55.3	0	30	

SAMPLE DUPLICATE: 2734794

Parameter	Units	10407134051 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	78.2	78.9	1	30	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

QC Batch: 504064 Analysis Method: EPA 8082A
QC Batch Method: EPA 3550 Analysis Description: 8082A GCS PCB
Associated Lab Samples: 10407134001, 10407134002, 10407134003, 10407134004, 10407134005, 10407134006, 10407134007, 10407134008, 10407134009, 10407134010, 10407134011, 10407134012, 10407134013, 10407134014, 10407134015, 10407134016, 10407134017, 10407134018, 10407134019, 10407134020

METHOD BLANK: 2740290 Matrix: Solid
Associated Lab Samples: 10407134001, 10407134002, 10407134003, 10407134004, 10407134005, 10407134006, 10407134007, 10407134008, 10407134009, 10407134010, 10407134011, 10407134012, 10407134013, 10407134014, 10407134015, 10407134016, 10407134017, 10407134018, 10407134019, 10407134020

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
PCB-1016 (Aroclor 1016)	ug/kg	ND	33.0	8.0	10/25/17 11:24	
PCB-1221 (Aroclor 1221)	ug/kg	ND	33.0	8.6	10/25/17 11:24	
PCB-1232 (Aroclor 1232)	ug/kg	ND	33.0	11.0	10/25/17 11:24	
PCB-1242 (Aroclor 1242)	ug/kg	ND	33.0	9.6	10/25/17 11:24	
PCB-1248 (Aroclor 1248)	ug/kg	ND	33.0	9.4	10/25/17 11:24	
PCB-1254 (Aroclor 1254)	ug/kg	ND	33.0	8.8	10/25/17 11:24	
PCB-1260 (Aroclor 1260)	ug/kg	ND	33.0	6.4	10/25/17 11:24	
PCB-1262 (Aroclor 1262)	ug/kg	ND	33.0	10.5	10/25/17 11:24	
PCB-1268 (Aroclor 1268)	ug/kg	ND	33.0	6.4	10/25/17 11:24	
Decachlorobiphenyl (S)	%.	78	45-144		10/25/17 11:24	
Tetrachloro-m-xylene (S)	%.	82	41-135		10/25/17 11:24	

LABORATORY CONTROL SAMPLE: 2740291

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
PCB-1016 (Aroclor 1016)	ug/kg	667	504	76	57-125	
PCB-1260 (Aroclor 1260)	ug/kg	667	511	77	57-125	
Decachlorobiphenyl (S)	%.			75	45-144	
Tetrachloro-m-xylene (S)	%.			71	41-135	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2740292 2740293

Parameter	Units	10407134001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
PCB-1016 (Aroclor 1016)	ug/kg	ND	890	893	691	668	78	75	33-125	3	30	
PCB-1260 (Aroclor 1260)	ug/kg	ND	890	893	673	670	76	75	37-125	0	30	
Decachlorobiphenyl (S)	%.						72	72	45-144			
Tetrachloro-m-xylene (S)	%.						75	70	41-135			

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

QC Batch: 504288 — Analysis Method: EPA 8082A
QC Batch Method: EPA 3550 — Analysis Description: 8082A GCS PCB
Associated Lab Samples: 10407134021, 10407134022, 10407134023, 10407134024, 10407134025, 10407134026, 10407134027, 10407134028, 10407134029, 10407134030, 10407134031, 10407134032, 10407134033, 10407134034, 10407134035, 10407134036, 10407134037, 10407134038, 10407134039, 10407134040

METHOD BLANK: 2741216 — Matrix: Solid
Associated Lab Samples: 10407134021, 10407134022, 10407134023, 10407134024, 10407134025, 10407134026, 10407134027, 10407134028, 10407134029, 10407134030, 10407134031, 10407134032, 10407134033, 10407134034, 10407134035, 10407134036, 10407134037, 10407134038, 10407134039, 10407134040

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
PCB-1016 (Aroclor 1016)	ug/kg	ND	33.0	8.0	10/26/17 08:05	
PCB-1221 (Aroclor 1221)	ug/kg	ND	33.0	8.6	10/26/17 08:05	
PCB-1232 (Aroclor 1232)	ug/kg	ND	33.0	11.0	10/26/17 08:05	
PCB-1242 (Aroclor 1242)	ug/kg	ND	33.0	9.6	10/26/17 08:05	
PCB-1248 (Aroclor 1248)	ug/kg	ND	33.0	9.4	10/26/17 08:05	
PCB-1254 (Aroclor 1254)	ug/kg	ND	33.0	8.8	10/26/17 08:05	
PCB-1260 (Aroclor 1260)	ug/kg	ND	33.0	6.4	10/26/17 08:05	
PCB-1262 (Aroclor 1262)	ug/kg	ND	33.0	10.5	10/26/17 08:05	
PCB-1268 (Aroclor 1268)	ug/kg	ND	33.0	6.4	10/26/17 08:05	
Decachlorobiphenyl (S)	%.	83	45-144		10/26/17 08:05	
Tetrachloro-m-xylene (S)	%.	91	41-135		10/26/17 08:05	

LABORATORY CONTROL SAMPLE: 2741217

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
PCB-1016 (Aroclor 1016)	ug/kg	667	594	89	57-125	
PCB-1260 (Aroclor 1260)	ug/kg	667	567	85	57-125	
Decachlorobiphenyl (S)	%.			79	45-144	
Tetrachloro-m-xylene (S)	%.			85	41-135	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2741218 2741219

Parameter	Units	10407134021 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
PCB-1016 (Aroclor 1016)	ug/kg	ND	993	995	700	802	70	81	33-125	14	30	
PCB-1260 (Aroclor 1260)	ug/kg	ND	993	995	704	773	71	78	37-125	9	30	
Decachlorobiphenyl (S)	%.						68	70	45-144			
Tetrachloro-m-xylene (S)	%.						71	76	41-135			

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

QC Batch: 504290 | Analysis Method: EPA 8082A
QC Batch Method: EPA 3550 | Analysis Description: 8082A GCS PCB
Associated Lab Samples: 10407134041, 10407134042, 10407134043, 10407134044, 10407134045, 10407134046, 10407134047, 10407134048, 10407134049, 10407134050, 10407134051, 10407134052, 10407134053

METHOD BLANK: 2741224 Matrix: Solid
Associated Lab Samples: 10407134041, 10407134042, 10407134043, 10407134044, 10407134045, 10407134046, 10407134047, 10407134048, 10407134049, 10407134050, 10407134051, 10407134052, 10407134053

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
PCB-1016 (Aroclor 1016)	ug/kg	ND	33.0	8.0	10/26/17 10:47	
PCB-1221 (Aroclor 1221)	ug/kg	ND	33.0	8.6	10/26/17 10:47	
PCB-1232 (Aroclor 1232)	ug/kg	ND	33.0	11.0	10/26/17 10:47	
PCB-1242 (Aroclor 1242)	ug/kg	ND	33.0	9.6	10/26/17 10:47	
PCB-1248 (Aroclor 1248)	ug/kg	ND	33.0	9.4	10/26/17 10:47	
PCB-1254 (Aroclor 1254)	ug/kg	ND	33.0	8.8	10/26/17 10:47	
PCB-1260 (Aroclor 1260)	ug/kg	ND	33.0	6.4	10/26/17 10:47	
PCB-1262 (Aroclor 1262)	ug/kg	ND	33.0	10.5	10/26/17 10:47	
PCB-1268 (Aroclor 1268)	ug/kg	ND	33.0	6.4	10/26/17 10:47	
Decachlorobiphenyl (S)	%.	92	45-144		10/26/17 10:47	
Tetrachloro-m-xylene (S)	%.	89	41-135		10/26/17 10:47	

LABORATORY CONTROL SAMPLE: 2741225

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
PCB-1016 (Aroclor 1016)	ug/kg	667	595	89	57-125	
PCB-1260 (Aroclor 1260)	ug/kg	667	610	92	57-125	
Decachlorobiphenyl (S)	%.			94	45-144	
Tetrachloro-m-xylene (S)	%.			89	41-135	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2741226 2741227

Parameter	Units	10407134041 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
PCB-1016 (Aroclor 1016)	ug/kg	ND	1480	1490	1220	1350	83	91	33-125	10	30	
PCB-1260 (Aroclor 1260)	ug/kg	76.9	1480	1490	1350	1430	86	91	37-125	6	30	
Decachlorobiphenyl (S)	%.						89	93	45-144			
Tetrachloro-m-xylene (S)	%.						84	89	41-135			

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

QC Batch: 503222 Analysis Method: EPA 8082A
QC Batch Method: EPA Mod. 3510C Analysis Description: 8082A GCS PCB
Associated Lab Samples: 10407134054

METHOD BLANK: 2735256 Matrix: Water
Associated Lab Samples: 10407134054

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
PCB-1016 (Aroclor 1016)	ug/L	ND	0.10	0.048	10/26/17 09:16	
PCB-1221 (Aroclor 1221)	ug/L	ND	0.10	0.043	10/26/17 09:16	
PCB-1232 (Aroclor 1232)	ug/L	ND	0.10	0.036	10/26/17 09:16	
PCB-1242 (Aroclor 1242)	ug/L	ND	0.10	0.047	10/26/17 09:16	
PCB-1248 (Aroclor 1248)	ug/L	ND	0.10	0.044	10/26/17 09:16	
PCB-1254 (Aroclor 1254)	ug/L	ND	0.10	0.046	10/26/17 09:16	
PCB-1260 (Aroclor 1260)	ug/L	ND	0.10	0.045	10/26/17 09:16	
PCB-1262 (Aroclor 1262)	ug/L	ND	0.10	0.033	10/26/17 09:16	
PCB-1268 (Aroclor 1268)	ug/L	ND	0.10	0.031	10/26/17 09:16	
Decachlorobiphenyl (S)	%.	79	30-150		10/26/17 09:16	
Tetrachloro-m-xylene (S)	%.	29	30-125		10/26/17 09:16	S0

LABORATORY CONTROL SAMPLE & LCSD: 2735257 2735258

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
PCB-1016 (Aroclor 1016)	ug/L	2	1.5	1.6	75	80	46-125	6	20	
PCB-1260 (Aroclor 1260)	ug/L	2	1.6	1.7	81	87	60-125	7	20	
Decachlorobiphenyl (S)	%.				76	78	30-150			
Tetrachloro-m-xylene (S)	%.				39	50	30-125			

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALIFIERS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

S0 Surrogate recovery outside laboratory control limits.

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10407134001	**BW17ML-42-0.0-0.15**	EPA 3550	504064	EPA 8082A	504502
10407134002	**BW17ML-67-0.0-0.10**	EPA 3550	504064	EPA 8082A	504502
10407134003	**BW17ML-67-0.15-0.39**	EPA 3550	504064	EPA 8082A	504502
10407134004	**BW17ML-167-0.15-0.39**	EPA 3550	504064	EPA 8082A	504502
10407134005	**BW17ML-41-0.0-0.15**	EPA 3550	504064	EPA 8082A	504502
10407134006	**BW17ML-41-0.15-0.43**	EPA 3550	504064	EPA 8082A	504502
10407134007	**BW17ML-055-0.0-0.15**	EPA 3550	504064	EPA 8082A	504502
10407134008	**BW17ML-055-0.15-0.40**	EPA 3550	504064	EPA 8082A	504502
10407134009	**BW17ML-043-0.0-0.15**	EPA 3550	504064	EPA 8082A	504502
10407134010	**BW17ML-043-0.15-0.46**	EPA 3550	504064	EPA 8082A	504502
10407134011	**BW17ML-143-0.15-0.46**	EPA 3550	504064	EPA 8082A	504502
10407134012	**BW17ML-044-0.0-0.15**	EPA 3550	504064	EPA 8082A	504502
10407134013	**BW17ML-044-0.15-0.45**	EPA 3550	504064	EPA 8082A	504502
10407134014	**BW17ML-42-0.15-0.36**	EPA 3550	504064	EPA 8082A	504502
10407134015	**BW17ML-053-0.0-0.15**	EPA 3550	504064	EPA 8082A	504502
10407134016	**BW17ML-053-0.15-0.39**	EPA 3550	504064	EPA 8082A	504502
10407134017	**BW17ML-061-0.0-0.15**	EPA 3550	504064	EPA 8082A	504502
10407134018	**BW17ML-061-0.15-0.39**	EPA 3550	504064	EPA 8082A	504502
10407134019	**BW17ML-063-0.0-0.15**	EPA 3550	504064	EPA 8082A	504502
10407134020	**BW17ML-063-0.15-0.42**	EPA 3550	504064	EPA 8082A	504502
10407134021	**BW17ML-163-0.15-0.42**	EPA 3550	504288	EPA 8082A	504742
10407134022	**BW17ML-160-0.15-0.41**	EPA 3550	504288	EPA 8082A	504742
10407134023	**BW17ML-060-0.0-0.15**	EPA 3550	504288	EPA 8082A	504742
10407134024	**BW17ML-060-0.15-0.41**	EPA 3550	504288	EPA 8082A	504742
10407134025	**BW17ML-046-0.0-0.15**	EPA 3550	504288	EPA 8082A	504742
10407134026	**BW17ML-046-0.15-0.31**	EPA 3550	504288	EPA 8082A	504742
10407134027	**BW17ML-047-0.0-0.15**	EPA 3550	504288	EPA 8082A	504742
10407134028	**BW17ML-047-0.15-0.36**	EPA 3550	504288	EPA 8082A	504742
10407134029	**BW17ML-048-0.0-0.15**	EPA 3550	504288	EPA 8082A	504742
10407134030	**BW17ML-048-0.15-0.26**	EPA 3550	504288	EPA 8082A	504742
10407134031	**BW17ML-049-0.0-0.15**	EPA 3550	504288	EPA 8082A	504742
10407134032	**BW17ML-049-0.15-0.39**	EPA 3550	504288	EPA 8082A	504742
10407134033	**BW17ML-149-0.15-0.39**	EPA 3550	504288	EPA 8082A	504742
10407134034	**BW17ML-050-0.0-0.15**	EPA 3550	504288	EPA 8082A	504742
10407134035	**BW17ML-050-0.15-0.44**	EPA 3550	504288	EPA 8082A	504742
10407134036	**BW17ML-150-0.15-0.44**	EPA 3550	504288	EPA 8082A	504742
10407134037	**BW17ML-052-0.0-0.15**	EPA 3550	504288	EPA 8082A	504742
10407134038	**BW17ML-052-0.15-0.44**	EPA 3550	504288	EPA 8082A	504742
10407134039	**BW17ML-054-0.0-0.15**	EPA 3550	504288	EPA 8082A	504742
10407134040	**BW17ML-054-0.15-0.40**	EPA 3550	504288	EPA 8082A	504742
10407134041	**BW17ML-056-0.0-0.15**	EPA 3550	504290	EPA 8082A	504741
10407134042	**BW17ML-056-0.15-0.34**	EPA 3550	504290	EPA 8082A	504741
10407134043	**BW17ML-058-0.0-0.15**	EPA 3550	504290	EPA 8082A	504741
10407134044	**BW17ML-058-0.15-0.45**	EPA 3550	504290	EPA 8082A	504741
10407134045	**BW17ML-057-0.0-0.15**	EPA 3550	504290	EPA 8082A	504741
10407134046	**BW17ML-057-0.15-0.38**	EPA 3550	504290	EPA 8082A	504741
10407134047	**BW17ML-059-0.0-0.15**	EPA 3550	504290	EPA 8082A	504741
10407134048	**BW17ML-064-0.0-0.15**	EPA 3550	504290	EPA 8082A	504741

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10407134049	**BW17ML-064-0.15-0.38**	EPA 3550	504290	EPA 8082A	504741
10407134050	**BW17ML-065-0.0-0.15**	EPA 3550	504290	EPA 8082A	504741
10407134051	**BW17ML-065-0.15-0.50**	EPA 3550	504290	EPA 8082A	504741
10407134052	**BW17ML-066-0.0-0.15**	EPA 3550	504290	EPA 8082A	504741
10407134053	**BW17ML-066-0.15-0.32**	EPA 3550	504290	EPA 8082A	504741
10407134054	**RB-20171010**	EPA Mod. 3510C	503222	EPA 8082A	504740
10407134001	**BW17ML-42-0.0-0.15**	ASTM D2974	503071		
10407134002	**BW17ML-67-0.0-0.10**	ASTM D2974	503071		
10407134003	**BW17ML-67-0.15-0.39**	ASTM D2974	503071		
10407134004	**BW17ML-167-0.15-0.39**	ASTM D2974	503071		
10407134005	**BW17ML-41-0.0-0.15**	ASTM D2974	503071		
10407134006	**BW17ML-41-0.15-0.43**	ASTM D2974	503071		
10407134007	**BW17ML-055-0.0-0.15**	ASTM D2974	503071		
10407134008	**BW17ML-055-0.15-0.40**	ASTM D2974	503071		
10407134009	**BW17ML-043-0.0-0.15**	ASTM D2974	503071		
10407134010	**BW17ML-043-0.15-0.46**	ASTM D2974	503071		
10407134011	**BW17ML-143-0.15-0.46**	ASTM D2974	503071		
10407134012	**BW17ML-044-0.0-0.15**	ASTM D2974	503071		
10407134013	**BW17ML-044-0.15-0.45**	ASTM D2974	503071		
10407134014	**BW17ML-42-0.15-0.36**	ASTM D2974	503071		
10407134015	**BW17ML-053-0.0-0.15**	ASTM D2974	503071		
10407134016	**BW17ML-053-0.15-0.39**	ASTM D2974	503071		
10407134017	**BW17ML-061-0.0-0.15**	ASTM D2974	503071		
10407134018	**BW17ML-061-0.15-0.39**	ASTM D2974	503071		
10407134019	**BW17ML-063-0.0-0.15**	ASTM D2974	503071		
10407134020	**BW17ML-063-0.15-0.42**	ASTM D2974	503071		
10407134021	**BW17ML-163-0.15-0.42**	ASTM D2974	503072		
10407134022	**BW17ML-160-0.15-0.41**	ASTM D2974	503072		
10407134023	**BW17ML-060-0.0-0.15**	ASTM D2974	503072		
10407134024	**BW17ML-060-0.15-0.41**	ASTM D2974	503072		
10407134025	**BW17ML-046-0.0-0.15**	ASTM D2974	503072		
10407134026	**BW17ML-046-0.15-0.31**	ASTM D2974	503072		
10407134027	**BW17ML-047-0.0-0.15**	ASTM D2974	503072		
10407134028	**BW17ML-047-0.15-0.36**	ASTM D2974	503072		
10407134029	**BW17ML-048-0.0-0.15**	ASTM D2974	503072		
10407134030	**BW17ML-048-0.15-0.26**	ASTM D2974	503072		
10407134031	**BW17ML-049-0.0-0.15**	ASTM D2974	503072		
10407134032	**BW17ML-049-0.15-0.39**	ASTM D2974	503072		
10407134033	**BW17ML-149-0.15-0.39**	ASTM D2974	503072		
10407134034	**BW17ML-050-0.0-0.15**	ASTM D2974	503072		
10407134035	**BW17ML-050-0.15-0.44**	ASTM D2974	503072		
10407134036	**BW17ML-150-0.15-0.44**	ASTM D2974	503072		
10407134037	**BW17ML-052-0.0-0.15**	ASTM D2974	503072		
10407134038	**BW17ML-052-0.15-0.44**	ASTM D2974	503072		
10407134039	**BW17ML-054-0.0-0.15**	ASTM D2974	503072		
10407134040	**BW17ML-054-0.15-0.40**	ASTM D2974	503072		
10407134041	**BW17ML-056-0.0-0.15**	ASTM D2974	503073		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407134

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10407134042	**BW17ML-056-0.15-0.34**	ASTM D2974	503073		
10407134043	**BW17ML-058-0.0-0.15**	ASTM D2974	503073		
10407134044	**BW17ML-058-0.15-0.45**	ASTM D2974	503073		
10407134045	**BW17ML-057-0.0-0.15**	ASTM D2974	503073		
10407134046	**BW17ML-057-0.15-0.38**	ASTM D2974	503073		
10407134047	**BW17ML-059-0.0-0.15**	ASTM D2974	503073		
10407134048	**BW17ML-064-0.0-0.15**	ASTM D2974	503073		
10407134049	**BW17ML-064-0.15-0.38**	ASTM D2974	503073		
10407134050	**BW17ML-065-0.0-0.15**	ASTM D2974	503073		
10407134051	**BW17ML-065-0.15-0.50**	ASTM D2974	503073		
10407134052	**BW17ML-066-0.0-0.15**	ASTM D2974	503073		
10407134053	**BW17ML-066-0.15-0.32**	ASTM D2974	503073		

Bay West
Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D EQuIS Information:	
Company: Bay West LLC	Report To: Nancy McDonald	Attention: Accounts Payable	Facility_Name: St. Louis River Sediment Areas of Concern	Page 1 of 5
Address: 5 Empire Drive	Copy To: Paul Raymaker, Jonna Bjelland	Company Name: Bay West LLC	Facility_Code: St Louis River Sed	
St. Paul MN 55103		Address: 5 Empire Drive	Facility_ID: 547023	COC#
Email To: nmcdonald@BAYWEST.com	Purchase Order No.: 105565	Lab Quote Reference: 3000019769	Subfacility_code:	
Phone: 651-291-3483	Project Name: SLR Sediment AOCs	Lab Project Manager: Oyeyemi Odujole		Site Location STATE: MN
Requested Due Date/TAT: Standard	Project Number: J170470			

Valid Matrix Codes (MATRIX / CODE): Drinking Water DW, Water ST, Water W, Waste Water W, Product P, Soil/Solid SL, Oil QL, Wipe WP, Air AR, Tissue TS, Other OT

Section E Required Client Information

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	PCBs (EPA 8082A)	Comments
1	BW17ML-42	BW17ML-42-0.0-0.15	S	G	10/12/17	8:40	1	1								1	001
2	BW17ML-42	BW17ML-42-0.15-0.36	S	G	10/12/17	8:40	1	1								1	* 014
3	BW17ML-67	BW17ML-67-0.0-0.10	S	G	10/12/17	9:00	1	1								1	002
4	BW17ML-67	BW17ML-67-0.15-0.39	S	G	10/12/17	9:00	1	1								1	003
5	BW17ML-67	BW17ML-167-0.15-0.39	S	G	10/12/17	9:00	1	1								1	004
6	BW17ML-41	BW17ML-41-0.0-0.15	S	G	10/12/17	9:30	1	1								1	005
7	BW17ML-41	BW17ML-41-0.15-0.43	S	G	10/12/17	9:30	1	1								1	006
8	BW17ML-055	BW17ML-055-0.0-0.15	S	G	10/12/17	10:00	1	1								1	007
9	BW17ML-055	BW17ML-055-0.15-0.40	S	G	10/12/17	10:00	1	1								1	008
10	BW17ML-043	BW17ML-043-0.0-0.15	S	G	10/12/17	10:30	1	1								1	009
11	BW17ML-043	BW17ML-043-0.15-0.46	S	G	10/12/17	10:30	1	1								1	010
12	BW17ML-043	BW17ML-143-0.15-0.46	S	G	10/12/17	10:50	1	1								1	011

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
MPCA Multi-site Project	Jonna Bjelland	10/13/17	1554	[illegible]	10/13/17	1554	1.4 0.5 1.7	Y	N	Y
							Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: PS

DATE Signed (MM/DD/YY): 10/12/17

Bay West
Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:

Company:	Bay West LLC
Address:	5 Empire Drive
	St. Paul MN 55103
Email To:	nmcdonald@BAYWEST.com
Phone:	651-291-3483
Requested Due Date/TAT:	Standard

Section B Required Project Information:

Report To:	Nancy McDonald
Copy To:	Paul Raymaker, Jonna Bjelland
Purchase Order No.:	105565
Project Name:	SLR Sediment AOCs
Project Number:	J170470

Section C Invoice Information:

Attention:	Accounts Payable
Company Name:	Bay West LLC
Address:	5 Empire Drive
Lab Quote Reference:	3000019769
Lab Project Manager:	Oyeyemi Odujole

Section D EQuIS Information:

Facility_Name:	St. Louis River Sediment Areas of Concern
Facility_Code:	St Louis River Sed
Facility_ID:	547023
Subfacility_code:	

Page 2 of 5

COC#

Site Location STATE: MN

Section E Required Client Information

Valid Matrix Codes (MATRIX / CODE): Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

Requested Analysis: PCBs (EPA 8082A)

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	PCBs (EPA 8082A)	Comments
1	BW17ML-044	BW17ML-044-0.0-0.15	S	G	10/12/17	11:00	1	1								1	012
2	BW17ML-044	BW17ML-044-0.15-0.45	S	G	10/12/17	11:00	1	1								1	013
3	BW17ML-053	BW17ML-053-0.0-0.15	S	G	10/12/17	11:15	1	1								1	*015
4	BW17ML-053	BW17ML-053-0.15-0.39	S	G	10/12/17	11:15	1	1								1	016
5	BW17ML-061	BW17ML-061-0.0-0.15	S	G	10/12/17	11:30	1	1								1	017
6	BW17ML-061	BW17ML-061-0.15-0.39	S	G	10/12/17	11:30	1	1								1	018
7	BW17ML-063	BW17ML-063-0.0-0.15	S	G	10/12/17	11:45	1	1								1	019
8	BW17ML-063	BW17ML-063-0.15-0.42	S	G	10/12/17	11:45	1	1								1	020
9	BW17ML-063	BW17ML-163-0.15-0.42	S	G	10/12/17	11:45	1	1								1	021
10	BW17ML-060	BW17ML-160-0.15-0.41	S	G	10/12/17	12:30	1	1								1	022
11	BW17ML-060	BW17ML-060-0.0-0.15	S	G	10/12/17	12:15	1	1								1	023
12	BW17ML-060	BW17ML-060-0.15-0.41	S	G	10/12/17	12:15	1	1								1	024

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
MPCA Multi-site Project	Jonna Bjelland	10/13/17	15:54	[illegible]	10/13/17	1554	1.4 0.5 1.7	Y	N	Y

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: PS

DATE Signed (MM/DD/YY): 10/12/17

Bay West
Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D EQuIS Information:	
Company: Bay West LLC	Report To: Nancy McDonald	Attention: Accounts Payable	Facility_Name: St. Louis River Sediment Areas of Concern	Page 3 of 5
Address: 5 Empire Drive	Copy To: Paul Raymaker, Jonna Bjelland	Company Name: Bay West LLC	Facility_Code: St Louis River Sed	
St. Paul MN 55103		Address: 5 Empire Drive	Facility_ID: 547023	COC#
Email To: nmcdonald@BAYWEST.com	Purchase Order No.: 105565	Lab Quote Reference: 3000019769	Subfacility_code:	
Phone: 651-291-3483	Project Name: SLR Sediment AOCs	Lab Project Manager: Oyeyemi Odujole		Site Location STATE: MN
Requested Due Date/TAT: Standard	Project Number: J170470			

Valid Matrix Codes (MATRIX / CODE): Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

Section E — Required Client Information. Collection; Preservatives; Requested Analysis

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	DATE	Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	PCBs (EPA 8082A)	Comments
1	BW17ML-046	BW17ML-046-0.0-0.15	S	G	10/12/17	12:45	1	1								1	025
2	BW17ML-046	BW17ML-046-0.15-0.31	S	G	10/12/17	12:45	1	1								1	026
3	BW17ML-047	BW17ML-047-0.0-0.15	S	G	10/12/17	1:20	1	1								1	027
4	BW17ML-047	BW17ML-047-0.15-0.36	S	G	10/12/17	1:20	1	1								1	028
5	BW17ML-048	BW17ML-048-0.0-0.15	S	G	10/12/17	13:45	1	1								1	029
6	BW17ML-048	BW17ML-048-0.15-0.26	S	G	10/12/17	13:45	1	1								1	030
7	BW17ML-049	BW17ML-049-0.0-0.15	S	G	10/12/17	14:00	1	1								1	031
8	BW17ML-049	BW17ML-049-0.15-0.39	S	G	10/12/17	14:00	1	1								1	032
9	BW17ML-049	BW17ML-149-0.15-0.39	S	G	10/12/17	14:15	1	1								1	033.
10	BW17ML-050	BW17ML-050-0.0-0.15	S	G	10/12/17	14:30	1	1								1	034
11	BW17ML-050	BW17ML-050-0.15-0.44	S	G	10/12/17	14:30	1	1								1	035
12	BW17ML-050	BW17ML-150-0.15-0.44	S	G	10/12/17	14:45	1	1								1	036

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
MPCA Multi-site Project	Jonna Bjelland	10/13/17	1554	[signature]	10/13/17	1554	1.4 0.5 1.7	Y	N	Y

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Patrick Sweeney
SIGNATURE of SAMPLER: PS
DATE Signed (MM/DD/YY): 10/12/17

Bay West

Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:

Company:	Bay West LLC
Address:	5 Empire Drive
	St. Paul MN 55103
Email To:	nmcdonald@BAYWEST.com
Phone:	651-291-3483
Requested Due Date/TAT:	Standard

Section B Required Project Information:

Report To:	Nancy McDonald
Copy To:	Paul Raymaker, Jonna Bjelland
Purchase Order No.:	105565
Project Name:	SLR Sediment AOCs
Project Number:	J170470

Section C Invoice Information:

Attention:	Accounts Payable
Company Name:	Bay West LLC
Address:	5 Empire Drive
Lab Quote Reference:	3000019769
Lab Project Manager:	Oyeyemi Odujole

Section D EQuIS Information:

Facility_Name:	St. Louis River Sediment Areas of Concern
Facility_Code:	St Louis River Sed
Facility_ID:	547023
Subfacility_code:	

Page 4 of 5

COC#

Site Location STATE: MN

Section E Required Client Information

Valid Matrix Codes: Drinking Water DW, Water ST, Water W, Waste Water W, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Tissue TS, Other OT

Requested Analysis

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	PCBs (EPA 8082A)	Comments
1	BW17ML-052	BW17ML-052-0.0-0.15	S	G	10/12/17	15:15	1	1								1	037
2	BW17ML-052	BW17ML-052-0.15-0.44	S	G	10/12/17	15:15	1	1								1	038
3	BW17ML-054	BW17ML-054-0.0-0.15	S	G	10/12/17	15:30	1	1								1	039
4	BW17ML-054	BW17ML-054-0.15-0.40	S	G	10/12/17	15:30	1	1								1	040
5	BW17ML-056	BW17ML-056-0.0-0.15	S	G	10/12/17	15:45	1	1								1	041
6	BW17ML-056	BW17ML-056-0.15-0.34	S	G	10/12/17	15:45	1	1								1	042
7	BW17ML-058	BW17ML-058-0.0-0.15	S	G	10/12/17	16:00	1	1								1	043
8	BW17ML-058	BW17ML-058-0.15-0.45	S	G	10/12/17	16:00	1	1								1	044
9	BW17ML-057	BW17ML-057-0.0-0.15	S	G	10/12/17	16:30	1	1								1	045
10	BW17ML-057	BW17ML-057-0.15-0.38	S	G	10/12/17	16:30	1	1								1	046
11	BW17ML-059	BW17ML-059-0.0-0.15	S	G	10/12/17	16:40	1	1								1	047
12	BW17ML-064	BW17ML-064-0.0-0.15	S	G	10/12/17	16:45	1	1								1	048

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
MPCA Multi-site Project	Jonna Bjelland	10/13/17	1554	[signature]	10/13/17	1554	1.4 0.5 1.7	Y	N	Y

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: PS

DATE Signed (MM/DD/YY): 10/12/17

Bay West
Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:

Company:	Bay West LLC
Address:	5 Empire Drive
	St. Paul MN 55103
Email To:	nmcdonald@BAYWEST.com
Phone:	651-291-3483
Requested Due Date/TAT:	Standard

Section B Required Project Information:

Report To:	Nancy McDonald
Copy To:	Paul Raymaker, Jonna Bjelland
Purchase Order No.:	105565
Project Name:	SLR Sediment AOCs
Project Number:	J170470

Section C Invoice Information:

Attention:	Accounts Payable
Company Name:	Bay West LLC
Address:	5 Empire Drive
Lab Quote Reference:	3000019769
Lab Project Manager:	Oyeyemi Odujole

Section D EQuIS Information:

Facility_Name:	St. Louis River Sediment Areas of Concern
Facility_Code:	St Louis River Sed
Facility_ID:	547023
Subfacility_code:	

Page 5 of 5

COC#

Site Location STATE: MN

Section E Required Client Information

Valid Matrix Codes (MATRIX / CODE): Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Requested Analysis: PCBs (EPA 8082A)	Comments
1	BW17ML-064	BW17ML-064-0.15-0.38	S	G	10/12/17	16:45	1	1								1	049
2	BW17ML-065	BW17ML-065-0.0-0.15	S	G	10/12/17	17:00	1	1								1	050
3	BW17ML-065	BW17ML-065-0.15-0.50	S	G	10/12/17	17:00	1	1								1	051
4	BW17ML-066	BW17ML-066-0.0-0.15	S	G	10/12/17	17:15	1	1								1	052
5	BW17ML-066	BW17ML-066-0.15-0.32	S	G	10/12/17	17:15	1	1								1	053
6	RB	RB-20171010	W	G	10/10/17	10:00	2	1								1	054
7																	
8																	
9																	
10																	
11																	
12																	

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
MPCA Multi-site Project	Jonna Bjelland	10/13/17	554	[illegible signature]	10/13/17	554	1.4 0.5 1.7	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: PS

DATE Signed (MM/DD/YY): 10/12/17

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 30Aug2017 Page 1 of 2
	Document No.: **F-MN-L-213-rev.21**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Bay West

Project #:

WO# : 10407134

10407134

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☒ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

Tracking Number:

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No **Seals Intact?** ☐ Yes ☒ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐ Bubble Wrap ☒ Bubble Bags ☐ None ☐ Other: **Temp Blank?** ☒ Yes ☐ No

Thermometer Used: ☐ 151401163 ☒ 087A9155100842 **Type of Ice:** ☒ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

Cooler Temp Read (°C): 16, 0.7, 1.9 **Cooler Temp Corrected (°C):** 17, 0.5, 1.7 **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Correction Factor:** -0.2 **Date and Initials of Person Examining Contents:** OT 10/13/17

USDA Regulated Soil (☐ N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☒ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☒ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present?	☒ Yes	☐ No		1.
Chain of Custody Filled Out?	☒ Yes	☐ No		2.
Chain of Custody Relinquished?	☒ Yes	☐ No		3.
Sampler Name and/or Signature on COC?	☒ Yes	☐ No	☐ N/A	4.
Samples Arrived within Hold Time?	☒ Yes	☐ No		5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No		6.
Rush Turn Around Time Requested?	☐ Yes	☒ No		7.
Sufficient Volume?	☒ Yes	☐ No		8.
Correct Containers Used? -Pace Containers Used?	☒ Yes ☒ Yes	☐ No ☐ No		9.
Containers Intact?	☒ Yes	☐ No		10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: SL, WT	☒ Yes	☐ No		12.
All containers needing acid/base preservation have been checked?	☐ Yes	☐ No	☒ N/A	13. ☐ HNO_3 ☐ H_2SO_4 ☐ NaOH Positive for Res. Chlorine? Y N Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes	☐ No	☒ N/A	
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	☐ Yes	☐ No	☒ N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☒ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☒ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

Project Manager Review: Oyeyemi Odujole **Date:** 10/16/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

November 08, 2017

Nancy McDonald
Bay West Inc
5 Empire Drive
Saint Paul, MN 55103

RE: Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Dear Nancy McDonald:

Enclosed are the analytical results for sample(s) received by the laboratory on October 13, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Due to Dry Weights being performed prior to analysis (part of the TOC procedure), Dry Weights are not reported out. The results of TOC include the Dry Weight factor.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Oyeyemi Odujole
oyeyemi.odujole@pacelabs.com
(612)607-6402
Project Manager

Enclosures

cc: Jonna Bjelland, Bay West, Inc.
Joe Erjavec, Bay West LLC
Paul Raymaker, Bay West
Jeff Smith, Pace Analytical Services, Inc

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

CERTIFICATIONS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Virginia Minnesota Certification ID's

315 Chestnut Street, Virginia, MN 55792
California Certification #2973
Montana Certificate #CERT0103
California Certification #2973
Alaska Certification UST-107
Alaska Certification UST-107
Alaska Certification #MN01084
Arizona Department of Health Certification #AZ0785

Minnesota Dept of Health Certification #: 027-137-445
North Dakota Certification: # R-203
Wisconsin DNR Certification # : 998027470
WA Department of Ecology Lab ID# C1007
Nevada DNR #MN010842018-1
Oklahoma Department of Environmental Quality
California Certification #2973

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE SUMMARY

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10407139001	BW17ML-42-0.0-0.15	Solid	10/12/17 08:40	10/13/17 15:54
10407139002	BW17ML-42-0.15-0.36	Solid	10/12/17 08:40	10/13/17 15:54
10407139003	BW17ML-67-0.0-0.10	Solid	10/12/17 09:00	10/13/17 15:54
10407139004	BW17ML-67-0.15-0.39	Solid	10/12/17 09:00	10/13/17 15:54
10407139006	BW17ML-41-0.0-0.15	Solid	10/12/17 09:30	10/13/17 15:54
10407139007	BW17ML-41-0.15-0.43	Solid	10/12/17 09:30	10/13/17 15:54
10407139008	BW17ML-055-0.0-0.15	Solid	10/12/17 10:00	10/13/17 15:54
10407139009	BW17ML-055-0.15-0.40	Solid	10/12/17 10:00	10/13/17 15:54
10407139010	BW17ML-043-0.0-0.15	Solid	10/12/17 10:30	10/13/17 15:54
10407139011	BW17ML-043-0.15-0.46	Solid	10/12/17 10:30	10/13/17 15:54
10407139012	BW17ML-044-0.0-0.15	Solid	10/12/17 11:00	10/13/17 15:54
10407139013	BW17ML-044-0.15-0.45	Solid	10/12/17 11:00	10/13/17 15:54
10407139014	BW17ML-053-0.0-0.15	Solid	10/12/17 11:15	10/13/17 15:54
10407139015	BW17ML-053-0.15-0.39	Solid	10/12/17 11:15	10/13/17 15:54
10407139016	BW17ML-061-0.0-0.15	Solid	10/12/17 11:30	10/13/17 15:54
10407139017	BW17ML-061-0.15-0.39	Solid	10/12/17 11:30	10/13/17 15:54
10407139018	BW17ML-063-0.0-0.15	Solid	10/12/17 11:45	10/13/17 15:54
10407139019	BW17ML-063-0.15-0.42	Solid	10/12/17 11:45	10/13/17 15:54
10407139020	BW17ML-060-0.0-0.15	Solid	10/12/17 12:15	10/13/17 15:54
10407139021	BW17ML-060-0.15-0.41	Solid	10/12/17 12:15	10/13/17 15:54
10407139022	BW17ML-046-0.0-0.15	Solid	10/12/17 12:45	10/13/17 15:54
10407139023	BW17ML-046-0.15-0.31	Solid	10/12/17 12:45	10/13/17 15:54
10407139024	BW17ML-045-0.0-0.15	Solid	10/12/17 01:00	10/13/17 15:54
10407139025	BW17ML-045-0.15-0.41	Solid	10/12/17 01:00	10/13/17 15:54
10407139026	BW17ML-047-0.0-0.15	Solid	10/12/17 01:20	10/13/17 15:54
10407139027	BW17ML-047-0.15-0.36	Solid	10/12/17 01:20	10/13/17 15:54
10407139028	BW17ML-048-0.0-0.15	Solid	10/12/17 13:45	10/13/17 15:54
10407139029	BW17ML-048-0.15-0.26	Solid	10/12/17 13:45	10/13/17 15:54
10407139030	BW17ML-049-0.0-0.15	Solid	10/12/17 14:00	10/13/17 15:54
10407139031	BW17ML-049-0.15-0.39	Solid	10/12/17 14:00	10/13/17 15:54
10407139032	BW17ML-050-0.0-0.15	Solid	10/12/17 14:30	10/13/17 15:54
10407139033	BW17ML-050-0.15-0.44	Solid	10/12/17 14:30	10/13/17 15:54
10407139034	BW17ML-051-0.0-0.15	Solid	10/12/17 14:50	10/13/17 15:54
10407139035	BW17ML-051-0.15-0.36	Solid	10/12/17 14:50	10/13/17 15:54
10407139036	BW17ML-052-0.0-0.15	Solid	10/12/17 15:15	10/13/17 15:54
10407139037	BW17ML-052-0.15-0.44	Solid	10/12/17 15:15	10/13/17 15:54
10407139038	BW17ML-054-0.0-0.15	Solid	10/12/17 15:30	10/13/17 15:54

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE SUMMARY

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10407139039	**BW17ML-054-0.15-0.40**	Solid	10/12/17 15:30	10/13/17 15:54
10407139040	**BW17ML-056-0.0-0.15**	Solid	10/12/17 15:45	10/13/17 15:54
10407139041	**BW17ML-056-0.15-0.34**	Solid	10/12/17 15:45	10/13/17 15:54
10407139042	**BW17ML-058-0.0-0.15**	Solid	10/12/17 16:00	10/13/17 15:54
10407139043	**BW17ML-058-0.15-0.45**	Solid	10/12/17 16:00	10/13/17 15:54
10407139044	**BW17ML-062-0.0-0.15**	Solid	10/12/17 16:15	10/13/17 15:54
10407139045	**BW17ML-057-0.0-0.15**	Solid	10/12/17 16:30	10/13/17 15:54
10407139046	**BW17ML-057-0.15-0.38**	Solid	10/12/17 16:30	10/13/17 15:54
10407139047	**BW17ML-059-0.0-0.15**	Solid	10/12/17 16:40	10/13/17 15:54
10407139048	**BW17ML-064-0.0-0.15**	Solid	10/12/17 16:45	10/13/17 15:54
10407139049	**BW17ML-064-0.15-0.38**	Solid	10/12/17 16:45	10/13/17 15:54
10407139050	**BW17ML-065-0.0-0.15**	Solid	10/12/17 17:00	10/13/17 15:54
10407139051	**BW17ML-065-0.15-0.50**	Solid	10/12/17 17:00	10/13/17 15:54
10407139052	**BW17ML-066-0.0-0.15**	Solid	10/12/17 17:15	10/13/17 15:54
10407139053	**BW17ML-066-0.15-0.32**	Solid	10/12/17 17:15	10/13/17 15:54

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE ANALYTE COUNT

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10407139001	**BW17ML-42-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139002	**BW17ML-42-0.15-0.36**	EPA 9060A	CRE	5	PASI-V
10407139003	**BW17ML-67-0.0-0.10**	EPA 9060A	CRE	5	PASI-V
10407139004	**BW17ML-67-0.15-0.39**	EPA 9060A	CRE	5	PASI-V
10407139006	**BW17ML-41-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139007	**BW17ML-41-0.15-0.43**	EPA 9060A	CRE	5	PASI-V
10407139008	**BW17ML-055-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139009	**BW17ML-055-0.15-0.40**	EPA 9060A	CRE	5	PASI-V
10407139010	**BW17ML-043-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139011	**BW17ML-043-0.15-0.46**	EPA 9060A	CRE	5	PASI-V
10407139012	**BW17ML-044-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139013	**BW17ML-044-0.15-0.45**	EPA 9060A	CRE	5	PASI-V
10407139014	**BW17ML-053-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139015	**BW17ML-053-0.15-0.39**	EPA 9060A	CRE	5	PASI-V
10407139016	**BW17ML-061-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139017	**BW17ML-061-0.15-0.39**	EPA 9060A	CRE	5	PASI-V
10407139018	**BW17ML-063-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139019	**BW17ML-063-0.15-0.42**	EPA 9060A	CRE	5	PASI-V
10407139020	**BW17ML-060-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139021	**BW17ML-060-0.15-0.41**	EPA 9060A	CRE	5	PASI-V
10407139022	**BW17ML-046-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139023	**BW17ML-046-0.15-0.31**	EPA 9060A	CRE	5	PASI-V
10407139024	**BW17ML-045-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139025	**BW17ML-045-0.15-0.41**	EPA 9060A	CRE	5	PASI-V
10407139026	**BW17ML-047-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139027	**BW17ML-047-0.15-0.36**	EPA 9060A	CRE	5	PASI-V
10407139028	**BW17ML-048-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139029	**BW17ML-048-0.15-0.26**	EPA 9060A	CRE	5	PASI-V
10407139030	**BW17ML-049-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139031	**BW17ML-049-0.15-0.39**	EPA 9060A	CRE	5	PASI-V
10407139032	**BW17ML-050-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139033	**BW17ML-050-0.15-0.44**	EPA 9060A	CRE	5	PASI-V
10407139034	**BW17ML-051-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139035	**BW17ML-051-0.15-0.36**	EPA 9060A	CRE	5	PASI-V
10407139036	**BW17ML-052-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139037	**BW17ML-052-0.15-0.44**	EPA 9060A	CRE	5	PASI-V
10407139038	**BW17ML-054-0.0-0.15**	EPA 9060A	CRE	5	PASI-V

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE ANALYTE COUNT

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10407139039	**BW17ML-054-0.15-0.40**	EPA 9060A	CRE	5	PASI-V
10407139040	**BW17ML-056-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139041	**BW17ML-056-0.15-0.34**	EPA 9060A	CRE	5	PASI-V
10407139042	**BW17ML-058-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139043	**BW17ML-058-0.15-0.45**	EPA 9060A	CRE	5	PASI-V
10407139044	**BW17ML-062-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139045	**BW17ML-057-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139046	**BW17ML-057-0.15-0.38**	EPA 9060A	CRE	5	PASI-V
10407139047	**BW17ML-059-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139048	**BW17ML-064-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139049	**BW17ML-064-0.15-0.38**	EPA 9060A	CRE	5	PASI-V
10407139050	**BW17ML-065-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139051	**BW17ML-065-0.15-0.50**	EPA 9060A	CRE	5	PASI-V
10407139052	**BW17ML-066-0.0-0.15**	EPA 9060A	CRE	5	PASI-V
10407139053	**BW17ML-066-0.15-0.32**	EPA 9060A	CRE	5	PASI-V

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

PROJECT NARRATIVE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Method: **EPA 9060A**
Description: Total Organic Carbon Quad
Client: Bay West, Inc.
Date: November 08, 2017

General Information:
52 samples were analyzed for EPA 9060A. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

QC Batch: 129011

A matrix spike and/or matrix spike duplicate (MS/MSD) were performed on the following sample(s): 10407139001,10407139011

M1: Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
- MS (Lab ID: 513526)
  - Mean Total Organic Carbon
- MSD (Lab ID: 513527)
  - Mean Total Organic Carbon

QC Batch: 129939

A matrix spike and/or matrix spike duplicate (MS/MSD) were performed on the following sample(s): 10407139022,10407139037

M1: Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
- MSD (Lab ID: 517237)
  - Mean Total Organic Carbon

R1: RPD value was outside control limits.
- MSD (Lab ID: 517237)
  - Mean Total Organic Carbon

QC Batch: 130745

A matrix spike and/or matrix spike duplicate (MS/MSD) were performed on the following sample(s): 10407139042,10407139048

M1: Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
- MS (Lab ID: 520501)
  - Mean Total Organic Carbon

R1: RPD value was outside control limits.
- MSD (Lab ID: 520502)
  - Mean Total Organic Carbon

Additional Comments:

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

PROJECT NARRATIVE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Method: **EPA 9060A**
Description: Total Organic Carbon Quad
Client: Bay West, Inc.
Date: November 08, 2017

This data package has been reviewed for quality and completeness and is approved for release.

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-42-0.0-0.15 **Lab ID: 10407139001** Collected: 10/12/17 08:40 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**12200**	mg/kg	1410	422	1		10/19/17 12:57	7440-44-0	
Total Organic Carbon	**14900**	mg/kg	1160	348	1		10/19/17 13:10	7440-44-0	
Total Organic Carbon	**13700**	mg/kg	1230	368	1		10/19/17 13:17	7440-44-0	
Total Organic Carbon	**12900**	mg/kg	1150	343	1		10/19/17 13:24	7440-44-0	
Mean Total Organic Carbon	**13400**	mg/kg	1240	370	1		10/19/17 13:24	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-42-0.15-0.36 **Lab ID: 10407139002** Collected: 10/12/17 08:40 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**19500**	mg/kg	1040	312	1		10/19/17 14:38	7440-44-0	
Total Organic Carbon	**18900**	mg/kg	1040	311	1		10/19/17 14:46	7440-44-0	
Total Organic Carbon	**18200**	mg/kg	1130	338	1		10/19/17 14:54	7440-44-0	
Total Organic Carbon	**14800**	mg/kg	1080	324	1		10/19/17 15:01	7440-44-0	
Mean Total Organic Carbon	**17900**	mg/kg	1070	321	1		10/19/17 15:01	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-67-0.0-0.10 **Lab ID: 10407139003** Collected: 10/12/17 09:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**19300**	mg/kg	1630	488	1		10/19/17 15:08	7440-44-0	
Total Organic Carbon	**40200**	mg/kg	1250	373	1		10/19/17 15:16	7440-44-0	
Total Organic Carbon	**34500**	mg/kg	1370	410	1		10/19/17 15:24	7440-44-0	
Total Organic Carbon	**36000**	mg/kg	1250	375	1		10/19/17 15:31	7440-44-0	
Mean Total Organic Carbon	**32500**	mg/kg	1380	411	1		10/19/17 15:31	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-67-0.15-0.39 **Lab ID: 10407139004** Collected: 10/12/17 09:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**29000**	mg/kg	1210	361	1		10/20/17 08:50	7440-44-0	
Total Organic Carbon	**31700**	mg/kg	1450	435	1		10/20/17 08:57	7440-44-0	
Total Organic Carbon	**30700**	mg/kg	1470	439	1		10/20/17 09:04	7440-44-0	
Total Organic Carbon	**31600**	mg/kg	1480	443	1		10/20/17 09:12	7440-44-0	
Mean Total Organic Carbon	**30700**	mg/kg	1400	419	1		10/20/17 09:12	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-41-0.0-0.15 **Lab ID: 10407139006** Collected: 10/12/17 09:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**15200**	mg/kg	2110	630	1		10/20/17 09:19	7440-44-0	
Total Organic Carbon	**35100**	mg/kg	1470	441	1		10/20/17 09:28	7440-44-0	
Total Organic Carbon	**27100**	mg/kg	1430	427	1		10/20/17 09:35	7440-44-0	
Total Organic Carbon	**32100**	mg/kg	1460	436	1		10/20/17 09:42	7440-44-0	
Mean Total Organic Carbon	**27400**	mg/kg	1620	483	1		10/20/17 09:42	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-41-0.15-0.43 **Lab ID: 10407139007** Collected: 10/12/17 09:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**51800**	mg/kg	1530	458	1		10/20/17 09:50	7440-44-0	
Total Organic Carbon	**52400**	mg/kg	1650	493	1		10/20/17 09:58	7440-44-0	
Total Organic Carbon	**52700**	mg/kg	2010	602	1		10/20/17 10:08	7440-44-0	
Total Organic Carbon	**22100**	mg/kg	1970	588	1		10/20/17 10:16	7440-44-0	
Mean Total Organic Carbon	**44700**	mg/kg	1790	535	1		10/20/17 10:16	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-055-0.0-0.15 **Lab ID: 10407139008** Collected: 10/12/17 10:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**35800**	mg/kg	2520	753	1		10/20/17 10:23	7440-44-0	
Total Organic Carbon	**38600**	mg/kg	2430	727	1		10/20/17 10:32	7440-44-0	
Total Organic Carbon	**17600**	mg/kg	2450	732	1		10/20/17 10:39	7440-44-0	
Total Organic Carbon	**22000**	mg/kg	2470	738	1		10/20/17 10:46	7440-44-0	
Mean Total Organic Carbon	**28500**	mg/kg	2470	737	1		10/20/17 10:46	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-055-0.15-0.40 **Lab ID: 10407139009** Collected: 10/12/17 10:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**49500**	mg/kg	1420	426	1		10/20/17 10:54	7440-44-0	
Total Organic Carbon	**48600**	mg/kg	1850	553	1		10/20/17 11:05	7440-44-0	
Total Organic Carbon	**49700**	mg/kg	1970	590	1		10/20/17 11:12	7440-44-0	
Total Organic Carbon	**47800**	mg/kg	1950	583	1		10/20/17 11:20	7440-44-0	
Mean Total Organic Carbon	**48900**	mg/kg	1800	538	1		10/20/17 11:20	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-043-0.0-0.15 **Lab ID: 10407139010** Collected: 10/12/17 10:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**25600**	mg/kg	1450	435	1		10/20/17 11:27	7440-44-0	
Total Organic Carbon	**27500**	mg/kg	1340	401	1		10/20/17 11:35	7440-44-0	
Total Organic Carbon	**13100**	mg/kg	1410	422	1		10/20/17 11:42	7440-44-0	
Total Organic Carbon	**23900**	mg/kg	1420	425	1		10/20/17 12:44	7440-44-0	
Mean Total Organic Carbon	**22500**	mg/kg	1410	421	1		10/20/17 12:44	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-043-0.15-0.46 **Lab ID: 10407139011** Collected: 10/12/17 10:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**29800**	mg/kg	2460	736	1		10/26/17 08:39	7440-44-0	
Total Organic Carbon	**34400**	mg/kg	2590	774	1		10/26/17 08:46	7440-44-0	
Total Organic Carbon	**24800**	mg/kg	2260	675	1		10/26/17 08:53	7440-44-0	
Total Organic Carbon	**33300**	mg/kg	2120	633	1		10/26/17 09:01	7440-44-0	
Mean Total Organic Carbon	**30600**	mg/kg	2360	705	1		10/26/17 09:01	7440-44-0	M1

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-044-0.0-0.15 **Lab ID: 10407139012** Collected: 10/12/17 11:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**34700**	mg/kg	2250	674	1		10/26/17 10:06	7440-44-0	
Total Organic Carbon	**55000**	mg/kg	1990	596	1		10/26/17 10:15	7440-44-0	
Total Organic Carbon	**29700**	mg/kg	2200	658	1		10/26/17 10:23	7440-44-0	
Total Organic Carbon	**42500**	mg/kg	2170	649	1		10/26/17 10:30	7440-44-0	
Mean Total Organic Carbon	**40500**	mg/kg	2150	644	1		10/26/17 10:30	7440-44-0	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-044-0.15-0.45 **Lab ID: 10407139013** Collected: 10/12/17 11:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**24300**	mg/kg	2120	635	1		10/26/17 10:37	7440-44-0	
Total Organic Carbon	**53400**	mg/kg	2010	602	1		10/26/17 10:47	7440-44-0	
Total Organic Carbon	**50600**	mg/kg	2330	698	1		10/26/17 10:55	7440-44-0	
Total Organic Carbon	**53100**	mg/kg	2300	686	1		10/26/17 11:03	7440-44-0	
Mean Total Organic Carbon	**45300**	mg/kg	2190	655	1		10/26/17 11:03	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-053-0.0-0.15 **Lab ID: 10407139014** Collected: 10/12/17 11:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**50600**	mg/kg	2480	743	1		10/26/17 11:11	7440-44-0	
Total Organic Carbon	**52600**	mg/kg	2600	777	1		10/26/17 11:18	7440-44-0	
Total Organic Carbon	**24700**	mg/kg	2810	841	1		10/26/17 11:25	7440-44-0	
Total Organic Carbon	**50900**	mg/kg	2380	711	1		10/26/17 12:33	7440-44-0	
Mean Total Organic Carbon	**44700**	mg/kg	2570	768	1		10/26/17 12:33	7440-44-0	

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-053-0.15-0.39 **Lab ID: 10407139015** Collected: 10/12/17 11:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**50700**	mg/kg	2380	712	1		10/26/17 12:40	7440-44-0	
Total Organic Carbon	**58700**	mg/kg	2560	764	1		10/26/17 12:57	7440-44-0	
Total Organic Carbon	**50500**	mg/kg	2400	718	1		10/26/17 13:06	7440-44-0	
Total Organic Carbon	**28900**	mg/kg	2840	849	1		10/26/17 13:30	7440-44-0	
Mean Total Organic Carbon	**40000**	mg/kg	2540	761	1		10/26/17 13:30	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-061-0.0-0.15 **Lab ID: 10407139016** Collected: 10/12/17 11:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**101000**	mg/kg	2770	829	1		10/26/17 13:37	7440-44-0	
Total Organic Carbon	**104000**	mg/kg	3160	944	1		10/26/17 13:46	7440-44-0	
Total Organic Carbon	**113000**	mg/kg	4060	1210	1		10/26/17 13:54	7440-44-0	
Total Organic Carbon	**98900**	mg/kg	3700	1110	1		10/26/17 14:02	7440-44-0	
Mean Total Organic Carbon	**104000**	mg/kg	3420	1020	1		10/26/17 14:02	7440-44-0	

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-061-0.15-0.39 **Lab ID: 10407139017** Collected: 10/12/17 11:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**83800**	mg/kg	3750	1120	1		10/26/17 14:09	7440-44-0	
Total Organic Carbon	**88700**	mg/kg	3480	1040	1		10/26/17 14:17	7440-44-0	
Total Organic Carbon	**84400**	mg/kg	6800	2030	1		10/26/17 14:24	7440-44-0	
Total Organic Carbon	**75300**	mg/kg	5560	1660	1		10/26/17 14:31	7440-44-0	
Mean Total Organic Carbon	**83100**	mg/kg	4900	1460	1		10/26/17 14:31	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-063-0.0-0.15 **Lab ID: 10407139018** Collected: 10/12/17 11:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**34200**	mg/kg	4980	1490	1		10/26/17 14:39	7440-44-0	
Total Organic Carbon	**116000**	mg/kg	3440	1030	1		10/26/17 14:48	7440-44-0	
Total Organic Carbon	**44600**	mg/kg	3670	1100	1		10/26/17 14:55	7440-44-0	
Total Organic Carbon	**124000**	mg/kg	3620	1080	1		10/26/17 15:02	7440-44-0	
Mean Total Organic Carbon	**79500**	mg/kg	3930	1170	1		10/26/17 15:02	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-063-0.15-0.42 **Lab ID: 10407139019** Collected: 10/12/17 11:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**14600**	mg/kg	3080	920	1		10/27/17 08:02	7440-44-0	
Total Organic Carbon	**18900**	mg/kg	1920	574	1		10/27/17 08:10	7440-44-0	
Total Organic Carbon	**12500**	mg/kg	2280	683	1		10/27/17 08:17	7440-44-0	
Total Organic Carbon	**13700**	mg/kg	2070	619	1		10/27/17 08:25	7440-44-0	
Mean Total Organic Carbon	**14900**	mg/kg	2340	699	1		10/27/17 08:25	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-060-0.0-0.15 **Lab ID: 10407139020** Collected: 10/12/17 12:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**16300**	mg/kg	2550	762	1		10/27/17 08:32	7440-44-0	
Total Organic Carbon	**49200**	mg/kg	1700	509	1		10/27/17 08:39	7440-44-0	
Total Organic Carbon	**39400**	mg/kg	1580	472	1		10/27/17 08:47	7440-44-0	
Total Organic Carbon	**37900**	mg/kg	1490	446	1		10/27/17 08:54	7440-44-0	
Mean Total Organic Carbon	**35700**	mg/kg	1830	547	1		10/27/17 08:54	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-060-0.15-0.41 **Lab ID: 10407139021** Collected: 10/12/17 12:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**54400**	mg/kg	1710	512	1		10/27/17 09:01	7440-44-0	
Total Organic Carbon	**72300**	mg/kg	2460	735	1		10/27/17 09:09	7440-44-0	
Total Organic Carbon	**59900**	mg/kg	2850	852	1		10/27/17 09:17	7440-44-0	
Total Organic Carbon	**52500**	mg/kg	2900	868	1		10/27/17 09:24	7440-44-0	
Mean Total Organic Carbon	**59800**	mg/kg	2480	741	1		10/27/17 09:24	7440-44-0	

Pace Analytical
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-046-0.0-0.15 **Lab ID: 10407139022** Collected: 10/12/17 12:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**56300**	mg/kg	2150	642	1		10/27/17 11:09	7440-44-0	
Total Organic Carbon	**56300**	mg/kg	2570	769	1		10/27/17 11:19	7440-44-0	
Total Organic Carbon	**56700**	mg/kg	2480	741	1		10/27/17 11:26	7440-44-0	
Total Organic Carbon	**50700**	mg/kg	2430	726	1		10/27/17 11:33	7440-44-0	
Mean Total Organic Carbon	**55000**	mg/kg	2410	720	1		10/27/17 11:33	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-046-0.15-0.31 **Lab ID: 10407139023** Collected: 10/12/17 12:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**50200**	mg/kg	2790	834	1		10/27/17 12:42	7440-44-0	
Total Organic Carbon	**46800**	mg/kg	2570	768	1		10/27/17 12:50	7440-44-0	
Total Organic Carbon	**45900**	mg/kg	2790	834	1		10/27/17 12:57	7440-44-0	
Total Organic Carbon	**48200**	mg/kg	2880	862	1		10/27/17 13:07	7440-44-0	
Mean Total Organic Carbon	**47800**	mg/kg	2760	825	1		10/27/17 13:07	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-045-0.0-0.15 **Lab ID: 10407139024** Collected: 10/12/17 01:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**52900**	mg/kg	2350	704	1		10/27/17 13:14	7440-44-0	
Total Organic Carbon	**53400**	mg/kg	2290	684	1		10/27/17 13:21	7440-44-0	
Total Organic Carbon	**52900**	mg/kg	2720	814	1		10/27/17 13:29	7440-44-0	
Total Organic Carbon	**26400**	mg/kg	2350	704	1		10/27/17 13:36	7440-44-0	
Mean Total Organic Carbon	**46400**	mg/kg	2430	726	1		10/27/17 13:36	7440-44-0	

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-045-0.15-0.41 **Lab ID: 10407139025** Collected: 10/12/17 01:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**37000**	mg/kg	2410	720	1		10/27/17 13:43	7440-44-0	
Total Organic Carbon	**38600**	mg/kg	1920	575	1		10/27/17 13:52	7440-44-0	
Total Organic Carbon	**37800**	mg/kg	2490	743	1		10/27/17 13:59	7440-44-0	
Total Organic Carbon	**18400**	mg/kg	2330	695	1		10/27/17 14:07	7440-44-0	
Mean Total Organic Carbon	**32900**	mg/kg	2290	683	1		10/27/17 14:07	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-047-0.0-0.15 **Lab ID: 10407139026** Collected: 10/12/17 01:20 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**41700**	mg/kg	2100	628	1		10/27/17 14:14	7440-44-0	
Total Organic Carbon	**42300**	mg/kg	2440	729	1		10/27/17 14:22	7440-44-0	
Total Organic Carbon	**35200**	mg/kg	2320	694	1		10/27/17 14:29	7440-44-0	
Total Organic Carbon	**42100**	mg/kg	2250	671	1		10/27/17 14:37	7440-44-0	
Mean Total Organic Carbon	**40300**	mg/kg	2280	681	1		10/27/17 14:37	7440-44-0	

REPORT OF LABORATORY ANALYSIS

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-047-0.15-0.36 **Lab ID: 10407139027** Collected: 10/12/17 01:20 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**40900**	mg/kg	2130	636	1		10/27/17 14:44	7440-44-0	
Total Organic Carbon	**60800**	mg/kg	2130	636	1		10/27/17 14:51	7440-44-0	
Total Organic Carbon	**31000**	mg/kg	2280	681	1		10/27/17 14:59	7440-44-0	
Total Organic Carbon	**32000**	mg/kg	2170	650	1		10/27/17 15:06	7440-44-0	
Mean Total Organic Carbon	**41200**	mg/kg	2180	651	1		10/27/17 15:06	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-048-0.0-0.15 **Lab ID: 10407139028** Collected: 10/12/17 13:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**78300**	mg/kg	2220	663	1		11/02/17 14:35	7440-44-0	
Total Organic Carbon	**83200**	mg/kg	3130	937	1		11/02/17 14:44	7440-44-0	
Total Organic Carbon	**47300**	mg/kg	3440	1030	1		11/02/17 14:51	7440-44-0	
Total Organic Carbon	**73700**	mg/kg	3130	936	1		11/02/17 14:59	7440-44-0	
Mean Total Organic Carbon	**70600**	mg/kg	2980	891	1		11/02/17 14:59	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-048-0.15-0.26 **Lab ID: 10407139029** Collected: 10/12/17 13:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**28700**	mg/kg	3390	1010	1		11/02/17 15:06	7440-44-0	
Total Organic Carbon	**77800**	mg/kg	3480	1040	1		11/02/17 15:13	7440-44-0	
Total Organic Carbon	**41000**	mg/kg	3700	1110	1		11/02/17 15:21	7440-44-0	
Total Organic Carbon	**67900**	mg/kg	3530	1060	1		11/02/17 15:28	7440-44-0	
Mean Total Organic Carbon	**53900**	mg/kg	3520	1050	1		11/02/17 15:28	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-049-0.0-0.15 **Lab ID: 10407139030** Collected: 10/12/17 14:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**42300**	mg/kg	2740	819	1		11/03/17 07:38	7440-44-0	
Total Organic Carbon	**48800**	mg/kg	2860	855	1		11/03/17 07:46	7440-44-0	
Total Organic Carbon	**45700**	mg/kg	3130	934	1		11/03/17 07:56	7440-44-0	
Total Organic Carbon	**46000**	mg/kg	2960	885	1		11/03/17 08:03	7440-44-0	
Mean Total Organic Carbon	**45700**	mg/kg	2920	874	1		11/03/17 08:03	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-049-0.15-0.39 **Lab ID: 10407139031** Collected: 10/12/17 14:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**43000**	mg/kg	3550	1060	1		11/03/17 08:10	7440-44-0	
Total Organic Carbon	**62100**	mg/kg	3960	1180	1		11/03/17 08:18	7440-44-0	
Total Organic Carbon	**61600**	mg/kg	3220	961	1		11/03/17 08:25	7440-44-0	
Total Organic Carbon	**43000**	mg/kg	3370	1010	1		11/03/17 08:33	7440-44-0	
Mean Total Organic Carbon	**52400**	mg/kg	3530	1050	1		11/03/17 08:33	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-050-0.0-0.15 **Lab ID: 10407139032** Collected: 10/12/17 14:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**32600**	mg/kg	2800	838	1		11/03/17 08:40	7440-44-0	
Total Organic Carbon	**41400**	mg/kg	2910	871	1		11/03/17 08:47	7440-44-0	
Total Organic Carbon	**28600**	mg/kg	2740	819	1		11/03/17 08:54	7440-44-0	
Total Organic Carbon	**29700**	mg/kg	3130	935	1		11/03/17 09:02	7440-44-0	
Mean Total Organic Carbon	**33100**	mg/kg	2900	866	1		11/03/17 09:02	7440-44-0	

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-050-0.15-0.44 **Lab ID: 10407139033** Collected: 10/12/17 14:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**21300**	mg/kg	3160	944	1		11/03/17 09:09	7440-44-0	
Total Organic Carbon	**39900**	mg/kg	2650	794	1		11/03/17 09:17	7440-44-0	
Total Organic Carbon	**19400**	mg/kg	2570	768	1		11/03/17 09:24	7440-44-0	
Total Organic Carbon	**19900**	mg/kg	2780	831	1		11/03/17 09:31	7440-44-0	
Mean Total Organic Carbon	**25100**	mg/kg	2790	834	1		11/03/17 09:31	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-051-0.0-0.15 **Lab ID: 10407139034** Collected: 10/12/17 14:50 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**25200**	mg/kg	3380	1010	1		11/03/17 09:38	7440-44-0	
Total Organic Carbon	**60900**	mg/kg	2980	890	1		11/03/17 09:46	7440-44-0	
Total Organic Carbon	**57800**	mg/kg	2790	834	1		11/03/17 10:17	7440-44-0	
Total Organic Carbon	**57400**	mg/kg	2980	890	1		11/03/17 10:28	7440-44-0	
Mean Total Organic Carbon	**50300**	mg/kg	3030	906	1		11/03/17 10:28	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-051-0.15-0.36 **Lab ID: 10407139035** Collected: 10/12/17 14:50 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**19800**	mg/kg	2840	849	1		11/03/17 10:35	7440-44-0	
Total Organic Carbon	**44000**	mg/kg	2310	692	1		11/03/17 10:44	7440-44-0	
Total Organic Carbon	**29200**	mg/kg	2300	688	1		11/03/17 10:51	7440-44-0	
Total Organic Carbon	**25000**	mg/kg	2320	695	1		11/03/17 10:58	7440-44-0	
Mean Total Organic Carbon	**29500**	mg/kg	2440	731	1		11/03/17 10:58	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-052-0.0-0.15 **Lab ID: 10407139036** Collected: 10/12/17 15:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**32300**	mg/kg	2240	671	1		11/03/17 11:33	7440-44-0	
Total Organic Carbon	**39600**	mg/kg	2190	656	1		11/03/17 11:42	7440-44-0	
Total Organic Carbon	**22400**	mg/kg	2060	615	1		11/03/17 11:49	7440-44-0	
Total Organic Carbon	**24600**	mg/kg	2400	718	1		11/03/17 11:57	7440-44-0	
Mean Total Organic Carbon	**29700**	mg/kg	2220	665	1		11/03/17 11:57	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-052-0.15-0.44 **Lab ID: 10407139037** Collected: 10/12/17 15:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**19500**	mg/kg	2340	699	1		11/03/17 12:04	7440-44-0	
Total Organic Carbon	**28600**	mg/kg	1780	531	1		11/03/17 12:11	7440-44-0	
Total Organic Carbon	**20200**	mg/kg	1830	547	1		11/03/17 12:20	7440-44-0	
Total Organic Carbon	**24300**	mg/kg	1860	557	1		11/03/17 12:27	7440-44-0	
Mean Total Organic Carbon	**23100**	mg/kg	1950	583	1		11/03/17 12:27	7440-44-0	M1,R1

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-054-0.0-0.15 **Lab ID: 10407139038** Collected: 10/12/17 15:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**36900**	mg/kg	2750	821	1		11/03/17 14:09	7440-44-0	
Total Organic Carbon	**56900**	mg/kg	2830	846	1		11/03/17 14:17	7440-44-0	
Total Organic Carbon	**27400**	mg/kg	2880	860	1		11/03/17 14:24	7440-44-0	
Total Organic Carbon	**24200**	mg/kg	2880	860	1		11/03/17 14:31	7440-44-0	
Mean Total Organic Carbon	**36400**	mg/kg	2830	847	1		11/03/17 14:31	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-054-0.15-0.40 **Lab ID: 10407139039** Collected: 10/12/17 15:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**16800**	mg/kg	2460	735	1		11/03/17 14:39	7440-44-0	
Total Organic Carbon	**36100**	mg/kg	1880	562	1		11/03/17 14:46	7440-44-0	
Total Organic Carbon	**29700**	mg/kg	2320	694	1		11/03/17 14:54	7440-44-0	
Total Organic Carbon	**27600**	mg/kg	2400	716	1		11/03/17 15:01	7440-44-0	
Mean Total Organic Carbon	**27500**	mg/kg	2260	677	1		11/03/17 15:01	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-056-0.0-0.15 **Lab ID: 10407139040** Collected: 10/12/17 15:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**23900**	mg/kg	2480	741	1		11/06/17 08:45	7440-44-0	
Total Organic Carbon	**54200**	mg/kg	1920	573	1		11/06/17 08:53	7440-44-0	
Total Organic Carbon	**19100**	mg/kg	2070	619	1		11/06/17 09:00	7440-44-0	
Total Organic Carbon	**54600**	mg/kg	2120	633	1		11/06/17 09:08	7440-44-0	
Mean Total Organic Carbon	**37900**	mg/kg	2150	642	1		11/06/17 09:08	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-056-0.15-0.34 **Lab ID: 10407139041** Collected: 10/12/17 15:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**20500**	mg/kg	1750	522	1		11/06/17 09:15	7440-44-0	
Total Organic Carbon	**55900**	mg/kg	1550	465	1		11/06/17 09:24	7440-44-0	
Total Organic Carbon	**52100**	mg/kg	1740	520	1		11/06/17 09:31	7440-44-0	
Total Organic Carbon	**26200**	mg/kg	1710	510	1		11/06/17 09:38	7440-44-0	
Mean Total Organic Carbon	**38700**	mg/kg	1690	504	1		11/06/17 09:38	7440-44-0	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-058-0.0-0.15 **Lab ID: 10407139042** Collected: 10/12/17 16:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**36100**	mg/kg	3220	962	1		11/06/17 11:27	7440-44-0	
Total Organic Carbon	**70300**	mg/kg	2850	853	1		11/06/17 11:34	7440-44-0	
Total Organic Carbon	**24700**	mg/kg	2870	858	1		11/06/17 11:41	7440-44-0	
Total Organic Carbon	**30100**	mg/kg	2870	858	1		11/06/17 11:49	7440-44-0	
Mean Total Organic Carbon	**40300**	mg/kg	2950	883	1		11/06/17 11:49	7440-44-0	M1,R1

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-058-0.15-0.45 **Lab ID: 10407139043** Collected: 10/12/17 16:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**85100**	mg/kg	2660	796	1		11/06/17 12:55	7440-44-0	
Total Organic Carbon	**107000**	mg/kg	3760	1130	1		11/06/17 13:07	7440-44-0	
Total Organic Carbon	**62900**	mg/kg	3860	1150	1		11/06/17 13:14	7440-44-0	
Total Organic Carbon	**89900**	mg/kg	3610	1080	1		11/06/17 13:21	7440-44-0	
Mean Total Organic Carbon	**86100**	mg/kg	3470	1040	1		11/06/17 13:21	7440-44-0	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-062-0.0-0.15 **Lab ID: 10407139044** Collected: 10/12/17 16:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**118000**	mg/kg	3340	998	1		11/06/17 13:29	7440-44-0	
Total Organic Carbon	**124000**	mg/kg	4900	1470	1		11/06/17 13:41	7440-44-0	
Total Organic Carbon	**84000**	mg/kg	5190	1550	1		11/06/17 13:48	7440-44-0	
Total Organic Carbon	**84300**	mg/kg	4940	1480	1		11/06/17 13:55	7440-44-0	
Mean Total Organic Carbon	**102000**	mg/kg	4590	1370	1		11/06/17 13:55	7440-44-0	

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-057-0.0-0.15 **Lab ID: 10407139045** Collected: 10/12/17 16:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**54100**	mg/kg	3380	1010	1		11/06/17 14:17	7440-44-0	
Total Organic Carbon	**54100**	mg/kg	3480	1040	1		11/06/17 14:25	7440-44-0	
Total Organic Carbon	**54000**	mg/kg	3530	1060	1		11/06/17 14:32	7440-44-0	
Total Organic Carbon	**21500**	mg/kg	3690	1100	1		11/06/17 14:40	7440-44-0	
Mean Total Organic Carbon	**45900**	mg/kg	3520	1050	1		11/06/17 14:40	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-057-0.15-0.38 **Lab ID: 10407139046** Collected: 10/12/17 16:30 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**43400**	mg/kg	3710	1110	1		11/06/17 14:47	7440-44-0	
Total Organic Carbon	**43100**	mg/kg	3460	1040	1		11/06/17 14:55	7440-44-0	
Total Organic Carbon	**21000**	mg/kg	3770	1130	1		11/06/17 15:02	7440-44-0	
Total Organic Carbon	**34200**	mg/kg	4200	1250	1		11/06/17 15:09	7440-44-0	
Mean Total Organic Carbon	**35400**	mg/kg	3790	1130	1		11/06/17 15:09	7440-44-0	

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-059-0.0-0.15 **Lab ID: 10407139047** Collected: 10/12/17 16:40 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**32300**	mg/kg	3200	956	1		11/06/17 15:16	7440-44-0	
Total Organic Carbon	**34700**	mg/kg	2610	779	1		11/06/17 15:25	7440-44-0	
Total Organic Carbon	**24500**	mg/kg	2870	859	1		11/06/17 15:32	7440-44-0	
Total Organic Carbon	**20400**	mg/kg	2800	837	1		11/06/17 15:39	7440-44-0	
Mean Total Organic Carbon	**28000**	mg/kg	2870	858	1		11/06/17 15:39	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-064-0.0-0.15 **Lab ID: 10407139048** Collected: 10/12/17 16:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**32400**	mg/kg	3330	997	1		11/06/17 16:16	7440-44-0	
Total Organic Carbon	**31100**	mg/kg	3060	915	1		11/06/17 16:24	7440-44-0	
Total Organic Carbon	**32100**	mg/kg	3050	913	1		11/06/17 16:31	7440-44-0	
Total Organic Carbon	**31100**	mg/kg	3290	984	1		11/06/17 16:38	7440-44-0	
Mean Total Organic Carbon	**31700**	mg/kg	3180	952	1		11/06/17 16:38	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-064-0.15-0.38 **Lab ID: 10407139049** Collected: 10/12/17 16:45 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**24600**	mg/kg	3130	935	1		11/07/17 09:38	7440-44-0	
Total Organic Carbon	**54000**	mg/kg	2730	816	1		11/07/17 09:46	7440-44-0	
Total Organic Carbon	**39300**	mg/kg	2790	834	1		11/07/17 09:53	7440-44-0	
Total Organic Carbon	**36900**	mg/kg	2800	838	1		11/07/17 10:00	7440-44-0	
Mean Total Organic Carbon	**38700**	mg/kg	2860	856	1		11/07/17 10:00	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-065-0.0-0.15 **Lab ID: 10407139050** Collected: 10/12/17 17:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**119000**	mg/kg	3790	1130	1		11/07/17 10:08	7440-44-0	
Total Organic Carbon	**168000**	mg/kg	7140	2140	1		11/07/17 10:15	7440-44-0	
Total Organic Carbon	**166000**	mg/kg	7090	2120	1		11/07/17 10:22	7440-44-0	
Total Organic Carbon	**120000**	mg/kg	6550	1960	1		11/07/17 10:30	7440-44-0	
Mean Total Organic Carbon	**143000**	mg/kg	6140	1840	1		11/07/17 10:30	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs

Pace Project No.: 10407139

Sample: BW17ML-065-0.15-0.50 **Lab ID: 10407139051** Collected: 10/12/17 17:00 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**189000**	mg/kg	7190	2150	1		11/07/17 10:37	7440-44-0	
Total Organic Carbon	**283000**	mg/kg	9680	2890	1		11/07/17 10:46	7440-44-0	
Total Organic Carbon	**103000**	mg/kg	10400	3100	1		11/07/17 10:54	7440-44-0	
Total Organic Carbon	**285000**	mg/kg	10100	3010	1		11/07/17 11:01	7440-44-0	
Mean Total Organic Carbon	**215000**	mg/kg	9330	2790	1		11/07/17 11:01	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-066-0.0-0.15 **Lab ID: 10407139052** Collected: 10/12/17 17:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**24100**	mg/kg	3450	1030	1		11/07/17 11:08	7440-44-0	
Total Organic Carbon	**67400**	mg/kg	3130	934	1		11/07/17 11:17	7440-44-0	
Total Organic Carbon	**66000**	mg/kg	3490	1040	1		11/07/17 11:24	7440-44-0	
Total Organic Carbon	**71800**	mg/kg	3680	1100	1		11/07/17 11:31	7440-44-0	
Mean Total Organic Carbon	**57300**	mg/kg	3440	1030	1		11/07/17 11:31	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Sample: BW17ML-066-0.15-0.32 **Lab ID: 10407139053** Collected: 10/12/17 17:15 Received: 10/13/17 15:54 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Total Organic Carbon Quad	Analytical Method: EPA 9060A								
Total Organic Carbon	**33000**	mg/kg	3190	954	1		11/07/17 11:39	7440-44-0	
Total Organic Carbon	**31200**	mg/kg	2970	887	1		11/07/17 11:47	7440-44-0	
Total Organic Carbon	**24000**	mg/kg	2860	856	1		11/07/17 11:54	7440-44-0	
Total Organic Carbon	**31700**	mg/kg	3020	902	1		11/07/17 12:02	7440-44-0	
Mean Total Organic Carbon	**30000**	mg/kg	3010	900	1		11/07/17 12:02	7440-44-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

QC Batch: 129011 Analysis Method: EPA 9060A
QC Batch Method: EPA 9060A Analysis Description: 9060 TOC Average
Associated Lab Samples: 10407139001, 10407139002, 10407139003, 10407139004, 10407139006, 10407139007, 10407139008, 10407139009, 10407139010, 10407139011, 10407139012, 10407139013, 10407139014, 10407139015, 10407139016, 10407139017, 10407139018, 10407139019, 10407139020, 10407139021

METHOD BLANK: 513522 Matrix: Solid
Associated Lab Samples: 10407139001, 10407139002, 10407139003, 10407139004, 10407139006, 10407139007, 10407139008, 10407139009, 10407139010, 10407139011, 10407139012, 10407139013, 10407139014, 10407139015, 10407139016, 10407139017, 10407139018, 10407139019, 10407139020, 10407139021

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mean Total Organic Carbon	mg/kg	ND	302	90.3	10/19/17 11:05	

LABORATORY CONTROL SAMPLE: 513523

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mean Total Organic Carbon	mg/kg	5820	6100	105	49-151	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 513524 513525

Parameter	Units	10407139001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mean Total Organic Carbon	mg/kg	13400	11800	11600	23300	24100	83	92	70-130	3	25	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 513526 513527

Parameter	Units	10407139011 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mean Total Organic Carbon	mg/kg	30600	24400	23500	54100	58200	96	118	70-130	7	25	M1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

QC Batch: 129939 | Analysis Method: EPA 9060A
QC Batch Method: EPA 9060A | Analysis Description: 9060 TOC Average

Associated Lab Samples: 10407139022, 10407139023, 10407139024, 10407139025, 10407139026, 10407139027, 10407139028, 10407139029, 10407139030, 10407139031, 10407139032, 10407139033, 10407139034, 10407139035, 10407139036, 10407139037, 10407139038, 10407139039, 10407139040, 10407139041

METHOD BLANK: 517232 Matrix: Solid

Associated Lab Samples: 10407139022, 10407139023, 10407139024, 10407139025, 10407139026, 10407139027, 10407139028, 10407139029, 10407139030, 10407139031, 10407139032, 10407139033, 10407139034, 10407139035, 10407139036, 10407139037, 10407139038, 10407139039, 10407139040, 10407139041

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mean Total Organic Carbon	mg/kg	ND	302	90.2	10/27/17 10:30	

LABORATORY CONTROL SAMPLE: 517233

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mean Total Organic Carbon	mg/kg	5820	6170	106	49-151	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 517234 517235

Parameter	Units	10407139022 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mean Total Organic Carbon	mg/kg	55000	59700	66500	103000	111000	81	85	70-130	7	25	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 517236 517237

Parameter	Units	10407139037 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mean Total Organic Carbon	mg/kg	23100	25100	25800	51400	36500	113	52	70-130	34	25	M1,R1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

QC Batch: 130745 | Analysis Method: EPA 9060A
QC Batch Method: EPA 9060A | Analysis Description: 9060 TOC Average
Associated Lab Samples: 10407139042, 10407139043, 10407139044, 10407139045, 10407139046, 10407139047, 10407139048, 10407139049, 10407139050, 10407139051, 10407139052, 10407139053

METHOD BLANK: 520499 | Matrix: Solid
Associated Lab Samples: 10407139042, 10407139043, 10407139044, 10407139045, 10407139046, 10407139047, 10407139048, 10407139049, 10407139050, 10407139051, 10407139052, 10407139053

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Mean Total Organic Carbon	mg/kg	ND	301	90.1	11/06/17 10:50	

LABORATORY CONTROL SAMPLE: 520500

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mean Total Organic Carbon	mg/kg	5820	6100	105	49-151	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 520501 520502

Parameter	Units	10407139042 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mean Total Organic Carbon	mg/kg	40300	40300	38000	103000	78000	155	99	70-130	27	25	M1,R1

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 520503 520504

Parameter	Units	10407139048 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Mean Total Organic Carbon	mg/kg	31700	40500	37000	64600	66700	81	95	70-130	3	25	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

QUALIFIERS

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-V Pace Analytical Services - Virginia

ANALYTE QUALIFIERS

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

R1 RPD value was outside control limits.

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10407139001	**BW17ML-42-0.0-0.15**	EPA 9060A	129011		
10407139001	**BW17ML-42-0.0-0.15**	EPA 9060A	129014		
10407139002	**BW17ML-42-0.15-0.36**	EPA 9060A	129011		
10407139002	**BW17ML-42-0.15-0.36**	EPA 9060A	129014		
10407139003	**BW17ML-67-0.0-0.10**	EPA 9060A	129011		
10407139003	**BW17ML-67-0.0-0.10**	EPA 9060A	129014		
10407139004	**BW17ML-67-0.15-0.39**	EPA 9060A	129011		
10407139004	**BW17ML-67-0.15-0.39**	EPA 9060A	129014		
10407139006	**BW17ML-41-0.0-0.15**	EPA 9060A	129011		
10407139006	**BW17ML-41-0.0-0.15**	EPA 9060A	129014		
10407139007	**BW17ML-41-0.15-0.43**	EPA 9060A	129011		
10407139007	**BW17ML-41-0.15-0.43**	EPA 9060A	129014		
10407139008	**BW17ML-055-0.0-0.15**	EPA 9060A	129011		
10407139008	**BW17ML-055-0.0-0.15**	EPA 9060A	129014		
10407139009	**BW17ML-055-0.15-0.40**	EPA 9060A	129011		
10407139009	**BW17ML-055-0.15-0.40**	EPA 9060A	129014		
10407139010	**BW17ML-043-0.0-0.15**	EPA 9060A	129011		
10407139010	**BW17ML-043-0.0-0.15**	EPA 9060A	129014		
10407139011	**BW17ML-043-0.15-0.46**	EPA 9060A	129011		
10407139011	**BW17ML-043-0.15-0.46**	EPA 9060A	129014		
10407139012	**BW17ML-044-0.0-0.15**	EPA 9060A	129011		
10407139012	**BW17ML-044-0.0-0.15**	EPA 9060A	129014		
10407139013	**BW17ML-044-0.15-0.45**	EPA 9060A	129011		
10407139013	**BW17ML-044-0.15-0.45**	EPA 9060A	129014		
10407139014	**BW17ML-053-0.0-0.15**	EPA 9060A	129011		
10407139014	**BW17ML-053-0.0-0.15**	EPA 9060A	129014		
10407139015	**BW17ML-053-0.15-0.39**	EPA 9060A	129011		
10407139015	**BW17ML-053-0.15-0.39**	EPA 9060A	129014		
10407139016	**BW17ML-061-0.0-0.15**	EPA 9060A	129011		
10407139016	**BW17ML-061-0.0-0.15**	EPA 9060A	129014		
10407139017	**BW17ML-061-0.15-0.39**	EPA 9060A	129011		
10407139017	**BW17ML-061-0.15-0.39**	EPA 9060A	129014		
10407139018	**BW17ML-063-0.0-0.15**	EPA 9060A	129011		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10407139018	**BW17ML-063-0.0-0.15**	EPA 9060A	129014		
10407139019	**BW17ML-063-0.15-0.42**	EPA 9060A	129011		
10407139019	**BW17ML-063-0.15-0.42**	EPA 9060A	129014		
10407139020	**BW17ML-060-0.0-0.15**	EPA 9060A	129011		
10407139020	**BW17ML-060-0.0-0.15**	EPA 9060A	129014		
10407139021	**BW17ML-060-0.15-0.41**	EPA 9060A	129011		
10407139021	**BW17ML-060-0.15-0.41**	EPA 9060A	129014		
10407139022	**BW17ML-046-0.0-0.15**	EPA 9060A	129939		
10407139022	**BW17ML-046-0.0-0.15**	EPA 9060A	129940		
10407139023	**BW17ML-046-0.15-0.31**	EPA 9060A	129939		
10407139023	**BW17ML-046-0.15-0.31**	EPA 9060A	129940		
10407139024	**BW17ML-045-0.0-0.15**	EPA 9060A	129939		
10407139024	**BW17ML-045-0.0-0.15**	EPA 9060A	129940		
10407139025	**BW17ML-045-0.15-0.41**	EPA 9060A	129939		
10407139025	**BW17ML-045-0.15-0.41**	EPA 9060A	129940		
10407139026	**BW17ML-047-0.0-0.15**	EPA 9060A	129939		
10407139026	**BW17ML-047-0.0-0.15**	EPA 9060A	129940		
10407139027	**BW17ML-047-0.15-0.36**	EPA 9060A	129939		
10407139027	**BW17ML-047-0.15-0.36**	EPA 9060A	129940		
10407139028	**BW17ML-048-0.0-0.15**	EPA 9060A	129939		
10407139028	**BW17ML-048-0.0-0.15**	EPA 9060A	129940		
10407139029	**BW17ML-048-0.15-0.26**	EPA 9060A	129939		
10407139029	**BW17ML-048-0.15-0.26**	EPA 9060A	129940		
10407139030	**BW17ML-049-0.0-0.15**	EPA 9060A	129939		
10407139030	**BW17ML-049-0.0-0.15**	EPA 9060A	129940		
10407139031	**BW17ML-049-0.15-0.39**	EPA 9060A	129939		
10407139031	**BW17ML-049-0.15-0.39**	EPA 9060A	129940		
10407139032	**BW17ML-050-0.0-0.15**	EPA 9060A	129939		
10407139032	**BW17ML-050-0.0-0.15**	EPA 9060A	129940		
10407139033	**BW17ML-050-0.15-0.44**	EPA 9060A	129939		
10407139033	**BW17ML-050-0.15-0.44**	EPA 9060A	129940		
10407139034	**BW17ML-051-0.0-0.15**	EPA 9060A	129939		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10407139034	**BW17ML-051-0.0-0.15**	EPA 9060A	129940		
10407139035	**BW17ML-051-0.15-0.36**	EPA 9060A	129939		
10407139035	**BW17ML-051-0.15-0.36**	EPA 9060A	129940		
10407139036	**BW17ML-052-0.0-0.15**	EPA 9060A	129939		
10407139036	**BW17ML-052-0.0-0.15**	EPA 9060A	129940		
10407139037	**BW17ML-052-0.15-0.44**	EPA 9060A	129939		
10407139037	**BW17ML-052-0.15-0.44**	EPA 9060A	129940		
10407139038	**BW17ML-054-0.0-0.15**	EPA 9060A	129939		
10407139038	**BW17ML-054-0.0-0.15**	EPA 9060A	129940		
10407139039	**BW17ML-054-0.15-0.40**	EPA 9060A	129939		
10407139039	**BW17ML-054-0.15-0.40**	EPA 9060A	129940		
10407139040	**BW17ML-056-0.0-0.15**	EPA 9060A	129939		
10407139040	**BW17ML-056-0.0-0.15**	EPA 9060A	129940		
10407139041	**BW17ML-056-0.15-0.34**	EPA 9060A	129939		
10407139041	**BW17ML-056-0.15-0.34**	EPA 9060A	129940		
10407139042	**BW17ML-058-0.0-0.15**	EPA 9060A	130745		
10407139042	**BW17ML-058-0.0-0.15**	EPA 9060A	130746		
10407139043	**BW17ML-058-0.15-0.45**	EPA 9060A	130745		
10407139043	**BW17ML-058-0.15-0.45**	EPA 9060A	130746		
10407139044	**BW17ML-062-0.0-0.15**	EPA 9060A	130745		
10407139044	**BW17ML-062-0.0-0.15**	EPA 9060A	130746		
10407139045	**BW17ML-057-0.0-0.15**	EPA 9060A	130745		
10407139045	**BW17ML-057-0.0-0.15**	EPA 9060A	130746		
10407139046	**BW17ML-057-0.15-0.38**	EPA 9060A	130745		
10407139046	**BW17ML-057-0.15-0.38**	EPA 9060A	130746		
10407139047	**BW17ML-059-0.0-0.15**	EPA 9060A	130745		
10407139047	**BW17ML-059-0.0-0.15**	EPA 9060A	130746		
10407139048	**BW17ML-064-0.0-0.15**	EPA 9060A	130745		
10407139048	**BW17ML-064-0.0-0.15**	EPA 9060A	130746		
10407139049	**BW17ML-064-0.15-0.38**	EPA 9060A	130745		
10407139049	**BW17ML-064-0.15-0.38**	EPA 9060A	130746		
10407139050	**BW17ML-065-0.0-0.15**	EPA 9060A	130745		
10407139050	**BW17ML-065-0.0-0.15**	EPA 9060A	130746		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: J170470 SLR Sediment AOCs
Pace Project No.: 10407139

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10407139051	**BW17ML-065-0.15-0.50**	EPA 9060A	130745		
10407139051	**BW17ML-065-0.15-0.50**	EPA 9060A	130746		
10407139052	**BW17ML-066-0.0-0.15**	EPA 9060A	130745		
10407139052	**BW17ML-066-0.0-0.15**	EPA 9060A	130746		
10407139053	**BW17ML-066-0.15-0.32**	EPA 9060A	130745		
10407139053	**BW17ML-066-0.15-0.32**	EPA 9060A	130746		

Bay West
Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

10407139

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D EQuIS Information:	
Company: Bay West LLC	Report To: Nancy McDonald	Attention: Accounts Payable	Facility_Name: St. Louis River Sediment Areas of Concern	Page 1 of 5
Address: 5 Empire Drive	Copy To: Paul Raymaker, Jonna Bjelland	Company Name: Bay West LLC	Facility_Code: St Louis River Sed	
St. Paul MN 55103		Address: 5 Empire Drive	Facility_ID: 547023	COC#
Email To: nmcdonald@BAYWEST.com	Purchase Order No.: 105567	Lab Quote Reference: 3000019769	Subfacility_code:	
Phone: 651-291-3483	Project Name: SLR Sediment AOCs	Lab Project Manager: Oyeyemi Odujole		Site Location STATE: MN
Requested Due Date/TAT: Standard	Project Number: J170470			

Valid Matrix Codes (MATRIX / CODE): Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

Section E — Required Client Information

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Requested Analysis: TOC by SW-846 9060A	Comments
1	BW17ML-42	BW17ML-42-0.0-0.15	S	G	10/12/17	8:40	1	1								1	001
2	BW17ML-42	BW17ML-42-0.15-0.36	S	G	10/12/17	8:40	1	1								1	002
3	BW17ML-67	BW17ML-67-0.0-0.10	S	G	10/12/17	9:00	1	1								1	003
4	BW17ML-67	BW17ML-67-0.15-0.39	S	G	10/12/17	9:00	1	1								1	004
5	BW17ML-67	BW17ML-167-0.15-0.39	S	G	10/12/17	9:00	1	1								1	005
6	BW17ML-41	BW17ML-41-0.0-0.15	S	G	10/12/17	9:30	1	1								1	006
7	BW17ML-41	BW17ML-41-0.15-0.43	S	G	10/12/17	9:30	1	1								1	007
8	BW17ML-055	BW17ML-055-0.0-0.15	S	G	10/12/17	10:00	1	1								1	008
9	BW17ML-055	BW17ML-055-0.15-0.40	S	G	10/12/17	10:00	1	1								1	009
10	BW17ML-043	BW17ML-043-0.0-0.15	S	G	10/12/17	10:30	1	1								1	010
11	BW17ML-043	BW17ML-043-0.15-0.46	S	G	10/12/17	10:30	1	1								1	011
12	BW17ML-044	BW17ML-044-0.0-0.15	S	G	10/12/17	11:00	1	1								1	012

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
MPCA Multi-site Project	Jonna Bjelland	10/13/17	1554	[illegible signature]	10/13/17	1554	1.4 0.5 1.7	Y	W	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: PS

DATE Signed (MM/DD/YY): 10/12/17

Bay West
Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D EQuIS Information:	
Company: Bay West LLC	Report To: Nancy McDonald	Attention: Accounts Payable	Facility_Name: St. Louis River Sediment Areas of Concern	Page 2 of 5
Address: 5 Empire Drive	Copy To: Paul Raymaker, Jonna Bjelland	Company Name: Bay West LLC	Facility_Code: St Louis River Sed	
St. Paul MN 55103		Address: 5 Empire Drive	Facility_ID: 547023	COC#
Email To: nmcdonald@BAYWEST.com	Purchase Order No.: 105567	Lab Quote Reference: 3000019769	Subfacility_code:	
Phone: 651-291-3483	Project Name: SLR Sediment AOCs	Lab Project Manager: Oyeyemi Odujole		Site Location STATE: MN
Requested Due Date/TAT: Standard	Project Number: J170470			

Section E — Required Client Information

Valid Matrix Codes (MATRIX / CODE): Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

Requested Analysis

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	TOC by SW-846 9060A	Comments
1	BW17ML-044	BW17ML-044-0.15-0.45	S	G	10/12/17	11:00	1	1								1	013
2	BW17ML-053	BW17ML-053-0.0-0.15	S	G	10/12/17	11:15	1	1								1	014
3	BW17ML-053	BW17ML-053-0.15-0.39	S	G	10/12/17	11:15	1	1								1	015
4	BW17ML-061	BW17ML-061-0.0-0.15	S	G	10/12/17	11:30	1	1								1	016
5	BW17ML-061	BW17ML-061-0.15-0.39	S	G	10/12/17	11:30	1	1								1	017
6	BW17ML-063	BW17ML-063-0.0-0.15	S	G	10/12/17	11:45	1	1								1	018
7	BW17ML-063	BW17ML-063-0.15-0.42	S	G	10/12/17	11:45	1	1								1	019
8	BW17ML-060	BW17ML-060-0.0-0.15	S	G	10/12/17	12:15	1	1								1	020
9	BW17ML-060	BW17ML-060-0.15-0.41	S	G	10/12/17	12:15	1	1								1	021
10	BW17ML-046	BW17ML-046-0.0-0.15	S	G	10/12/17	12:45	1	1								1	022
11	BW17ML-046	BW17ML-046-0.15-0.31	S	G	10/12/17	12:45	1	1								1	023
12	BW17ML-045	BW17ML-045-0.0-0.15	S	G	10/12/17	1:00	1	1								1	024

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
MPCA Multi-site Project	Jonna Bjelland	10/13/17	1554	[signature]	10/13/17	1554	1.4 0.5 1.7	Y	N	Y
							Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: PS — DATE Signed (MM/DD/YY): 10/12/17

Bay West
Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D EQuIS Information:	
Company: Bay West LLC	Report To: Nancy McDonald	Attention: Accounts Payable	Facility_Name: St. Louis River Sediment Areas of Concern	Page 3 of 5
Address: 5 Empire Drive	Copy To: Paul Raymaker, Jonna Bjelland	Company Name: Bay West LLC	Facility_Code: St Louis River Sed	
St. Paul MN 55103		Address: 5 Empire Drive	Facility_ID: 547023	COC#
Email To: nmcdonald@BAYWEST.com	Purchase Order No.: 105567	Lab Quote Reference: 3000019769	Subfacility_code:	
Phone: 651-291-3483	Project Name: SLR Sediment AOCs	Lab Project Manager: Oyeyemi Odujole		Site Location STATE: MN
Requested Due Date/TAT: Standard	Project Number: J170470			

Valid Matrix Codes (MATRIX / CODE): Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

Requested Analysis

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	TOC by SW-846 9060A	Comments
1	BW17ML-045	BW17ML-045-0.15-0.41	S	G	10/12/17	1:00	1	1								1	025
2	BW17ML-047	BW17ML-047-0.0-0.15	S	G	10/12/17	1:20	1	1								1	026
3	BW17ML-047	BW17ML-047-0.15-0.36	S	G	10/12/17	1:20	1	1								1	027
4	BW17ML-048	BW17ML-048-0.0-0.15	S	G	10/12/17	13:45	1	1								1	028
5	BW17ML-048	BW17ML-048-0.15-0.26	S	G	10/12/17	13:45	1	1								1	029
6	BW17ML-049	BW17ML-049-0.0-0.15	S	G	10/12/17	14:00	1	1								1	030
7	BW17ML-049	BW17ML-049-0.15-0.39	S	G	10/12/17	14:00	1	1								1	031
8	BW17ML-050	BW17ML-050-0.0-0.15	S	G	10/12/17	14:30	1	1								1	032
9	BW17ML-050	BW17ML-050-0.15-0.44	S	G	10/12/17	14:30	1	1								1	033
10	BW17ML-051	BW17ML-051-0.0-0.15	S	G	10/12/17	14:50	1	1								1	034
11	BW17ML-051	BW17ML-051-0.15-0.36	S	G	10/12/17	14:50	1	1								1	035
12	BW17ML-052	BW17ML-052-0.0-0.15	S	G	10/12/17	15:15	1	1								1	036

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
MPCA Multi-site Project	Jonna Bjelland	10/13/17	1554	[signature]	10/13/17	1554	1.9 0.5 1.7	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: PS

DATE Signed (MM/DD/YY): 10/12/17

Bay West

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D EQuIS Information:	
Company: Bay West LLC	Report To: Nancy McDonald	Attention: Accounts Payable	Facility_Name: St. Louis River Sediment Areas of Concern	Page 4 of 5
Address: 5 Empire Drive	Copy To: Paul Raymaker, Jonna Bjelland	Company Name: Bay West LLC	Facility_Code: St Louis River Sed	
St. Paul MN 55103		Address: 5 Empire Drive	Facility_ID: 547023	COC#
Email To: nmcdonald@BAYWEST.com	Purchase Order No.: 105567	Lab Quote Reference: 3000019769	Subfacility_code:	
Phone: 651-291-3483	Project Name: SLR Sediment AOCs	Lab Project Manager: Oyeyemi Odujole		Site Location STATE: MN
Requested Due Date/TAT: Standard	Project Number: J170470			

Valid Matrix Codes: Drinking Water DW, Water ST, Water W, Waste Water W, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Tissue TS, Other OT

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	TOC by SW-846 9060A	Comments
1	BW17ML-052	BW17ML-052-0.15-0.44	S	G	10/12/17	15:15	1	1								1	037
2	BW17ML-054	BW17ML-054-0.0-0.15	S	G	10/12/17	15:30	1	1								1	038
3	BW17ML-054	BW17ML-054-0.15-0.40	S	G	10/12/17	15:30	1	1								1	039
4	BW17ML-056	BW17ML-056-0.0-0.15	S	G	10/12/17	15:45	1	1								1	040
5	BW17ML-056	BW17ML-056-0.15-0.34	S	G	10/12/17	15:45	1	1								1	041
6	BW17ML-058	BW17ML-058-0.0-0.15	S	G	10/12/17	16:00	1	1								1	042
7	BW17ML-058	BW17ML-058-0.15-0.45	S	G	10/12/17	16:00	1	1								1	043
8	BW17ML-062	BW17ML-062-0.0-0.15	S	G	10/12/17	16:15	1	1								1	044
9	BW17ML-057	BW17ML-057-0.0-0.15	S	G	10/12/17	16:30	1	1								1	045
10	BW17ML-057	BW17ML-057-0.15-0.38	S	G	10/12/17	16:30	1	1								1	046
11	BW17ML-059	BW17ML-059-0.0-0.15	S	G	10/12/17	16:40	1	1								1	047
12	BW17ML-064	BW17ML-064-0.0-0.15	S	G	10/12/17	16:45	1	1								1	048

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
MPCA Multi-site Project	Jonna Bjelland	10/13/17	1554	[illegible]	10/13/17	1554	1.4 0.5 1.7	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: PS

DATE Signed (MM/DD/YY): 10/12/17

Bay West

Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:

Company:	Bay West LLC
Address:	5 Empire Drive
	St. Paul MN 55103
Email To:	nmcdonald@BAYWEST.com
Phone:	651-291-3483
Requested Due Date/TAT:	Standard

Section B Required Project Information:

Report To:	Nancy McDonald
Copy To:	Paul Raymaker, Jonna Bjelland
Purchase Order No.:	105567
Project Name:	SLR Sediment AOCs
Project Number:	J170470

Section C Invoice Information:

Attention:	Accounts Payable
Company Name:	Bay West LLC
Address:	5 Empire Drive
Lab Quote Reference:	3000019769
Lab Project Manager:	Oyeyemi Odujole

Section D EQuIS Information:

Facility_Name:	St. Louis River Sediment Areas of Concern
Facility_Code:	St Louis River Sed
Facility_ID:	547023
Subfacility_code:	

Page 5 of 5

COC#

Site Location STATE: MN

Section E Required Client Information

Valid Matrix Codes (MATRIX / CODE): Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

Collection; Preservatives; Requested Analysis

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	DATE	Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	TOC by SW-846 9060A	Comments
1	BW17ML-064	BW17ML-064-0.15-0.38	S	G	10/12/17	16:45	1	1								1	049
2	BW17ML-065	BW17ML-065-0.0-0.15	S	G	10/12/17	17:00	1	1								1	050
3	BW17ML-065	BW17ML-065-0.15-0.50	S	G	10/12/17	17:00	1	1								1	051
4	BW17ML-066	BW17ML-066-0.0-0.15	S	G	10/12/17	17:15	1	1								1	052
5	BW17ML-066	BW17ML-066-0.15-0.32	S	G	10/12/17	17:15	1	1								1	053
6																	
7																	
8																	
9																	
10																	
11																	
12																	

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
MPCA Multi-site Project	Jonna Bjelland	10/13/17	1554	[illegible]	10/13/17	1554	1.4 0.5 1.7	Y	N	Y
							Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: PS

DATE Signed (MM/DD/YY): 10/12/17

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 30Aug2017 Page 1 of 2
	Document No.: **F-MN-L-213-rev.21**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Bay West

Project #: **WO# : 10407139**

10407139

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☑ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

Tracking Number:

Custody Seal on Cooler/Box Present? ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☑ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other: **Temp Blank?** ☑ Yes ☐ No

Thermometer Used: ☐ 151401163 ☑ G87A9155100842

Type of Ice: ☑ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

Cooler Temp Read (°C): 1.6, 0.7, 1.9 **Cooler Temp Corrected (°C):** 1.9, 0.5, 1.7 **Biological Tissue Frozen?** ☐ Yes ☐ No ☑ N/A

Temp should be above freezing to 6°C **Correction Factor:** -.2 **Date and Initials of Person Examining Contents:** GT 10/13/17

USDA Regulated Soil (☐ N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☑ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☑ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

		COMMENTS:
Chain of Custody Present?	☑ Yes ☐ No	1.
Chain of Custody Filled Out?	☑ Yes ☐ No	2.
Chain of Custody Relinquished?	☑ Yes ☐ No	3.
Sampler Name and/or Signature on COC?	☑ Yes ☐ No ☐ N/A	4.
Samples Arrived within Hold Time?	☑ Yes ☐ No	5.
Short Hold Time Analysis (<72 hr)?	☐ Yes ☑ No	6.
Rush Turn Around Time Requested?	☐ Yes ☑ No	7.
Sufficient Volume?	☑ Yes ☐ No	8.
Correct Containers Used?	☑ Yes ☐ No	9.
-Pace Containers Used?	☑ Yes ☐ No	
Containers Intact?	☑ Yes ☐ No	10.
Filtered Volume Received for Dissolved Tests?	☐ Yes ☐ No ☑ N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: GW	☑ Yes ☐ No	12. WT on 10407134
All containers needing acid/base preservation have been checked?	☐ Yes ☐ No ☑ N/A	13. ☐ HNO_3 ☐ H_2SO_4 ☐ NaOH Positive for Res. Chlorine? Y N
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes ☐ No ☑ N/A	Sample #
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	☐ Yes ☐ No ☑ N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes ☐ No ☑ N/A	14.
Trip Blank Present?	☐ Yes ☐ No ☑ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes ☐ No ☑ N/A	
Pace Trip Blank Lot # (if purchased):		

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

Project Manager Review: Oyeyemi Odujole **Date:** 10/16/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

CHAIN-OF-CUSTODY / Analytical Request Document

Bay West

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D EQuIS Information:	
Company: Bay West LLC	Report To: Nancy McDonald	Attention: Accounts Payable	Facility_Name: St. Louis River Sediment Areas of Concern	Page 1 of 5
Address: 5 Empire Drive	Copy To: Paul Raymaker, Jonna Bjelland	Company Name: Bay West LLC	Facility_Code: St Louis River Sed	
St. Paul MN 55103		Address: 5 Empire Drive	Facility_ID: 547023	COC#
Email To: nmcdonald@BAYWEST.com	Purchase Order No.: 105567	Lab Quote Reference: 3000019769	Subfacility_code:	
Phone: 651-291-3483	Project Name: SLR Sediment AOCs	Lab Project Manager: Oyeyemi Odujole		Site Location STATE: MN
Requested Due Date/TAT: Standard	Project Number: J170470			

Section E — Required Client Information

Valid Matrix Codes (MATRIX / CODE): Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

Requested Analysis

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	TOC by SW-846 9060A											Comments
1	BW17ML-42	BW17ML-42-0.0-0.15	S	G	10/12/17	8:40	1	1								1											
2	BW17ML-42	BW17ML-42-0.15-0.36	S	G	10/12/17	8:40	1	1								1											
3	BW17ML-67	BW17ML-67-0.0-0.10	S	G	10/12/17	9:00	1	1								1											
4	BW17ML-67	BW17ML-67-0.15-0.39	S	G	10/12/17	9:00	1	1								1											
5	~~BW17ML-67~~	~~BW17ML-167-0.15-0.39~~	~~S~~	~~G~~	~~10/12/17~~	~~9:00~~	~~1~~	~~1~~								~~1~~											
6	BW17ML-41	BW17ML-41-0.0-0.15	S	G	10/12/17	9:30	1	1								1											
7	BW17ML-41	BW17ML-41-0.15-0.43	S	G	10/12/17	9:30	1	1								1											
8	BW17ML-055	BW17ML-055-0.0-0.15	S	G	10/12/17	10:00	1	1								1											
9	BW17ML-055	BW17ML-055-0.15-0.40	S	G	10/12/17	10:00	1	1								1											
10	BW17ML-043	BW17ML-043-0.0-0.15	S	G	10/12/17	10:30	1	1								1											
11	BW17ML-043	BW17ML-043-0.15-0.46	S	G	10/12/17	10:30	1	1								1											
12	BW17ML-044	BW17ML-044-0.0-0.15	S	G	10/12/17	11:00	1	1								1											

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
MPCA Multi-site Project						

SAMPLE CONDITIONS			
Temp (°C)	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY):

Chain of Custody

WO#:1298946
PM: HRZ Due Date: 10/31/17
CLIENT: PACE MPLS

Workorder: 10407139 Workorder Name: J170470 SLR Sediment AOCs Owner Received Date: 10/13/2017 Results Requested By: 10/27/2017

Report To	Subcontract To
Oyeyemi Odujole Pace Analytical Minnesota 1700 Elm Street Suite 200 Minneapolis, MN 55414 Phone (612)607-6402	Pace Analytical Virginia MN 315 Chestnut Street Virginia, MN 55792 Phone (218)742-1042

						Preserved Containers	Requested Analysis		
Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Unpreserved	Dry weight	TOC Quadruplicate - 9060A	LAB USE ONLY
1	BW17ML-42-0.0-0.15	PS	10/12/2017 08:40	10407139001	Solid	1	X	X	
2	BW17ML-42-0.15-0.36	PS	10/12/2017 08:40	10407139002	Solid	1	X	X	
3	BW17ML-67-0.0-0.10	PS	10/12/2017 09:00	10407139003	Solid	1	X	X	
4	BW17ML-67-0.15-0.39	PS	10/12/2017 09:00	10407139004	Solid	1	X	X	
5	BW17ML-41-0.0-0.15	PS	10/12/2017 09:30	10407139006	Solid	1	X	X	
6	BW17ML-41-0.15-0.43	PS	10/12/2017 09:30	10407139007	Solid	1	X	X	
7	BW17ML-055-0.0-0.15	PS	10/12/2017 10:00	10407139008	Solid	1	X	X	
8	BW17ML-055-0.15-0.40	PS	10/12/2017 10:00	10407139009	Solid	1	X	X	
9	BW17ML-043-0.0-0.15	PS	10/12/2017 10:30	10407139010	Solid	1	X	X	
10	BW17ML-043-0.15-0.46	PS	10/12/2017 10:30	10407139011	Solid	1	X	X	
11	BW17ML-044-0.0-0.15	PS	10/12/2017 11:00	10407139012	Solid	1	X	X	
12	BW17ML-044-0.15-0.45	PS	10/12/2017 11:00	10407139013	Solid	1	X	X	
13	BW17ML-053-0.0-0.15	PS	10/12/2017 11:15	10407139014	Solid	1	X	X	
14	BW17ML-053-0.15-0.39	PS	10/12/2017 11:15	10407139015	Solid	1	X	X	
15	BW17ML-061-0.0-0.15	PS	10/12/2017 11:30	10407139016	Solid	1	X	X	
16	BW17ML-061-0.15-0.39	PS	10/12/2017 11:30	10407139017	Solid	1	X	X	
17	BW17ML-063-0.0-0.15	PS	10/12/2017 11:45	10407139018	Solid	1	X	X	
18	BW17ML-063-0.15-0.42	PS	10/12/2017 11:45	10407139019	Solid	1	X	X	
19	BW17ML-060-0.0-0.15	PS	10/12/2017 12:15	10407139020	Solid	1	X	X	

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: 10407139 **Workorder Name:** J170470 SLR Sediment AOCs **Owner Received Date:** 10/13/2017 **Results Requested By:** 10/27/2017

Report To	Subcontract To
Oyeyemi Odujole Pace Analytical Minnesota 1700 Elm Street Suite 200 Minneapolis, MN 55414 Phone (612)607-6402	Pace Analytical Virginia MN 315 Chestnut Street Virginia, MN 55792 Phone (218)742-1042

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: Unpreserved	Requested Analysis: Dry weight	Requested Analysis: TOC Quadruplicate - 9060A	LAB USE ONLY
20	BW17ML-060-0.15-0.41	PS	10/12/2017 12:15	10407139021	Solid	1	X	X	
21	BW17ML-046-0.0-0.15	PS	10/12/2017 12:45	10407139022	Solid	1	X	X	
22	BW17ML-046-0.15-0.31	PS	10/12/2017 12:45	10407139023	Solid	1	X	X	
23	BW17ML-045-0.0-0.15	PS	10/12/2017 01:00	10407139024	Solid	1	X	X	
24	BW17ML-045-0.15-0.41	PS	10/12/2017 01:00	10407139025	Solid	1	X	X	
25	BW17ML-047-0.0-0.15	PS	10/12/2017 01:20	10407139026	Solid	1	X	X	
26	BW17ML-047-0.15-0.36	PS	10/12/2017 01:20	10407139027	Solid	1	X	X	
27	BW17ML-048-0.0-0.15	PS	10/12/2017 13:45	10407139028	Solid	1	X	X	
28	BW17ML-048-0.15-0.26	PS	10/12/2017 13:45	10407139029	Solid	1	X	X	
29	BW17ML-049-0.0-0.15	PS	10/12/2017 14:00	10407139030	Solid	1	X	X	
30	BW17ML-049-0.15-0.39	PS	10/12/2017 14:00	10407139031	Solid	1	X	X	
31	BW17ML-050-0.0-0.15	PS	10/12/2017 14:30	10407139032	Solid	1	X	X	
32	BW17ML-050-0.15-0.44	PS	10/12/2017 14:30	10407139033	Solid	1	X	X	
33	BW17ML-051-0.0-0.15	PS	10/12/2017 14:50	10407139034	Solid	1	X	X	
34	BW17ML-051-0.15-0.36	PS	10/12/2017 14:50	10407139035	Solid	1	X	X	
35	BW17ML-052-0.0-0.15	PS	10/12/2017 15:15	10407139036	Solid	1	X	X	
36	BW17ML-052-0.15-0.44	PS	10/12/2017 15:15	10407139037	Solid	1	X	X	
37	BW17ML-054-0.0-0.15	PS	10/12/2017 15:30	10407139038	Solid	1	X	X	
38	BW17ML-054-0.15-0.40	PS	10/12/2017 15:30	10407139039	Solid	1	X	X	
39	BW17ML-056-0.0-0.15	PS	10/12/2017 15:45	10407139040	Solid	1	X	X	

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: 10407139 Workorder Name: J170470 SLR Sediment AOCs Owner Received Date: 10/13/2017 Results Requested By: 10/27/2017

Report To	Subcontract To
Oyeyemi Odujole Pace Analytical Minnesota 1700 Elm Street Suite 200 Minneapolis, MN 55414 Phone (612)607-6402	Pace Analytical Virginia MN 315 Chestnut Street Virginia, MN 55792 Phone (218)742-1042

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: Unpreserved	Requested Analysis: Dry weight	Requested Analysis: TOC Quadruplicate - 9060A	LAB USE ONLY
40	BW17ML-056-0.15-0.34	PS	10/12/2017 15:45	10407139041	Solid	1	X	X	
41	BW17ML-058-0.0-0.15	PS	10/12/2017 16:00	10407139042	Solid	1	X	X	
42	BW17ML-058-0.15-0.45	PS	10/12/2017 16:00	10407139043	Solid	1	X	X	
43	BW17ML-062-0.0-0.15	PS	10/12/2017 16:15	10407139044	Solid	1	X	X	
44	BW17ML-057-0.0-0.15	PS	10/12/2017 16:30	10407139045	Solid	1	X	X	
45	BW17ML-057-0.15-0.38	PS	10/12/2017 16:30	10407139046	Solid	1	X	X	
46	BW17ML-059-0.0-0.15	PS	10/12/2017 16:40	10407139047	Solid	1	X	X	
47	BW17ML-064-0.0-0.15	PS	10/12/2017 16:45	10407139048	Solid	1	X	X	
48	BW17ML-064-0.15-0.38	PS	10/12/2017 16:45	10407139049	Solid	1	X	X	
49	BW17ML-065-0.0-0.15	PS	10/12/2017 17:00	10407139050	Solid	1	X	X	
50	BW17ML-065-0.15-0.50	PS	10/12/2017 17:00	10407139051	Solid	1	X	X	
51	BW17ML-066-0.0-0.15	PS	10/12/2017 17:15	10407139052	Solid	1	X	X	
52	BW17ML-066-0.15-0.32	PS	10/12/2017 17:15	10407139053	Solid	1	X	X	

Transfers	Released By	Date/Time	Received By	Date/Time
1	[signature] PACE	10/16/07 1600	[signature]	10/16/17 1830
2	[signature]	10/16/17 2310	[signature]	10/17/17 0800
3				

Comments

Cooler Temperature on Receipt 1.5 °C Custody Seal Y or N Received on Ice Y or N Samples Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document. This chain of custody is considered complete as is since this information is available in the owner laboratory.

Pace Analytical	Document Name: Sample Condition Upon Receipt Form	Document Revised: 15Mar2016 Page 1 of 1
	Document No.: F-VM-C-001-Rev.10	Issuing Authority: Pace Virginia, Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Pace MN

Project #:

WO# : 1298946

PM: HRZ Due Date: 10/31/17

CLIENT: PACE MPLS

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☑ Pace ☐ Other:

Tracking Number:

Custody Seal on Cooler/Box Present? ☑ Yes ☐ No Seals Intact? ☑ Yes ☐ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☑ Bubble Wrap ☑ Bubble Bags ☐ None ☑ Other: Hazpac

Temp Blank? ☑ Yes ☐ No

Thermometer Used: ☑ 140792808 Type of Ice: ☑ Wet ☐ Blue ☐ None ☑ Samples on ice, cooling process has begun

Cooler Temp Read °C: 1.2 Cooler Temp Corrected °C: 1.5

Temp should be above freezing to 6°C Correction Factor: +0.3

Biological Tissue Frozen? ☐ Yes ☐ No ☑ NA

Date and Initials of Person Examining Contents: JB 10/16/17

Comments: 10/17/17 dl

Chain of Custody Present?	☑ Yes	☐ No	☐ N/A	1.
Chain of Custody Filled Out?	☑ Yes	☐ No	☐ N/A	2.
Chain of Custody Relinquished?	☑ Yes	☐ No	☐ N/A	3.
Sampler Name and Signature on COC?	☑ Yes	☐ No	☐ N/A	4.
Samples Arrived within Hold Time?	☑ Yes	☐ No	☐ N/A	5. If Fecal: ☐ <8 hours ☐ >8, <24 hours ☐ >24 hours
Short Hold Time Analysis (<72 hr)?	☐ Yes	☑ No	☐ N/A	6.
Rush Turn Around Time Requested?	☐ Yes	☑ No	☐ N/A	7.
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	8.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	9.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☑ Yes	☐ No	☐ N/A	10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☑ N/A	11. Note if sediment is visible in the dissolved containers.
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: ~~WT~~ SL dl	☑ Yes	☐ No	☐ N/A	12.
All containers needing acid/base preservation will be checked and documented in the pH logbook.	☐ Yes	☐ No	☑ N/A	See pH log for results and additional preservation documentation
Headspace in Methyl Mercury Container	☐ Yes	☐ No	☑ N/A	13.
Headspace in VOA Vials (>6mm)?	☐ Yes	☐ No	☑ N/A	14.
Trip Blank Present?	☐ Yes	☐ No	☑ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☑ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

FECAL WAIVER ON FILE Y N TEMPERATURE WAIVER ON FILE Y N

Project Manager Review: Date: 10-17-17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

SGS AXYS

2045 Mills Road West
Sidney, BC, Canada V8L5X2
TEL: (250) 655-5800
TOLL-FREE: 1-888-373-0881

SGS AXYS Client No.: 4819

Client Address: Bay West LLC
5 Empire Drive
St. Paul, MN, US, 55103

The SGS AXYS contact for these data is Dale Robinson.

DIOXIN/FURAN ANALYSIS

SOLID SAMPLES

PROJECT NAME: MUNGER LANDING ADDITIONAL SEDIMENT CHARACTERIZATION

WORK ORDER #: 3000019769

Contract: 4819
Data Package Identification: DPWG62496

Analysis WG61707

5 January 2018

Project Name: Munger Landing Additional Sediment Characterization
Work Order #: 3000019769

05 January 2018

NARRATIVE

This narrative describes the analysis of seventeen solid samples for the determination of polychlorinated dibenzodioxins and dibenzofurans using High Resolution Gas Chromatography / High Resolution Mass Spectrometry (HRGC/HRMS).

SAMPLE RECEIPT AND STORAGE

The samples were received at SGS AXYS on the 16th of October 2017. The sample temperature upon receipt was 9.1°C, which was above the method recommendations (0-4°C). The effect on the samples are unknown. Details of sample conditions upon receipt are provided on the Sample Receiving Record form included in this data package. The samples were stored at -20°C in dark prior to extraction and analysis.

SAMPLE PREPARATION AND ANALYSIS

Extraction and analysis procedures were in general accordance with **USEPA Method 1613B,** as documented in **SGS AXYS Method MLA-017**: "***Analytical Method for the Determination of Polychlorinated Dibenzodioxins and Dibenzofurans by EPA Method 1613B, EPA Method 8290/8290A, Env. Canada EPS 1/RM/19 or EPA Method DLM02.2***". A method summary (MSU-017) of the SGS AXYS Method MLA-017 with a list of modifications to USEPA Method 1613B is included in this data package.

The samples and QC samples (a procedural blank and a known sample called Ongoing Precision and Recovery (OPR)) were analyzed in one batch named WG61707. Clean sand was used as the matrix for the procedural blank and OPR. A Matrix Spike (MS) and a Matrix Spike Duplicate (MSD) were also analyzed in the batch and designated AXYS IDs WG61707-103 and -104, respectively. Sample BW17ML-052-0.15-0.44 (AXYS ID: L28336-27) was used as the matrix for the MS and MSD. The composition of the batch is shown on the Correlation Table included in this data package.

Approximately 10g (dry weight) of each sample was accurately weighed, spiked with ^{13}C-labeled quantification standards and Soxhlet extracted with 80:20 toluene/acetone. The resulting extract was spiked with ^{13}C-labeled cleanup standards and cleaned up using acid/base silica, alumina and carbon celite chromatographic columns. The cleaned extract was reduced in volume and spiked with ^{13}C-labeled recovery (internal) standards prior to instrumental analysis. The final extract volume was 20µL; 1µL was injected for the DB5 column analysis and 2µL were injected for the DB225 column analysis.

CALCULATION

Target analyte concentrations were determined by isotope dilution or internal standard quantification procedures using Waters MassLynx or Micromass OPUSQuan software. Formulae used in the conversion of the raw chromatograms to concentrations are provided in the method summary document.

Sample specific detection limits (SDLs) were determined from the analysis data following the same procedures used to convert target peak responses to concentrations. The SDLs were used as the detection qualifier.

Because of instrument variability and laboratory background levels, it is the policy of SGS AXYS to report detection limits no lower than 0.5pg absolute (0.05pg/g on a 10g sample). In cases where a detection limit is observed to be less than 0.5pg absolute, the reporting limit is raised to 0.5pg absolute. This is reflected on the report forms.

Homologue totals were obtained by summing the concentration of all detected congeners at each level of chlorination. Toxic Equivalents (TEQ) were calculated using WHO 2005 TEFs. Congener peaks that did not meet the method ion abundance ratio criteria were excluded from the homologue totals and TEQ calculations.

REPORTING CONVENTIONS

The AXYS contract number assigned for internal tracking was 4819. The samples were assigned unique laboratory identifiers of the form L28336-XX; where X is a numeral. All data reports reference both the AXYS ID and the client sample identifier. To assist with locating data a table correlating AXYS ID with the client sample number is included in this data package.

Any extra work required and performed after the initial instrumental analysis of the sample's extract is given an extra "test suffix" code. The single letter code per extra work performed is added to the AXYS sample ID as a suffix, and is combined with any other applicable test suffix codes. The extra work codes used to report data in this package include:

- i = instrumental re-analysis of the sample extract
- L = extract was given further cleanup to remove interferences
- W = dilution of the sample extract followed by re-analysis on instrument

The following data qualifier flags are used in this data package:

- D = dilution data
- E = area response exceeds the instrument calibration range, see dilution data
- J = concentration less than lowest calibration equivalent
- K = identifies a target that could not be confirmed by virtue of not satisfying all method required criteria, the reported value may be interpreted as an estimated maximum possible concentration
- T = analyte recalculated against alternate labeled compound(s)
- U = identifies a compound that was not detected
- X = result reported separately.

Results are reported in concentration units of picograms per gram (pg/g) on a dry weight basis. Concentrations and detection limits are provided to three significant figures with a maximum of three decimal places for concentrations and four decimal places for detection limits.

QA/QC NOTES

The QC samples were prepared alongside the field samples in an analysis batch and carried intact through the entire analytical procedures. The field sample data were evaluated in relation to the batch QC sample data.

- Sample analyte concentrations are not blank corrected. Sample data should be evaluated with consideration of analyte levels in the Lab Blank.
- By virtue of the isotope dilution/internal standard quantification procedures, data are recovery corrected for possible losses during extraction and cleanup procedures.

- All linearity, calibration verification, OPR and labeled compound recovery specifications were met with the following exception:

The percent recovery of 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF and OCDF in sample BW17ML-052-0.15-0.44 (MS) (AXYS ID: WG61707-103) were observed to be high and as a result the relative percent difference (RPD) of these compounds between samples BW17ML-052-0.15-0.44 (MS) and BW17ML-052-0.15-0.44 (MSD) (AXYS IDs: WG61707-103 and -104, respectively) were observed to be greater than method specifications. All calculations and chromatography were confirmed. This variability between the samples may relate to the sample homogeneity, as differences in sample composition may have been present due to the nature of the sample. Given that all Lab QC samples were within method specifications, sample data are not considered to be affected by this variance.

ANALYTICAL DISCUSSION

Column DB-5 Analysis

An interference causing the recovery of ^{13}C-1,2,3,7,8-PeCDD to be slightly elevated, identified as a phthalate ester, was observed to elute near the retention time corresponding to native and labeled 1,2,3,7,8-PeCDD in all samples; the quantification of 1,2,3,7,8-PeCDD is not affected.

The phthalate ester interference affected the response of native and labeled 1,2,3,7,8-PeCDD equally, resulting in a calculated over-recovery of ^{13}C-1,2,3,7,8-PeCDD, but not affecting the accuracy of the 1,2,3,7,8-PeCDD result. Due to the calculated over-recovery of the surrogate, the total PeCDD result would have been under-reported and some samples required a correction factor to be applied based on the ratio of ^{13}C-1,2,3,7,8-PeCDD to ^{13}C-1,2,3,7,8- and ^{13}C-2,3,4,7,8-PeCDF in the sample compared to the opening calibration verification. For samples that required the correction factor, the total PeCDD result has been recalculated and flagged with a 'T'.

Dilutions
Some samples required dilution and instrumental reanalysis to bring the area response of some congeners to within the calibrated linear range of the instrument. The affected target concentrations are reported from the diluted extract (indicated by suffix 'W' or 'Wi' on the AXYS ID).
Sample BW17ML-049-0.15-0.39 (AXYS ID: L28336-22) required a dilution as there were matrix interferences present (indicated by suffix 'LWi' on the AXYS ID).
The dilution factors are provided on the reports for the dilution analyses.

Re-columns
Some samples required further chromatographic clean up and instrumental reanalysis as there were matrix interferences present. All targets for the re-columned samples have been reported from the analysis of the cleaned-up extract (indicated by suffix 'L' or 'LWi' on the AXYS ID).

Re-injections
Some of the diluted and cleaned-up samples required more than one GCMS acquisition before all instrumental method specifications were met. The sample extracts were instrumentally reanalyzed and method specifications were met; sample concentrations are reported from these re-injections (indicated by suffix 'Wi' or 'LWi' on the AXYS ID).

Column DB-225 Analysis

Re-column and Dilution
Sample BW17ML-049-0.15-0.39 (AXYS ID: L28336-22) required further chromatographic clean up, followed by a dilution and instrumental reanalysis as there were matrix interferences present. All targets for the re-columned samples have been reported from the analysis of the cleaned-up extract (indicated by suffix 'LW' on AXYS ID).

DATA PACKAGE

This data package has been assigned a unique identifier, DPWG62496, shown on the front page of this data package. Included in the data package following the narrative is the following documentations:

- Method summary
- Sample Correlation Table
- Sample receiving documentation
- Sample transfer records
- Sample data reports (in order of AXYS sample ID)
- Lab QC sample data reports
- Instrumental QC data reports (organized by analysis start date)
- Accreditation Scope

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, except for the conditions detailed above. In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. The following signature, on behalf of SGS AXYS Analytical Services Ltd, authorizes the release of the data contained in this data package.

Signed: Kristen Bowes, B.Sc.,
Data Validation Chemist

05 Jan 2018
Date Signed

SGS AXYS Analytical Services Ltd.

SUMMARY OF SGS AXYS METHOD MLA-017 REV. 20 VER. 10:

ANALYTICAL METHOD FOR THE DETERMINATION OF POLYCHLORINATED DIBENZODIOXINS AND DIBENZOFURANS BY EPA METHOD 1613B, 8290/8290A OR DLM02.2

SGS AXYS Method MLA-017 describes the analysis of polychlorinated (tetra-octa) dibenzo-dioxins and dibenzofurans in solids (sediment, soil, biosolid, pulp), tissues (including blood, serum, plasma and milk), aqueous samples, XAD-2 columns, air samples, particulate filters and solvent extracts.

Target Analytes

Dioxins (PCDD)	Furans (PCDF)
2,3,7,8 Tetrachlorodibenzodioxin (TCDD)	2,3,7,8 Tetrachlorodibenzofuran (TCDF)
Total TCDD	Total TCDF
1,2,3,7,8 Pentachlorodibenzodioxin (PeCDD)	1,2,3,7,8 Pentachlorodibenzofuran (PeCDF)
Total PeCDD	2,3,4,7,8 PeCDF
	Total PeCDF
1,2,3,4,7,8 Hexachlorodibenzodioxin (HxCDD)	1,2,3,4,7,8 Hexachlorodibenzofuran (HxCDF)
1,2,3,6,7,8 HxCDD	1,2,3,6,7,8 HxCDF
1,2,3,7,8,9 HxCDD	1,2,3,7,8,9 HxCDF
Total HxCDD	2,3,4,6,7,8 HxCDF
	Total HxCDF
1,2,3,4,6,7,8 Heptachlorodibenzodioxin (HpCDD)	1,2,3,4,6,7,8 Heptachlorodibenzofuran (HpCDF)
Total HpCDD	1,2,3,4,7,8,9 HpCDF
	Total HpCDF
Octachlorodibenzodioxin (OCDD)	Octachlorodibenzofuran (OCDF)

1.0 EXTRACTION AND CLEANUP PROCEDURES

All samples are spiked with ^{13}C-labelled surrogate standards prior to extraction and extracted as per the table below. Optional extraction procedures are shown within parentheses.

SGS AXYS Analytical Services Ltd.

Sample Extraction

Matrix	Extraction
Aqueous samples	Liquid-liquid extraction with dichloromethane. (If visible particulates are present the sample is filtered prior to extraction and the particulate fraction separately extracted by Soxhlet extraction or Dean-Stark Soxhlet extraction. The two extracts are then combined.)
Solid (sediment, soil, sludge, particles on filter paper)	Soxhlet extraction with toluene:acetone 80:20. (optional: Dean-Stark Soxhlet extraction with toluene)
Solid (pulp, black liquor)	Soxhlet extraction with toluene:acetone 80:20.
Solid (ash, slag)	Sonication with hydrochloric acid and filtering. Liquid-liquid extraction of filtrate using dichloromethane, Soxhlet extraction of particulate using toluene:acetone 80:20. The two extracts are combined.
Tissue	Soxhlet extraction with dichloromethane:hexane 1:1 (optional: Base digestion and liquid-liquid extraction with hexane)
Whole blood/serum	Liquid-liquid extraction with ethanol:hexane:saturated ammonium sulfate.
Milk	Liquid-liquid extraction with acetone and hexane.
XAD-2 column and filter	XAD-2 adsorbent is dried and Soxhlet extracted (with toluene:acetone 80:20) or Dean-Stark Soxhlet extracted (with toluene). The filter is extracted by Dean-Stark Soxhlet extraction using toluene.
Ambient air (PUF and filter)	The PUF and filter(s) are Soxhlet extracted together using toluene:acetone 80:20.
Stationary Source Air Samples (Stack Gas sample trains)	The filter is sonicated with dilute hydrochloride acid and filtered. Equipment rinsates are collected, filtered, dried and/or extracted depending on sampling conditions.

The extracts are then routinely cleaned up according to the following table:

Water Soil Sediment XAD-2 adsorbent Air samples Sludge High organic soil	(Base/acid wash →) DX $AgNO_3$ 30g 44% → (DX Florisil →) Copper → Alumina/carbon/Celite combination column
Tissue Blood/serum/ plasma Milk	(Biobead →) DX 20g 44% → DX Florisil → (Copper →) Alumina/carbon/Celite combination column

Note: Items in brackets are optional procedures that may be used if needed or if required by Project Managers.

An optional Biobead clean-up may be carried out for biosolid sample extracts.

2.0 INSTRUMENTATION

Instrumental analysis is performed on a DB-5 capillary chromatography column coupled to a high-resolution mass spectrometer (HRMS). The HRMS is operated at a static (10000) mass resolution in the voltage selected ion-recording mode (V-SIR) using selected PFK ions as a reference for mass lock. Two masses from the molecular ion cluster are used to monitor each of the target analytes and ^{13}C-labelled surrogate standards. Five chlorinated diphenylethers are monitored to check for interference using one specific ion for each compound.

A second column, DB-225, is used for confirmation/quantification of 2,3,7,8-TCDF and 1,2,3,7,8,9-HxCDD in all samples and matrices for which a peak was detected in the DB-5 run for these congeners.

Upon client request, the concentrations of PCDD/F may be determined using bracketing calibration procedures and a smaller suite of surrogate standards.

3.0 CALIBRATION

Initial calibration (default procedure) is performed using a five point calibration series of solutions that encompass the working concentration range. Initial calibration solutions contain the suite of labelled surrogate and recovery standards and authentic target PCDDs/PCDFs. Calibration is verified at least once every 12 hours by analysis of a mid-level calibration solution. Calibration procedures use the mean RRFs determined from the initial calibration to calculate analyte concentrations.

SGS AXYS Analytical Services Ltd.

Alternately clients may request initial calibration be performed using a six point calibration series of solutions if lower detection limits are required.

Concentration of PCDD/PCDF Calibration Solutions

	Concentration (ng/mL)						Authentic Standard Amount added to sample (pg)
	CS0.2	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**	
Native Compound							
2,3,7,8-TCDD	0.1	0.5	2	10	40	200	200
2,3,7,8-TCDF	0.1	0.5	2	10	40	200	200
1,2,3,7,8-PeCDD	0.5	2.5	10	50	200	1000	1000
1,2,3,7,8-PeCDF	0.5	2.5	10	50	200	1000	1000
2,3,4,7,8-PeCDF	0.5	2.5	10	50	200	1000	1000
1,2,3,4,7,8-HxCDD	0.5	2.5	10	50	200	1000	1000
1,2,3,6,7,8-HxCDD	0.5	2.5	10	50	200	1000	1000
1,2,3,7,8,9-HXCDD	0.5	2.5	10	50	200	1000	1000
1,2,3,4,7,8-HxCDF	0.5	2.5	10	50	200	1000	1000
1,2,3,6,7,8-HxCDF	0.5	2.5	10	50	200	1000	1000
1,2,3,7,8,9-HxCDF	0.5	2.5	10	50	200	1000	1000
2,3,4,6,7,8-HxCDF	0.5	2.5	10	50	200	1000	1000
1,2,3,4,6,7,8-HpCDD	0.5	2.5	10	50	200	1000	1000
1,2,3,4,6,7,8-HpCDF	0.5	2.5	10	50	200	1000	1000
1,2,3,4,7,8,9-HpCDF	0.5	2.5	10	50	200	1000	1000
OCDD	1.0	5.0	20	100	400	2000	2000
OCDF	1.0	5.0	20	100	400	2000	2000
Surrogate Standards							**Surrogate Standard Amount added to sample (pg)** [1]
$^{13}C_{12}$-2,3,7,8-TCDD	100	100	100	100	100	100	2000
$^{13}C_{12}$-2,3,7,8-TCDF	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,7,8-PeCDF	100	100	100	100	100	100	2000
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100	100	100	100	100	100	2000
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100	100	100	100	100	100	2000

$^{13}C_{12}$-OCDD	200	200	200	200	200	200	4000
Cleanup Standard							
$^{37}Cl_4$-2,3,7,8-TCDD	0.1	0.5	2	10	40	200	200
Recovery Standard							
$^{13}C_{12}$-1,2,3,4-TCDD	100	100	100	100	100	100	2000
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	100	100	100	100	100	100	2000

[1] Blood/plasma/serum and milk samples are spiked with ½ the amounts of surrogate and recovery standards shown in this table.

4.0 QUANTIFICATION PROCEDURES

The response for any component is taken as the sum of the integrated peak areas for the two characteristic masses for that compound. Quantification is by the isotope dilution method. Target concentrations are determined with respect to labelled surrogate standards. Mean relative response factors (RRF), determined from the multi-level initial calibration series are used to convert raw peak areas in sample chromatograms to final concentrations as follows:

$$\text{Concentration of Target} = \left(\frac{\text{area of Target}}{\text{area of Qt Std}}\right) \times \left(\frac{\text{weight of Qt Std}}{\text{RRF}}\right) \times \left(\frac{1}{\text{weight of sample}}\right)$$

$$\textit{where} \quad \text{RRF} = \left(\frac{\text{area of Target}}{\text{area of Qt Std}}\right) \times \left(\frac{\text{weight of Qt Std}}{\text{weight of Target}}\right)$$

and the Qt Std is either the surrogate or the internal standard

Those compounds quantified against a labelled standard added at the beginning of the analysis procedure are recovery corrected by the method of quantification. Surrogate recoveries are determined similarly against the recovery (internal) standard and are used as general indicators of overall analytical quality.

4.1 Reporting Limits

Concentrations and detection limits for the 2,3,7,8-polychlorinated dioxins and furans (tetra-octa) are reported. Typical reporting units for all data are pg/g, pg/L or pg/sample. Concentrations for solids are reported on a dry weight basis. Concentrations in tissues (including blood and milk) are reported on a wet weight basis and/or on a lipid weight basis when requested. Concentrations in aqueous samples are reported on a volume basis. Concentrations in XAD-2 resin, filters and stack gas samples are reported on a per sample basis or a per volume basis. Concentrations in particulate filters are reported on a per sample basis.

The following are commonly requested reporting limits:

Sample Specific Detection Limit or Sample Detection Limit (SDL) – determined individually for every sample analysis run by converting the area equivalent of 3.0 times (2.5 times for EPA 1600 series methods) the estimated chromatographic noise height to a concentration in the same manner that target peak responses are converted to final concentrations. The SDL accounts for any effect of matrix on the detection system and for recovery achieved through the analytical work-up. Equivalent term(s): Estimated Detection Limit (EDL) from EPA method 8290.

Method Detection Limit (MDL) - determined as specified by EPA Fed. Reg. 40 CFR Part 136 Appendix B (no iteration option). The 99% confidence level MDL is determined based on analysis of a minimum of 7 replicate matrix spikes fortified at 1-10 times the estimated detection limit. MDL is determined as required based on accreditation, contract and workload requirements.

Lower Method Calibration Limit (LMCL) - determined by prorating the concentration of the lowest calibration limit for sample size and extract volume. The following equation is used. ((lowest level cal conc.) x (extract volume))/sample size. Typical extract volume for PCDDs/PCDFs is 20 µL.

For the analysis of PCDDs/PCDFs SGS AXYS standard is to report sample concentrations using the SDL with a minimum reporting limit of 0.5 pg absolute.

Analyte Ions Monitored, Surrogates Used and RRF Determination for Dioxins/Furans

Analytes	Quantification Ion (m/z)	Confirmation Ion (m/z)	Surrogate	RRF Determined From
2,3,7,8-TCDD	319.8965	321.8936	$^{13}C_{12}$-2,3,7,8-TCDD	2,3,7,8-TCDD
1,3,6,8-TCDD *	319.8965	321.8936	$^{13}C_{12}$-2,3,7,8-TCDD	2,3,7,8-TCDD
1,3,7,9-TCDD *	319.8965	321.8936	$^{13}C_{12}$-2,3,7,8-TCDD	2,3,7,8-TCDD
1,2,3,7,8-PeCDD	353.8576	355.8546	$^{13}C_{12}$-1,2,3,7,8-PeCDD	1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD	389.8156	391.8127	$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD	389.8156	391.8127	$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD	389.8156	391.8127	Mean of $^{13}C_{12}$-1,2,3,6,7,8/1,2,3,4,7,8-HxCDD	1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD	423.7767	425.7737	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-HpCDD
OCDD	457.7377	459.7348	$^{13}C_{12}$-OCDD	OCDD
2,3,7,8-TCDF	303.9016	305.8987	$^{13}C_{12}$-2,3,7,8 -TCDF	2,3,7,8-TCDF
1,2,7,8-TCDF *	303.9016	305.8987	$^{13}C_{12}$-2,3,7,8 -TCDF	2,3,7,8-TCDF
1,2,3,7,8-PeCDF	339.8597	341.8568	$^{13}C_{12}$-1,2,3,7,8-PeCDF	1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF	339.8597	341.8568	$^{13}C_{12}$-2,3,4,7,8-PeCDF	2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF	373.8207	375.8178	$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF	373.8207	375.8178	$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1,2,3,6,7,8-HxCDF
2,3,4,6,7,8-HxCDF	373.8207	375.8178	$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF	373.8207	375.8178	$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1,2,3,7,8,9-HxCDF
1,2,3,4,6,7,8-HpCDF	407.7818	409.7788	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF	407.7818	409.7788	$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8,9-HpCDF
OCDF	441.7428	443.7398	$^{13}C_{12}$-OCDD	OCDF

SGS AXYS Analytical Services Ltd.

Cleanup Standard				
$^{37}Cl_4$-2,3,7,8-TCDD	327.8847	-	$^{13}C_{12}$-1,2,3,4-TCDD	
Field Standard				
$^{13}C_6$-1,2,3,4-TCDD	325.9166	327.9137	$^{13}C_{12}$-1,2,3,4-TCDD	$^{13}C_{12}$-1,2,3,4-TCDD
Labelled Surrogates	**Quantification Ion (m/z)**	**Confirmation Ion (m/z)**	**Recovery Calculated Using**	
$^{13}C_{12}$-2,3,7,8-TCDD	331.9368	333.9339	$^{13}C_{12}$-1,2,3,4-TCDD	
$^{13}C_{12}$-1,2,3,7,8-PeCDD	365.8978	367.8949	$^{13}C_{12}$-1,2,3,4-TCDD	
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	401.8559	403.8530	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	401.8559	403.8530	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	435.8169	437.8140	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-OCDD	469.7780	471.7750	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-2,3,7,8 -TCDF	315.9419	317.9389	$^{13}C_{12}$-1,2,3,4-TCDD	
$^{13}C_{12}$-1,2,3,7,8-PeCDF	351.9000	353.8970	$^{13}C_{12}$-1,2,3,4-TCDD	
$^{13}C_{12}$-2,3,4,7,8-PeCDF	351.9000	353.8970	$^{13}C_{12}$-1,2,3,4-TCDD	
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	383.8639	385.8610	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	383.8639	385.8610	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	383.8639	385.8610	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	383.8639	385.8610	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	417.8250	419.8220	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	417.8250	419.8220	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
Recovery Standards				
$^{13}C_{12}$-1,2,3,4-TCDD	331.9368	333.9339	*Optional isomers which may be reported upon client request.	
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	401.8559	403.8530		
Cl-DPE Monitoring Ions				
Descriptor	**Exact M/Z**	**M/Z Type**	**Substance**	
3	375.8364	M+2	HxCDPE	
4	409.7974	M+2	HpCDPE	
5	445.7555	M+4	OCDPE	
6	479.7165	M+4	NCDPE	
7	513.6775	M+4	DCDPE	

5.0 QUALITY ACCEPTANCE CRITERIA

Samples are analyzed in batches consisting of a maximum of twenty samples, one procedural blank and one spiked matrix (OPR) sample. A duplicate is analyzed, provided there is sufficient sample, with batches containing 7-20 samples. Matrix spike/matrix spike duplicate (MS/MSD) pairs may be analyzed on an individual contract basis. The batch is carried through the complete analytical process as a unit. For sample data to be reportable, the batch QC data must meet the established acceptance criteria presented on the analysis reports.

SGS AXYS Analytical Services Ltd.

QC Specification Table: Authentic and Surrogate Standard Recoveries, CAL/VER, IPR, OPR and Samples

	Test Conc. (ng/mL)	IPR		OPR (%)	I-CAL (%)	CAL/VER (%)	Labelled Compound (% rec. in sample)	
		SD (%) *	$\bar{X}$ (%)				Warning Limits	Control Limits
Native Compound								
2,3,7,8-TCDD	10	28	83-129	70-130	20	78-125	-	-
2,3,7,8-TCDF	10	20	87-137	75-130	20	84-120	-	-
1,2,3,7,8-PeCDD	50	15	76-132	70-130	20	78-125	-	-
1,2,3,7,8-PeCDF	50	15	86-124	80-130	20	82-120	-	-
2,3,4,7,8-PeCDF	50	17.2	72-150	70-130	20	82-122	-	-
1,2,3,4,7,8-HxCDD	50	18.8	78-152	70-130	20	78-125	-	-
1,2,3,6,7,8-HxCDD	50	15.4	84-124	76-130	20	78-125	-	-
1,2,3,7,8,9-HXCDD	50	22.2	74-142	70-130	35	82-122	-	-
1,2,3,4,7,8-HxCDF	50	17.4	82-118	72-130	20	90-112	-	-
1,2,3,6,7,8-HxCDF	50	13.4	92-120	84-130	20	88-114	-	-
1,2,3,7,8,9-HxCDF	50	12.8	84-122	78-130	20	90-112	-	-
2,3,4,6,7,8-HxCDF	50	14.8	74-148	70-130	20	88-114	-	-
1,2,3,4,6,7,8-HpCDD	50	15.4	76-130	70-130	20	86-116	-	-
1,2,3,4,6,7,8-HpCDF	50	12.6	90-112	82-122	20	90-110	-	-
1,2,3,4,7,8,9-HpCDF	50	16.2	86-126	78-130	20	86-116	-	-
OCDD	100	19	89-127	78-130	20	79-125	-	-
OCDF	100	27	74-146	70-130	35	75-125	-	-
Surrogate Standards								
$^{13}C_{12}$-2,3,7,8-TCDD	100	37	28-134	25-130	35	82-121	40-120	25-130
$^{13}C_{12}$-2,3,7,8-TCDF	100	35	31-113	25-130	35	71-130	40-120	24-130
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100	39	27-184	25-150	35	70-130	40-120	25-130
$^{13}C_{12}$-1,2,3,7,8-PeCDF	100	34	27-156	25-130	35	76-130	40-120	24-130
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100	38	16-279	25-130	35	77-130	40-120	21-130
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100	41	29-147	25-130	35	85-117	40-120	32-130
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100	38	34-122	25-130	35	85-118	40-120	28-130
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100	43	27-152	25-130	35	76-130	40-120	26-130
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100	35	30-122	25-130	35	70-130	40-120	26-123
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100	40	24-157	25-130	35	74-130	40-120	29-130
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100	37	29-136	25-130	35	73-130	40-120	28-130
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100	35	34-129	26-130	35	72-130	40-120	23-130
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100	41	32-110	25-130	35	78-129	40-120	28-130
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100	40	28-141	25-130	35	77-129	40-120	26-130
$^{13}C_{12}$-OCDD	200	47.5	20.5-138	25-130	35	70-130	25-120	17-130
Cleanup Standard								
$^{37}Cl_4$-2,3,7,8-TCDD	10	36	39-154	31-130	35	79-127	40-120	35-130

* For comparability with EPA 1613B the precision specification for IPR is stated as %SD (=standard deviation relative to the fortification level,)

SGS AXYS Analytical Services Ltd.

QC Specification Table: QC Samples, Instrumental Analysis, and Analyte Quantification

QC Parameter	Specification
Analysis Duplicate	Must agree to within ±20% of the mean (applicable to concentrations >10 times the DL)[1]
Procedural Blank	**Blood/serum/plasma and milk:** TCDD/F <0.2 pg/sample, PeCDD/F <0.5 pg/sample, HxCDD/F and HpCDD/F <1.0 pg/ sample, OCDD/F<5 pg/sample. **Other matrices:** TCDD/F <0.5 pg/sample, PeCDD/F, HxCDD/F, HpCDD/F <1.0 pg/sample, OCDD/F <5 pg/sample. Higher levels acceptable where all sample concentrations are > 10X the blank concentrations.
Detection Limit	SDL Requirements (where target concentrations are detectable or sample extracts display atypical interference, SDL values may be higher): **Blood/serum/plasma and milk:** Tetra-penta-CDD/F 0.2 pg/sample, Hexa-octa-CDD/F 0.5 pg/sample **Other matrices**: 0.5 pg/sample
Instrument Carry over and Background: **Toluene Blank**	A. 1st toluene blank following Cal Ver must have <0.6 pg TCDD and <25 pg OCDD[2] B. 2nd toluene blank following Cal Ver must have <0.2 pg TCDD/F, <0.8 pg Pe-HpCDD/F, and <5.0 pg OCDD[2] Blood/serum/plasma and milk extract analysis: As many toluene blanks as necessary are run to achieve an instrument blank level of <0.1 pg TCDD/F, <0.3 pg PeCDD/F, <0.5 pg HxCDD/F, <0.5 pg HpCDD/F and <3.5 pg OCDD.
Samples	<10% contribution from preceding sample (based on observed instrument carryover rate).
Analyte Peak Response	Response must be below the upper calibrated range of the instrument. Data may be taken from more than one chromatogram to get the responses in the calibrated range.
Ion Ratios	Must be within ±15% of theoretical. For 1613B applications only (as per section 16.3 of 1613B) an alternate acceptance criteria of within ±10% of the ratio in the midpoint calibration (CS3) or calibration verification (Cal Ver), whichever is most recent., may be applied. Exception for blood/serum/plasma samples: Ion ratios for sample responses below the lowest calibration level equivalent must be within ±35% of theoretical.
Sensitivity	S:N ≥10:1 for all compounds in CS-0.2 for 1.0 µL injected, plus for blood/serum/plasma and milk S:N ≥3:1 for 0.05 pg injected 2,3,7,8-TCDD.

[1] Duplicate criterion is a guideline; final assessment depends upon sample characteristics, overall batch QC and on-going lab performance.

[2] Instrument background specifications are calculated from spiking labelled standard into the toluene blank and expressed as pg in a 20 µL extract.

SGS AXYS Analytical Services Ltd.

Modifications to EPA Method 1613B

The following sections of EPA Method 1613B have been modified as described below.

Section 2.1.2

Aqueous liquid from multiphase samples is liquid/liquid extracted with DCM. The extract from the aqueous phase is then combined with the extract from the solid phase portion of the sample.

Section 7.2.1

Anhydrous sodium sulfate (Na_2SO_4) is baked overnight prior to use. There is no solvent rinse with dichloromethane.

Section 7.10

The concentration of the labelled compound solution is 100 ng/mL (except for labeled OCDD which is 200 ng/mL) and is prepared in toluene; 20 µL of the labelled compound solution is spiked to solids and tissue samples to yield the method specified concentrations in the final extracts.

Section 7.11

The concentration of the cleanup standard spiking solution is 10 ng/mL (2 ng/mL for tissue samples) in toluene, and the sample spiking volume is 20 µL. The resulting concentration in the final extracts is reduced (to ¼ of the concentration specified in EPA method 1613B for all matrices except tissue, and to $^{1}/_{20}$ of the EPA method 1613B specified level for tissue).

Sections 7.13, 14.0, 15.0

A modified EPA 1613B/8290 procedure is offered that includes an additional lower level calibration solution, 0.2 times the concentration of CS1 in the initial calibration series so that initial calibration is based on a six-point series. The calibration solutions are prepared in nonane. A modified EPA 1613B/8290 procedure using calibration solutions prepared in toluene is also available.

Section 7.14

The concentration of the PAR spiking solutions is 0.2/1.0/2.0 ng/mL for tetra/penta, hexa, hepta, hexa/octas respectively and the spiking volume is 1 mL. The resulting final concentration in the extracts are as specified in the method.

Section 9.3.3

Table 7 (EPA 1613B) specifications for the percent recovery of surrogate standards in samples that are higher than 130% have been lowered to 130%, as presented in table "QC Specification Table: Authentic and Surrogate Standard Recoveries, CAL/VER, IPR, OPR and Samples" of this document.

Section 11.5

Multiphase, predominately aqueous, samples containing >1% suspended solids may be prepared and extracted using the same procedure as samples containing ≤1% suspended solids with client approval. This involves separating the solids and aqueous phases by filtration, extracting the solids by Soxhlet extraction, extracting the filtrate by liquid/liquid extraction, and combining the extract from the two phases. Alternatively, with client approval, multiphase, predominately particulate, samples containing >1% suspended solids may be processed as solids samples using Soxhlet or Soxhlet Dean-Stark extraction.

Section 11.7

To avoid compromising sample integrity through contamination or loss of material to surfaces particles larger than 1 mm in solid samples are by default not subject to grinding prior to extraction. Instead solid samples are homogenized prior to sub-sampling by breaking up clumps with a disposable spoon and mixing/stirring. If required by the client rocks larger than 0.4 cm are removed. Surrogate standard is added after homogenization and sub-sampling.

Section 12.3

For solids samples with suitable moisture content, an option is offered for drying the sample with anhydrous sodium sulfate followed by Soxhlet extraction with 80:20 toluene:acetone. Alternatively Soxhlet Dean-Stark extraction using toluene is available

Section 12.3.1 – 12.3.5

Silica or quartz sand is not pre-extracted in the Dean Stark apparatus. Silica is baked the lab. Quartz sand is proofed prior to use. Sand is mixed with the sample in a beaker and then loaded into the soxhlet thimble.

Section 12.3.9.1.1

Sample extracts are reduced to approximately 1 mL after extraction, not 5 mL.

Section 12.4

The equilibration time for the sodium sulfate drying step is sufficient to produce a dry, free-flowing powder (minimum 30 minutes). This may be less than the 12-hour minimum specified in EPA 1613B.

Section 12.5.3

Ultra-pure water is used to rinse the extract between base and acid washes, not NaCl solution.

Section 12.6.1.1

Rotary evaporator baths are maintained at 35°C. Trends in QC blanks are monitored and diagnostic proofing is conducted if indicated instead of collecting proofs each day and archiving. Historical proofing tests have demonstrated that routine cleaning practices between samples are sufficient to ensure rotary evaporator cleanliness; as an additional safeguard the laboratory segregates processing of samples on the basis of predicted target concentration levels.

Section 12.7.3

Water baths are not used with the nitrogen blowdown apparatus.

Section 12.7.4

Solvent exchange is dependent on the type of solvent present: if toluene is present the extract is reduced to 50 µL and topped up to 1 mL with hexane; if dichloromethane is present the extract is reduced to 300 µL and topped up to 1 mL with hexane.

Section 12.7.7

Sample extracts are concentrated in a microvial using nitrogen to near dryness before adding the recovery standard.

Section 13.7

Gravimetric lipid analysis is carried out on two subsamples of the extract, representing 2/15ths of the extract. A correction factor is applied to the surrogate recovery standards.

Sections 14.0, 15.0, 16.0, Table 8, Table 9

M/Z channels 354/356 and 366/368 are used to confirm and quantify the native and surrogate penta-substituted dioxins, respectively; this change from the method's specification is made in the instrument method in order to avoid a persistent interference in the 356/358 and 368/370 M/Z channels. The theoretical ratio for the P5CDD M/M+2 ions is 0.61; therefore, the acceptance range is 0.52 - 0.70.

Section 14.2

The EPA 1613B/8290 procedure uses nonane to dilute extracts. Alternatively a modified EPA 1613B/8290 procedure using toluene to dilute extracts may be performed.

Section 15.3.5

Table 6 (EPA 1613B) specifications for CAL-VER solution concentrations outside the 70-130% range have been revised to be 70-130%, as presented in table "QC Specification Table: Authentic and Surrogate Standard Recoveries, CAL/VER, IPR, OPR and Samples" on page 7 of this document.

Section 15.4.2.2

Figure 7 (EPA 1613B) is incorrectly titled as 'on DB-5 column', should be 'on DB-225 column'. The peak annotation in figure 7 is also incorrect; the centre peak is 2,3,7,8-TCDF, not 2,3,4,8-TCDF as indicated.

Section 15.5.3

Table 6 (EPA 1613B) specifications for OPR concentrations outside the 70-130% range have been revised to be 70-130%, as presented in table "QC Specification Table: Authentic and Surrogate Standard Recoveries, CAL/VER, IPR, OPR and Samples" on page 7 of this document.

Section 17.0

Conci - the concentrations of target analytes, and the labelled compound concentrations and recoveries, are calculated using the equations below. These procedures are equivalent to those described in the method but are more direct.

$$Conc = \frac{A_i}{A_{si}} \times \frac{M_{si}}{RRF_{i,si}} \times \frac{1}{M_x}$$

where Ai = summed areas of the primary and secondary m/z's for the analyte peak of interest (compound i)

Asi = summed areas of the primary and secondary m/z's for the labelled surrogate peak used to quantify i)

Mx = mass of sample taken for analysis

Msi = mass of labelled surrogate (compound si) added to sample as calculated by the concentration of standard spiked (pg/mL) multiplied by the volume spiked (mL)

$RRFi, si$ = mean relative response factor of i to si from the five-point calibration range and defined individually as:

$$\frac{A_i}{A_{si}} \; x \; \frac{M_{si}}{M_i}$$

Calculation of Surrogate Standard Concentrations and Percent Recoveries:

Concentrations of surrogate standards are calculated using the following equation:

$$Conc_{si} = \frac{A_{si}}{A_{rs}} \; x \; \frac{M_{rs}}{RRF_{si,rs}}$$

and, the percent recoveries of the surrogate standards are calculated using the following equation:

$$\%Recovery = \frac{A_{si}}{A_{rs}} \; x \; \frac{M_{rs}}{RRF_{si,rs}} \; x \; \frac{1}{M_{si}} \; x \; 100$$

where A_{rs} and A_{si} are the summed peak areas (from the primary and secondary m/z channels) of recovery standard and labelled surrogate added to the sample;
M_{rs} and M_{si} are the masses of recovery standard and labelled surrogate added to the sample, and;
$RRF_{si,rs}$ is the mean relative response factor of the labelled surrogate to the recovery standard as determined by the five-point calibration range and defined individually as:

$$\frac{A_{si}}{A_{rs}} \; x \; \frac{M_{rs}}{M_{si}}$$

Section 17.5

Where acceptable to the client, extracts may be diluted with solvent and re-analyzed by GC/MS to bring the instrumental response to within the linear range of the instrument. Typically, no additional recovery (internal) standard is added. For very high-level samples where a smaller sample aliquot may not be representative, extracts may be diluted and respiked with labelled quantification standards and re-analyzed by GC/MS to bring the instrumental response analytes within range. Final results are recovery corrected using the mean recovery of labelled quantification standards.

Modifications to EPA Method 8290

The SGS AXYS implementation of EPA Methods 8290 and 8290A includes the following:

1. A sample hold time of 30 days from time of sample collection is recommended.
2. Extract hold time, stored at <-10°C, is 45 days.
3. The same surrogate, recovery, authentic spike and calibration solutions that are used for EPA method 1613B are used to perform EPA Methods 8290 and 8290A.
4. A matrix spike/matrix spike duplicate (MS/MSD) sample may be analysed with every analysis batch, as negotiated with the client and provided sufficient sample is available. This requirement may be waived by contract.
5. The typical final extract volume is 20 µL but may vary between 10 µL and 50 µL.
6. HRGC/MS analysis is performed according to EPA 1613B protocols with the following requirements:
   - An instrumental blank is analyzed at the beginning of every 12-hour analysis sequence, injected following the CAL/VER solution.
   - Should the CAL/VER analysis fail at the end of a 12 hour period by no more than 25% RPD for the native analytes and 35% for the labelled standards, the mean RRF from the two CAL/VER analyses may be used to calculate the analyte concentrations.
7. Quantification of target analytes is performed using an expanded suite of surrogate standards and quantification references (listed in table "Analyte Ions Monitored, Surrogates Used and RRF Determination for Dioxins/Furans" on pages 5-6 of this document) as per method 8290A section 5.8 allowances (alternative quantification using the smaller suite of surrogate standards listed in method 8290A and in table "Analyte Ions Monitored, Surrogates Used and RRF Determination for Dioxins/Furans by EPA 8290/8290A" on page 14 of this document may be negotiated by individual customers).
8. The QC specifications in table "QC Criteria for PCDD/F Analysis by EPA 8290/8290A" below are used for evaluating data.

SGS AXYS Analytical Services Ltd.

The following modifications have been made to EPA Methods 8290 and 8290A:

1. Procedures described in section "Modifications to EPA Method 1613B" of this document are applicable.
2. The concentrations of the initial calibration solutions, surrogate standard solution and recovery standard solution are modified to be those described in table "Concentration of PCDD/PCDF Calibration Solutions" found on pages 3-4 of this document.
3. The amount of surrogate standard and recovery standard added to each sample are modified to be as described in table "Concentration of PCDD/PCDF Calibration Solutions" found on pages 3-4 of this document.
4. Sample Specific Estimated Detection Limits (EDL) are reported as Sample Specific Detection Limits (SDL), calculated as described in sections "4. Quantification Procedures" and "4.1 Reporting Limits" of this document.

QC Criteria for PCDD/F Analysis by EPA 8290/8290A

Initial Calibration	Native analytes: ±20% RSD for mean RRF Labelled Compounds: ±30% RSD for mean RRF
CAL-VER	Native Analytes: RRF must be ±20% of mean RRF from ICAL Labelled Compounds: RRF must be ±30% of mean RRF from ICAL
Sample Surrogate Recovery	40-135% (lower or higher recoveries for the procedural blank may be accepted based on analyst professional judgement.)
Spiked Reference Sample	In house specification: 70%-130% of the expected value for all targets except 1,2,3,7,8,9-HxCDF, which is 60%-140%. Professional judgement may be applied in consideration of overall QC data, including MS/MSD to determine acceptability.
Analysis Duplicate	Must agree to within 25% RPD
MS/MSD	Must agree to within 20% RPD

Analyte Ions Monitored, Surrogates Used and RRF Determination for Dioxins/Furans by EPA 8290/8290A

Analytes	Quantification Ion (m/z)	Confirmation Ion (m/z)	Surrogate	RRF Determined From
2,3,7,8-TCDD	319.8965	321.8936	$^{13}C_{12}$-2,3,7,8-TCDD	2,3,7,8-TCDD
1,2,3,7,8-PeCDD	353.8576	355.8546	$^{13}C_{12}$-1,2,3,7,8-PeCDD	1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD	389.8156	391.8127	$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD	389.8156	391.8127	$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD	389.8156	391.8127	$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD	423.7767	425.7737	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-HpCDD
OCDD	457.7377	459.7348	$^{13}C_{12}$-OCDD	OCDD
2,3,7,8-TCDF	303.9016	305.8987	$^{13}C_{12}$-2,3,7,8-TCDF	2,3,7,8-TCDF

1,2,3,7,8-PeCDF	339.8597	341.8568	$^{13}C_{12}$-1,2,3,7,8-PeCDF	1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF	339.8597	341.8568	$^{13}C_{12}$-1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF	373.8207	375.8178	$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF	373.8207	375.8178	$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF
2,3,4,6,7,8-HxCDF	373.8207	375.8178	$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	2,3,4,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF	373.8207	375.8178	$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1,2,3,7,8,9-HxCDF
1,2,3,4,6,7,8-HpCDF	407.7818	409.7788	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF	407.7818	409.7788	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF
OCDF	441.7428	443.7398	$^{13}C_{12}$-OCDD	OCDF
Labelled Surrogate Stds	**Quantification Ion (m/z)**	**Confirmation Ion (m/z)**	**Recovery Calculated Using**	
$^{13}C_{12}$-2,3,7,8-TCDF	315.9419	317.9389	$^{13}C_{12}$-1,2,3,4-TCDD	
$^{13}C_{12}$-2,3,7,8-TCDD	331.9368	333.9339	$^{13}C_{12}$-1,2,3,4-TCDD	
$^{13}C_{12}$-1,2,3,7,8-PeCDF	351.9000	353.8970	$^{13}C_{12}$-1,2,3,4-TCDD	
$^{13}C_{12}$-1,2,3,7,8-PeCDD	365.8978	367.8949	$^{13}C_{12}$-1,2,3,4-TCDD	
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	383.8639	385.8610	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	401.8559	403.8530	$^{13}C_{12}$-1,2,3,7, 8,9-HxCDD	
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	417.8250	419.8220	$^{13}C_{12}$-1,2,3,7,8,9 -HxCDD	
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	435.8169	437.8140	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
$^{13}C_{12}$-OCDD	469.7780	471.7750	$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	
Labelled Recovery Stds				
$^{13}C_{12}$-1,2,3,4-TCDD	331.9368	333.9339		
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	401.8559	403.8530		

Bay West Inc.

CORRELATION TABLE

DIOXIN/FURAN ANALYSIS

Lab Name: SGS AXYS Analytical Services Ltd.	**Project Manager: Dale Robinson**
Project Name: Munger Landing Additional Sediment Characterization	**Contract No: 4819**
Work Order #: 3000019769	**SGS AXYS Method: MLA-017**
Data Package Identification: DPWG62496	**Program: Solid Samples**
Client Sample No.	**Lab Sample ID**
LAB BLANK	WG61707-101
OPR	WG61707-102
MATRIX SPIKE	WG61707-103
MATRIX SPIKE DUPLICATE	WG61707-104
BW17ML-047-0.15-0.36	L28336-18
BW17ML-048-0.0-0.15	L28336-19
BW17ML-048-0.15-0.26	L28336-20
BW17ML-049-0.0-0.15	L28336-21
BW17ML-049-0.15-0.39	L28336-22
BW17ML-050-0.0-0.15	L28336-23
BW17ML-051-0.0-0.15	L28336-24
BW17ML-051-0.15-0.36	L28336-25
BW17ML-052-0.0-0.15	L28336-26
BW17ML-052-0.15-0.44	L28336-27
BW17ML-054-0.0-0.15	L28336-28
BW17ML-054-0.15-0.40	L28336-29
BW17ML-056-0.0-0.15	L28336-30
BW17ML-056-0.15-0.34	L28336-31
BW17ML-058-0.0-0.15	L28336-32
BW17ML-058-0.15-0.45	L28336-33
BW17ML-062-0.0-0.15	L28336-34

Bay West
Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

4819

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D EQuIS Information:	
Company: Bay West LLC	Report To: Nancy McDonald	Attention: Accounts Payable	Facility_Name: St. Louis River Sediment Areas of Concern	Page 1 of 3
Address: 5 Empire Drive	Copy To: Paul Raymaker, Jonna Bjelland	Company Name: Bay West LLC	Facility_Code: St Louis River Sed	
St. Paul MN 55103		Address: 5 Empire Drive	Facility_ID: 547023	COC#
Email To: nmcdonald@BAYWEST.com	Purchase Order No.: 105566	Lab Quote Reference: 3000019769	Subfacility_code:	
Phone: 651-291-3483	Project Name: SLR Sediment AOCs	Lab Project Manager: Oyeyemi Odujole		Site Location STATE: MN
Requested Due Date/TAT: Standard	Project Number: J170470			

Valid Matrix Codes: MATRIX / CODE — Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Dioxins/Furans (EPA 8290A)	Comments
1	BW17ML-055	BW17ML-055-0.0-0.15	S	G	10/12/17	10:00	1	1								1	L28336 -1
2	BW17ML-055	BW17ML-055-0.15-0.40	S	G	10/12/17	10:00	1	1								1	-2
3	BW17ML-043	BW17ML-043-0.0-0.15	S	G	10/12/17	10:30	1	1								1	-3
4	BW17ML-043	BW17ML-043-0.15-0.46	S	G	10/12/17	10:30	1	1								1	-4
5	BW17ML-044	BW17ML-044-0.0-0.15	S	G	10/12/17	11:00	1	1								1	-5
6	BW17ML-044	BW17ML-044-0.15-0.45	S	G	10/12/17	11:00	1	1								1	-6
7	BW17ML-053	BW17ML-053-0.0-0.15	S	G	10/12/17	11:15	1	1								1	-7
8	BW17ML-053	BW17ML-053-0.15-0.39	S	G	10/12/17	11:15	1	1								1	-8
9	BW17ML-061	BW17ML-061-0.0-0.15	S	G	10/12/17	11:30	1	1								1	-9
10	BW17ML-061	BW17ML-061-0.15-0.39	S	G	10/12/17	11:30	1	1								1	-10
11	BW17ML-063	BW17ML-063-0.0-0.15	S	G	10/12/17	11:45	1	1								1	-11
12	BW17ML-060	BW17ML-060-0.0-0.15	S	G	10/12/17	12:15	1	1								1	-12

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
MPCA Multi-site Project	Jonna Bjelland/BW	10-12-17	17:45	[signature]	16-OCT-2017	08:55	

Sample conditions: Temp (°C) | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: [signature]

DATE Signed (MM/DD/YY): 10/12/17

Bay West

Customer-Focused Environmental & Industrial Solutions

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

4819

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	Section D EQuIS Information:	
Company: Bay West LLC	Report To: Nancy McDonald	Attention: Accounts Payable	Facility_Name: St. Louis River Sediment Areas of Concern	Page 2 of 3
Address: 5 Empire Drive	Copy To: Paul Raymaker, Jonna Bjelland	Company Name: Bay West LLC	Facility_Code: St Louis River Sed	
St. Paul MN 55103		Address: 5 Empire Drive	Facility_ID: 547023	COC#
Email To: nmcdonald@BAYWEST.com	Purchase Order No.: 105566	Lab Quote Reference: 3000019769	Subfacility_code:	
Phone: 651-291-3483	Project Name: SLR Sediment AOCs	Lab Project Manager: Oyeyemi Odujole		Site Location STATE: MN
Requested Due Date/TAT: Standard	Project Number: J170470			

Valid Matrix Codes: Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

Requested Analysis: Dioxins/Furans (EPA 8290A)

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	DATE	Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Dioxins/Furans (EPA 8290A)	Comments
1	BW17ML-046	BW17ML-046-0.0-0.15	S	G	10/12/17	12:45	1	1								1	L28336-13
2	BW17ML-046	BW17ML-046-0.15-0.31	S	G	10/12/17	12:45	1	1								1	-14
3	BW17ML-045	BW17ML-045-0.0-0.15	S	G	10/12/17	1:00	1	1								1	-15
4	BW17ML-045	BW17ML-045-0.15-.41	S	G	10/12/17	1:00	1	1								1	-16
5	BW17ML-047	BW17ML-047-0.0-0.15	S	G	10/12/17	13:30	1	1								1	-17
6	BW17ML-047	BW17ML-047-0.15-0.36	S	G	10/12/17	13:30	1	1								1	-18
7	BW17ML-048	BW17ML-048-0.0-0.15	S	G	10/12/17	13:45	1	1								1	-19
8	BW17ML-048	BW17ML-048-0.15-0.26	S	G	10/12/17	13:45	1	1								1	-20
9	BW17ML-049	BW17ML-049-0.0-0.15	S	G	10/12/17	14:00	1	1								1	-21
10	BW17ML-049	BW17ML-049-0.15-0.39	S	G	10/12/17	14:00	1	1								1	-22
11	BW17ML-050	BW17ML-050-0.0-0.15	S	G	10/12/17	14:30	1	1								1	-23
12	BW17ML-051	BW17ML-051-0.0-0.15	S	G	10/12/17	14:50	1	1								1	-24

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
MPCA Multi-site Project	Jonna Bjelland / BW	10/12/17	17:45	[signature]	16·Oct.2017	08:55	

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 10/12/17

Temp (°C) | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

SGS AXYS

Bay West

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

4819

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:		Section D EQuIS Information:			
Company:	Bay West LLC	Report To:	Nancy McDonald	Attention:	Accounts Payable	Facility_Name:	St. Louis River Sediment Areas of Concern	Page	3 of 3
Address:	5 Empire Drive	Copy To:	Paul Raymaker, Jonna Bjelland	Company Name:	Bay West LLC	Facility_Code:	St Louis River Sed		
	St. Paul MN 55103			Address:	5 Empire Drive	Facility_ID:	547023	COC#	
Email To:	nmcdonald@BAYWEST.com	Purchase Order No.:	105566	Lab Quote Reference:	3000019769	Subfacility_code:			
Phone:	651-291-3483	Project Name:	SLR Sediment AOCs	Lab Project Manager:	Oyeyemi Odujole			Site Location STATE:	MN
Requested Due Date/TAT:	Standard	Project Number:	J170470						

Section E Required Client Information

Valid Matrix Codes: Drinking Water DW; Water ST; Water W; Waste Water W; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

ITEM #	Sample Location ID (sys_loc_code)	Sample ID (sys_sample_code)	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	Collection DATE	Collection Time	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Requested Analysis: Dioxins/Furans (EPA 8290A)	Comments
1	BW17ML-051	BW17ML-051-0.15-0.36	S	G	10/12/17	14:50	1	1								1	L28336-25
2	BW17ML-052	BW17ML-052-0.0-0.15	S	G	10/12/17	15:15	1	1								1	-26
3	BW17ML-052	BW17ML-052-0.15-0.44	S	G	10/12/17	15:15	1	1								1	-27
4	BW17ML-054	BW17ML-054-0.0-0.15	S	G	10/12/17	15:30	1	1								1	-28
5	BW17ML-054	BW17ML-054-0.15-0.40	S	G	10/12/17	15:30	1	1								1	-29
6	BW17ML-056	BW17ML-056-0.0-0.15	S	G	10/12/17	15:45	1	1								1	-30
7	BW17ML-056	BW17ML-056-0.15-0.34	S	G	10/12/17	15:45	1	1								1	-31
8	BW17ML-058	BW17ML-058-0.0-0.15	S	G	10/12/17	16:00	1	1								1	-32
9	BW17ML-058	BW17ML-058-0.15-0.45	S	G	10/12/17	16:00	1	1								1	-33
10	BW17ML-062	BW17ML-062-0.0-0.15	S	G	10/12/17	16:15	1	1								1	-34
11							1	1								1	
12							1	1								1	

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
MPCA Multi-site Project	Jonna Bjelland / BW	10/13/17	17:45		16-OCT-2017	08:55	

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Patrick Sweeney

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 10/12/17

Temp (°C) | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

FedEx Express

Expanded Service International Air Waybill

4819

Origin Copy

FedEx Tracking Number 8077 9442 1318 Form ID No. 0426

Not all services and options are available to all destinations.

1 From

Date 10/12/17 Sender's FedEx Account Number

Sender's Name Emma Belland Phone 612-554-4079

Company Bay West

Address 5 Empire Drive Dept./Floor

Address

City St Paul Province MN CANADA Postal Code 55103

2 Your Internal Reference

3 To 28 ☐ Residential Delivery

Recipient's Name Sample Receiving Phone 250 655 6800

Company SGS AXYS Analytical

Address Dept./Floor

Address 2045 Mills Rd.

City Sidney State Province BC

Country CA ZIP Postal Code V8L 5X2

Recipient's Tax ID Number Required for Customs Purposes
e.g., GST/RFC/VAT/IN/EIN/ABN, or as locally required.

4 Shipment Information

Total Packages (Shipper's Load and Count/SLAC) 1 Total Weight 67 ☐ lbs. ☐ kg DIM / / ☐ in. ☐ cm

Commodity Description	Harmonized Code	Country of Manufacture	Value for Customs
Environmental Samples		USA	100

Canada Export Declaration / B13A: ☐ No B13A required. ☐ Manual B13A attached. ☐ B13A filed electronically. ☐ B13A Summary Reporting.

Auth. ID / Form ID#

Total Declared Value for Carriage

Total Declared Value for Customs (Specify Currency)

Origin Station ID	Country Code/Destination Station ID	URSA Routing

Handling Units | Total Volume

Received At: 1 ☐ Reg. Stop 2 ☐ On-Call Stop 3 ☐ Drop Box 4 ☐ World Service Center 5 ☐ Station Forms Attached: ☐ CI ☐ CO

FedEx Emp. # Audit Emp. # Date Time Del. Courier Emp. # Date Time

Freight Fret Other Autre Total

5a Express Package Service *Packages up to 150 lbs. (68 kg)*

01 ☒ FedEx International Priority 06 ☐ FedEx International First (Available to select locations.)

☐ 03 ☐ FedEx International Economy (FedEx Envelope and FedEx Pak rate not available.)

5b Express Freight Service *Packages over 150 lbs. (68 kg)*

70 ☐ FedEx International Priority Freight 86 ☐ FedEx International Economy Freight

Booking Number
Please call your local FedEx office to book shipments.

6 Packaging *These unique brown boxes with special pricing are provided by FedEx for FedEx Intl. Priority only.

06 ☐ FedEx Envelope 02 ☐ FedEx Pak 03 ☐ FedEx Box 04 ☐ FedEx Tube
01 ☒ Other Cooler 15 ☐ FedEx 10kg Box* 25 ☐ FedEx 25kg Box*

7 Special Handling

01 ☐ HOLD at FedEx Location (May not be in the same city.) 03 ☐ SATURDAY Delivery (Available to select locations for FedEx International Priority and FedEx International Priority Freight only.)

☐

Does this shipment contain dangerous goods? One box must be checked.

☒ No 04 ☐ Yes (As per attached Shipper's Declaration.) 08 ☐ Yes (Shipper's Declaration not required.) 06 ☐ Dry Ice 9, UN 1845 ___ x ___ kg

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging or placed in a FedEx Express Drop Box.

CA ☐ Cargo Aircraft Only

8 Broker Selection *Optional*
Not available with FedEx International First.

40 ☐ International Broker Select (To specify a broker other than FedEx.)

Broker's Name
City/State/Country
ZIP/Postal Code Phone

9 Payment Complete payment options for both transportation charges and duties and taxes.

Bill transportation charges to:

Enter FedEx Acct. No. or Credit Card No. below.

1 ☒ Sender (Acct. No. in Section 1 will be billed.) 2 ☐ Recipient 3 ☐ Third Party 4 ☐ Credit Card 5 ☐ Cash / Cheque

FedEx Acct. No. [redacted]

Credit Card Exp. Date Credit Card Auth.

Bill Customs charges to: ALL shipments may be subject to Customs charges, which FedEx does not estimate prior to clearance.

Enter FedEx Acct. No. below.

1 ☐ Sender (Acct. No. in Section 1 will be billed.) 2 ☒ Recipient 3 ☐ Third Party 5 ☐ Cash / Cheque

FedEx Acct. No. 2223 8445 0

10 Required Signature

Use of this Air Waybill constitutes your agreement to the Conditions of Contract on the back of this Air Waybill. Certain international treaties, including the Warsaw Convention, may apply to this shipment and limit our liability for damage, loss, or delay, as described in the Conditions of Contract.

Sender's Signature
This is not authorization to deliver this shipment without a recipient signature.

Received above shipment in good order and condition. We agree to pay all charges, including Customs duties and taxes as applicable, and we agree to the Conditions of Contract as stated on the reverse side of the Recipient's Copy.

Recipient's Signature 09:55 16·Oct·2017

FedEx Tracking Number 8077 9442 1318 0426 Form ID No.

628 PART 157683 Rev. Date 12/10 PRINTED IN U.S.A. RRDA

01/15

Custody SEAL
Received INTACT
08:55 16-OCT.2017

~~Pace Analytical~~®
CUSTODY SEAL

SIGNATURE

DATE 10/12/17

SGS AXYS Analytical Services Ltd
SAMPLE RECEIVING RECORD

Waybill : Yes /No
Date Shipped: 12-OCT-17
Waybill #: 807794421318
Date /Time Received: 16-OCT-17 08:55
SGS AXYS Client & Contract # 4819-Bay West LLC
Project Number:
Receipt No: WB22870
Login Number: L28336

Received By: RGENDIVE
Log in by: RGENDIVE
Signature:
Axys Sample ID's: L28336-1 to 34
Matrix Type: Sed
Condition of Shipping Container: INTACT
Temperature upon Receipt: 8.9 Celcius
Ice packs thawing
Thermometer ID: 5566
Corrected Temperature: 9.1 Celcius

16-OCT-2017 RG

Custody Seals: Shipping Containers Yes /No   Intact Yes /No   Seal Numbers Yes /No
Samples Yes /No   Intact Yes /No   Seal Numbers Yes /No

Chain of Custody or Documents: Yes /No
Sample ID's Yes /No
Collection Location Yes /No
Date & Time Collection Yes /No
Collector's Name Yes /No

Tracking Report /Packing List: Yes /No
Sample Tag Numbers Yes /No
Sample Type Yes /No
Preservative Added Yes /No
Preservation Requested Yes /No

Sample Tags Yes /No
Sample Labels Yes /No
Sample Labels Cross Referenced to COC Yes /No   Information Agrees Yes /No
Sample Tags Cross Referenced to Sample Labels Yes /No   Information Agrees Yes /No
Sample Tags Cross Referenced to COC Yes /No   Information Agrees Yes /No

Comments: RECEIVED ABOVE TEMP

Action Taken:

FSA-015 Rev09, 22-Jan-2013

For scanning
DPR
31-OCT-17

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017

04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification		Received		Due	PR
L28336-1		16-OCT-17			
	Storage: WIF-4, FLOOR (In front of shelf 2)				
BW17ML-055-0.0-0.15					
12-OCT-17 10:00	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD
L28336-2		16-OCT-17			
	Storage: WIF-4, FLOOR (In front of shelf 2)				
BW17ML-055-0.15-0.40					
12-OCT-17 10:00	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD
L28336-3		16-OCT-17			
	Storage: WIF-4, FLOOR (In front of shelf 2)				
BW17ML-043-0.0-0.15					
12-OCT-17 10:30	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017
04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification		Received	Due		PR
L28336-4	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17			
BW17ML-043-0.15-0.46					
12-OCT-17 10:30	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD
L28336-5	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17			
BW17ML-044-0.0-0.15					
12-OCT-17 11:00	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD
L28336-6	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17			
BW17ML-044-0.15-0.45					
12-OCT-17 11:00	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017
04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification		Received	Due		PR
L28336-7		16-OCT-17			
	Storage: WIF-4, FLOOR (In front of shelf 2)				
BW17ML-053-0.0-0.15					
12-OCT-17 11:15	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE		:		USD
Solid	7:MOISTURE		:		USD
Solid	DX017.1613		:		USD
Solid	DX017.1613-2		:		USD
Solid	HOMOGENIZATION		:		USD
EDataDeliv	DX017 EDD		:		USD
Data Package	DX017 MINI		:		USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB		USD
L28336-8		16-OCT-17			
	Storage: WIF-4, FLOOR (In front of shelf 2)				
BW17ML-053-0.15-0.39					
12-OCT-17 11:15	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE		:		USD
Solid	7:MOISTURE		:		USD
Solid	DX017.1613		:		USD
Solid	DX017.1613-2		:		USD
Solid	HOMOGENIZATION		:		USD
EDataDeliv	DX017 EDD		:		USD
Data Package	DX017 MINI		:		USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB		USD
L28336-9		16-OCT-17			
	Storage: WIF-4, FLOOR (In front of shelf 2)				
BW17ML-061-0.0-0.15					
12-OCT-17 11:30	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE		:		USD
Solid	7:MOISTURE		:		USD
Solid	DX017.1613		:		USD
Solid	DX017.1613-2		:		USD
Solid	HOMOGENIZATION		:		USD
EDataDeliv	DX017 EDD		:		USD
Data Package	DX017 MINI		:		USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB		USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017

04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification

		Received	Due	PR
L28336-10	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-061-0.15-0.39 12-OCT-17 11:30	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-11	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-063-0.0-0.15 12-OCT-17 11:45	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-12	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-060-0.0-0.15 12-OCT-17 12:15	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017
04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification		Received	Due	PR
L28336-13	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-046-0.0-0.15 12-OCT-17 12:45	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-14	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-046-0.15-0.31 12-OCT-17 12:45	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-15	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-045-0.0-0.15 12-OCT-17 01:00	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017
04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification		Received	Due	PR
L28336-16	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-045-0.15-0.41 12-OCT-17 01:00	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-17	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-047-0.0-0.15 12-OCT-17 13:30	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-18	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-047-0.15-0.36 12-OCT-17 13:30	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017
04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification		Received	Due	PR
L28336-19	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-048-0.0-0.15 12-OCT-17 13:45	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-20	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-048-0.15-0.26 12-OCT-17 13:45	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-21	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-049-0.0-0.15 12-OCT-17 14:00	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017

04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification		Received	Due	PR
L28336-22	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-049-0.15-0.39 12-OCT-17 14:00	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-23	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-050-0.0-0.15 12-OCT-17 14:30	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-24	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-051-0.0-0.15 12-OCT-17 14:50	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017

04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification		Received	Due	PR
L28336-25	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-051-0.15-0.36 12-OCT-17 14:50	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-26	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-052-0.0-0.15 12-OCT-17 15:15	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD
L28336-27	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-052-0.15-0.44 12-OCT-17 15:15	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017

04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification			Received	Due	PR
L28336-28	Storage: WIF-4, FLOOR (In front of shelf 2)		16-OCT-17		
BW17ML-054-0.0-0.15 12-OCT-17 15:30	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD
L28336-29	Storage: WIF-4, FLOOR (In front of shelf 2)		16-OCT-17		
BW17ML-054-0.15-0.40 12-OCT-17 15:30	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD
L28336-30	Storage: WIF-4, FLOOR (In front of shelf 2)		16-OCT-17		
BW17ML-056-0.0-0.15 12-OCT-17 15:45	Project #: MUNGER LANDING SEDS				
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017

04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification			Received	Due	PR
L28336-31			16-OCT-17		
		Storage: WIF-4, FLOOR (In front of shelf 2)			
BW17ML-056-0.15-0.34					
12-OCT-17 15:45		Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD
L28336-32			16-OCT-17		
		Storage: WIF-4, FLOOR (In front of shelf 2)			
BW17ML-058-0.0-0.15					
12-OCT-17 16:00		Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD
L28336-33			16-OCT-17		
		Storage: WIF-4, FLOOR (In front of shelf 2)			
BW17ML-058-0.15-0.45					
12-OCT-17 16:00		Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE			:	USD
Solid	7:MOISTURE			:	USD
Solid	DX017.1613			:	USD
Solid	DX017.1613-2			:	USD
Solid	HOMOGENIZATION			:	USD
EDataDeliv	DX017 EDD			:	USD
Data Package	DX017 MINI			:	USD
ANY	SAMPLE RECEIPT		1	: 250 mL glass AMB	USD

SGS AXYS Analytical Services Ltd.

Login Chain of Custody Report (In01)

Oct. 31, 2017
04:30 PM

Login Number: L28336
Account: 4819 Bay West LLC
Project: MUNGER LANDING SEDS

Axys ID versus Client Sample Identification		**Received**	**Due**	**PR**
L28336-34	Storage: WIF-4, FLOOR (In front of shelf 2)	16-OCT-17		
BW17ML-062-0.0-0.15 12-OCT-17 16:15	Project #: MUNGER LANDING SEDS			
Solid	2:MOISTURE		:	USD
Solid	7:MOISTURE		:	USD
Solid	DX017.1613		:	USD
Solid	DX017.1613-2		:	USD
Solid	HOMOGENIZATION		:	USD
EDataDeliv	DX017 EDD		:	USD
Data Package	DX017 MINI		:	USD
ANY	SAMPLE RECEIPT	1	: 250 mL glass AMB	USD

Robinson, Dale (Sidney)

DATA PKG.

From: Robinson, Dale (Sidney)
Sent: Tuesday, October 24, 2017 11:22 AM
To: 'Paul Raymaker'
Cc: 'Jonna Bjelland'; Chris Musson
Subject: RE: Bay West SCOF for Project J170470

Hi Paul, Chris, and Jonna,

It has just come to my attention that the SCOF and COC for the Munger Landing sediment project specifically requests the use of EPA method 8290A, which SGS AXYS does not specifically offer. Although our MLA-017 dioxin method is compliant with 8290A, it adheres to the EPA 1613B dioxin method, which is actually a method that exceeds 8290A requirements as it makes use of a larger suite of internal quantification standards and uses tighter quantification specs.

Please advise if that is going to be an issue. Pricing indicated in the SCOF remains the same, so there will be no changes otherwise.

Cheers,

Dale Robinson

Project Manager

SGS AXYS
2045 W. Mills Road
Sidney, BC V8L 5X2

Direct Office: +1 250 655 5812
Main Phone: +1 250 655 5800
Toll Free: +1 888 373 0881
Fax: +1 250 655 5811
E-mail: dale.robinson@sgs.com

From: Paul Raymaker [mailto:praymaker@baywest.com]
Sent: Friday, September 29, 2017 1:16 PM
To: Dale Robinson <drobinson@axys.com>; Chris Musson <cmusson@BAYWEST.com>
Cc: Richard Grace <rgrace@axys.com>
Subject: RE: Bay West SCOF for Project J170470

Dale, attached is fully executed SCOF. Could you please request that your staff include 4 extra sample sets if they haven't sent out the coolers yet?

Paul Raymaker, P.G.
Geologist
Direct: 651-291-3411 Cell: 651-785-5618
praymaker@baywest.com

Bay West LLC
Customer-Focused Environmental & Industrial Solutions
5201 East River Road #313, Minneapolis, MN 55421
24-hrs: 1-800-279-0456
www.baywest.com

Check it out. . . Bay West Way of Being

Please consider the environment before printing this email.

From: Dale Robinson [mailto:drobinson@axys.com]
Sent: Friday, September 29, 2017 2:52 PM
To: Paul Raymaker <praymaker@baywest.com>; Chris Musson <cmusson@BAYWEST.com>
Cc: Richard Grace <rgrace@axys.com>
Subject: RE: Bay West SCOF for Project J170470

Thanks, Paul, for the confirmation of address. I've set up a shipping requisition to have the needed supplies be sent out to you. I've asked that it be sent out today, which should not be a problem. Our shipping department is putting that together as we speak. It will go to Jonna's attention at the address provided.

Also, please see attached the signed SCOF. Please advise if you require any additional information or have any further questions.

Cheers,

Dale Robinson

Project Manager

SGS AXYS
2045 W. Mills Road
Sidney, BC V8L 5X2

Direct Office: +1 250 655 5812
Main Phone: +1 250 655 5800
Toll Free: +1 888 373 0881
Fax: +1 250 655 5811
E-mail: drobinson@axys.com

From: Paul Raymaker [mailto:praymaker@baywest.com]
Sent: Friday, September 29, 2017 7:42 AM
To: Richard Grace; Chris Musson
Cc: Dale Robinson
Subject: RE: Bay West SCOF for Project J170470

Thanks for verifying what we discussed. The SCOF you attached remains unchanged. Please sign the SCOF and return to us. We will then sign and return to you for your records.

The following is the street address for our Duluth Office:

Attn: Jonna Bjelland – SLR AOC Munger Landing
1106 88th Avenue West, Duluth, MN 55808

Let me know if you have any questions.

Paul Raymaker, P.G.
Geologist
Direct: 651-291-3411 Cell: 651-785-5618
praymaker@baywest.com

Bay West LLC
Customer-Focused Environmental & Industrial Solutions
5201 East River Road #313, Minneapolis, MN 55421
24-hrs: 1-800-279-0456
www.baywest.com

Check it out... Bay West Way of Being

Please consider the environment before printing this email.

From: Richard Grace [mailto:rgrace@axys.com]
Sent: Tuesday, September 26, 2017 2:33 PM
To: Paul Raymaker <praymaker@baywest.com>; Chris Musson <cmusson@BAYWEST.com>
Cc: Dale Robinson <drobinson@axys.com>
Subject: FW: Bay West SCOF for Project J170470

Hi Paul;

Thanks for the input this morning Paul. I've also corrected Chris's e-mail (thanks, Chris my apologies as this mornings e-mail did not get through). Just to confirm the items discussed;

1. Level IV data packages are not required. We will provide standard PDFs (level 2 equivalent with short narrative as per MPCA format).
2. EDD format will be BayWest EFWEDD. I believe this is in place. We can confirm that all items needed for Dioxins and Furans reporting moving forward. I believe that it is.
3. Bottles, coolers , CoCs and ice packs will need to be sent to your Duluth office by Oct. 5th. Dale will need your street address for Fed Ex delivery. We have your Fed Tax ID that is needed for shipment of supplies.

Please let us know if the SCOF is a go. We may need to get jars early so let us know if we should send this week.

Cheers,

Richard Grace
Director - Sales, Marketing, and Service

SGS AXYS
2045 Mills Road West
Sidney, British Columbia
V8L 5X2
Phone - 1-905-484-2314
Toll Free - 1-888-373-0881
Fax - 1-250-655-5811
e-mail - rgrace@axys.com

From: Richard Grace
Sent: Tuesday, September 26, 2017 5:58 AM
To: 'cmussan@BAYWEST.com'; 'Paul Raymaker'
Cc: Dale Robinson
Subject: FW: Bay West SCOF for Project J170470

Hi Chris and Paul;

All looks good with the exception of confirming reporting formats. 2 quick questions on reporting formats, then I think we are ready to go (can give a call on these issues if helpful);

1. The standard report supplied is a level 2 plus narrative. Do you need a level IV data a package? If it is required there is a line in the MPCA contract for that ($30 per analysis per sample) and this would need to be added to the SCOF.
2. MPCA receives 2 custom EDDs (referred to as Generic and Basic) for their work. Last year's Dioxin work had an EQiUS EDD that was added after completion. Bay West has their own EDD's (EQiUS). Is the Bay West format required (believe the format is referred to as EFWEDD)? If so, this would replace the EDDs normally supplied. If all 3 formats are required, a 15$ per sample charge would apply to the EQiUS. There is a line item in MPCA work plans "non-routine sample analysis" where this would be added.

Hope the confirmation on reporting formats is helpful. Let us know what is required here.

Best Regards,

Richard Grace
Director - Sales, Marketing, and Service

SGS AXYS
2045 Mills Road West
Sidney, British Columbia
V8L 5X2
Phone - 1-905-484-2314
Toll Free - 1-888-373-0881
Fax - 1-250-655-5811
e-mail - rgrace@axys.com

From: Dale Robinson
Sent: Monday, September 25, 2017 1:54 PM
To: Chris Musson
Cc: Paul Raymaker; Richard Grace
Subject: RE: Bay West SCOF for Project J170470

Hi Chris,

Thanks for your email and for the SCOF for this new project.

Everything looks good to me, but I'd also like to have Richard Grace (CC'ed), SGS AXYS account manager for Bay West, have a quick look over it as well before it's signed and returned to you (two sets of eyes are always better than one). Assuming there are no issues, I will have the SCOF signed and back to you in the next day or two.

Cheers,

Dale Robinson

Project Manager

SGS AXYS
2045 W. Mills Road
Sidney, BC V8L 5X2

Direct Office: +1 250 655 5812
Main Phone: +1 250 655 5800
Toll Free: +1 888 373 0881
Fax: +1 250 655 5811
E-mail: drobinson@axys.com

From: Chris Musson [mailto:cmusson@BAYWEST.com]
Sent: Monday, September 25, 2017 8:42 AM
To: Dale Robinson
Cc: Paul Raymaker
Subject: Bay West SCOF for Project J170470

Good Morning Dale,

Bay West has a new project (J170470) starting up and we'd like to execute a SCOF with AXYS for this work. Paul Raymaker is the Bay West Project Manager for this project and is cc'd on this email.

Please see attached and review/sign if everything looks good.

Please let me know if you have any questions.

Thanks,

Chris Musson
Staff Professional / Engineer
direct: 651-291-3426 · cell: 651-503-8213
cmusson@baywest.com

Bay West LLC
Customer-Focused Environmental & Industrial Solutions
5 Empire Drive, St. Paul, MN 55103
24-hrs: 1-800-279-0456
www.baywest.com

Check it out. . . Bay West Way of Being

Please consider the environment before printing this email.

DATA PKG.

Robinson, Dale (Sidney)

From:	Robinson, Dale (Sidney)
Sent:	Tuesday, October 24, 2017 12:11 PM
To:	'Paul Raymaker'; Jonna Bjelland
Cc:	Alexandra Blel
Subject:	RE: SCOF - PEP SLR

Sounds good! Thanks, Paul. Our routine method for dioxins/furans is always our MLA-017 for MPCA (EPA 1613B equivalent).

Cheers,

Dale Robinson

Project Manager

SGS AXYS
2045 W. Mills Road
Sidney, BC V8L 5X2

Direct Office: +1 250 655 5812
Main Phone: +1 250 655 5800
Toll Free: +1 888 373 0881
Fax: +1 250 655 5811
E-mail: dale.robinson@sgs.com

From: Paul Raymaker [mailto:praymaker@baywest.com]
Sent: Tuesday, October 24, 2017 12:09 PM
To: Robinson, Dale (Sidney) <Dale.Robinson@sgs.com>; Jonna Bjelland <jbjelland@BAYWEST.com>
Cc: Alexandra Blel <ablel@BAYWEST.com>
Subject: RE: SCOF - PEP SLR

Hi Dale-
As long as samples are being analyzed for dioxins/furans using the methods that are including in the Minnesota State Contract, we should be good. I do think we should revise the SCOF for the upcoming work. We will revise and send to you for signature. Thanks for letting us know, we'll make sure to designate the correct analysis on our CoCs in the future.

Paul Raymaker, P.G.
Geologist
Direct: 651-291-3411 Cell: 651-785-5618
praymaker@baywest.com

Bay West LLC
Customer-Focused Environmental & Industrial Solutions
5201 East River Road #313, Minneapolis, MN 55421

SGS AXYS ANALYTICAL SERVICES LTD.

SAMPLE TRANSFER FORM

This form is to be used by Chemists in the Lab Services area when transferring a sample from a broken or damaged sample container to another container.

Date 03 NOV 2017	**Analyst** JLH
SGS AXYS Sample ID L28336-5	**Contract Number** 4819

Jar or Container Number : 1 **of** 1 ☑ **AGRICULTURAL HAZARD**

Description of Damage : Bottom of Jar broke off

Reason for Breakage :

☑ Freezing/Thawing ☐ Shipping Other: ______

Physical Description of Sample :

☑ Wet Solid ☐ Tissue Colour: Brown

☐ Dry Solid ☐ Blood/Serum Other: ______

☐ Moist Solid ☐ Aqueous

Containers Filled :

____ x 60 mL Jar 1 x 500 mL Jar Other: ______

____ x 120 mL Jar ____ x 40 mL Vial

____ x 250 mL Jar ____ x 60 mL Vial

Approximate Losses Upon Transfer :

Liquid 45 mL Cloudy ☐ or Clear ☑

Solid 2 g

Observations RE: Sample Integrity (see note 3)

not compromised

☐ **Project Chemist Informed**

Notes to Chemist:

1. **Arrange for a photocopy of the form to accompany sample back to Sample Receiving dept.**
2. **Scan original to the 'Reporting Sample Prep' folder. Name the document as the sample's login number. Place original in Sample Prep's scanned paperwork folder once scanned.**
3. **Under "Observations RE: Sample Integrity" provide a comment if the sample integrity was clearly observed to be compromised.**

FOR AGRICULTURAL HAZARDS: Sample Receiving must perform LIMS entry regarding disposal of lost material.

SGS AXYS ANALYTICAL SERVICES LTD.

SAMPLE TRANSFER FORM

This form is to be used by Chemists in the Lab Services area when transferring a sample from a broken or damaged sample container to another container.

Date 03 Nov 2017	**Analyst** JLH
SGS AXYS Sample ID L28336-11	**Contract Number** 4819
Jar or Container Number : 1 **of** 1	☑ **AGRICULTURAL HAZARD**

Description of Damage : Bottom of Jar broke off.

Reason for Breakage :

☑ Freezing/Thawing ☐ Shipping Other: ____________

Physical Description of Sample :

☑ Wet Solid ☐ Tissue Colour: Brown

☐ Dry Solid ☐ Blood/Serum Other: ____________

☐ Moist Solid ☐ Aqueous

Containers Filled :

____ x 60 mL Jar 1 x 500 mL Jar Other: ____________

____ x 120 mL Jar ____ x 40 mL Vial

____ x 250 mL Jar ____ x 60 mL Vial

Approximate Losses Upon Transfer :

Liquid 5 mL Cloudy ☐ or Clear ☐

Solid 2 g

Observations RE: Sample Integrity (see note 3) not compromised.	☐ **Project Chemist Informed**

Notes to Chemist:

1. **Arrange for a photocopy of the form to accompany sample back to Sample Receiving dept.**
2. **Scan original to the 'Reporting Sample Prep' folder. Name the document as the sample's login number. Place original in Sample Prep's scanned paperwork folder once scanned.**
3. **Under "Observations RE: Sample Integrity" provide a comment if the sample integrity was clearly observed to be compromised.**

FOR AGRICULTURAL HAZARDS: Sample Receiving must perform LIMS entry regarding disposal of lost material.

SGS AXYS ANALYTICAL SERVICES LTD.

SAMPLE TRANSFER FORM

This form is to be used by Chemists in the Lab Services area when transferring a sample from a broken or damaged sample container to another container.

Date 03 NOV 2017	**Analyst** JLH
SGS AXYS Sample ID L28336-16	**Contract Number** 4819
Jar or Container Number : 1 **of** 1	☑ **AGRICULTURAL HAZARD**
Description of Damage :	
Reason for Breakage : ☑ Freezing/Thawing ☐ Shipping Other: ______	
Physical Description of Sample : ☑ Wet Solid ☐ Tissue Colour: Brown ☐ Dry Solid ☐ Blood/Serum Other: ______ ☐ Moist Solid ☐ Aqueous	
Containers Filled : ______ x 60 mL Jar, 1 x 500 mL Jar, Other: ______; ______ x 120 mL Jar, ______ x 40 mL Vial; ______ x 250 mL Jar, ______ x 60 mL Vial	
Approximate Losses Upon Transfer : Liquid 5 mL, Cloudy ☐ or Clear ☑; Solid 2 g	
Observations RE: Sample Integrity (see note 3) not compromised	☐ **Project Chemist Informed**

Notes to Chemist:

1. **Arrange for a photocopy of the form to accompany sample back to Sample Receiving dept.**
2. **Scan original to the 'Reporting Sample Prep' folder. Name the document as the sample's login number. Place original in Sample Prep's scanned paperwork folder once scanned.**
3. **Under "Observations RE: Sample Integrity" provide a comment if the sample integrity was clearly observed to be compromised.**

FOR AGRICULTURAL HAZARDS: Sample Receiving must perform LIMS entry regarding disposal of lost material.

SGS AXYS ANALYTICAL SERVICES LTD.

SAMPLE TRANSFER FORM

This form is to be used by Chemists in the Lab Services area when transferring a sample from a broken or damaged sample container to another container.

Date 03NOV2017	**Analyst** LMM
SGS AXYS Sample ID L28336-18	**Contract Number** 4819

Jar or Container Number : 1 **of** 1 ☑ **AGRICULTURAL HAZARD**

Description of Damage :
bottom of jar broken off

Reason for Breakage :
☑ Freezing/Thawing ☐ Shipping Other: ______

Physical Description of Sample :
☑ Wet Solid ☐ Tissue Colour: brown
☐ Dry Solid ☐ Blood/Serum Other: ______
☐ Moist Solid ☐ Aqueous

Containers Filled :
____ x 60 mL Jar ____ x 500 mL Jar Other: ______
____ x 120 mL Jar ____ x 40 mL Vial
1 x 250 mL Jar ____ x 60 mL Vial

Approximate Losses Upon Transfer :
Liquid 3-5 mL Cloudy ☐ or Clear ☑
Solid 2-3 g

Observations RE: Sample Integrity (see note 3)	☐ **Project Chemist Informed**
not compromised	

Notes to Chemist:

1. **Arrange for a photocopy of the form to accompany sample back to Sample Receiving dept.**
2. **Scan original to the 'Reporting Sample Prep' folder. Name the document as the sample's login number. Place original in Sample Prep's scanned paperwork folder once scanned.**
3. **Under "Observations RE: Sample Integrity" provide a comment if the sample integrity was clearly observed to be compromised.**

FOR AGRICULTURAL HAZARDS: Sample Receiving must perform LIMS entry regarding disposal of lost material.

SGS AXYS ANALYTICAL SERVICES LTD.

SAMPLE TRANSFER FORM

This form is to be used by Chemists in the Lab Services area when transferring a sample from a broken or damaged sample container to another container.

Date	**Analyst**
03 NOV 2017	UMM
SGS AXYS Sample ID L28336-25	**Contract Number** 4819

Jar or Container Number : 1 **of** 1 ☑ **AGRICULTURAL HAZARD**

Description of Damage :
bottom of jar broken off.

Reason for Breakage :
☑ Freezing/Thawing ☐ Shipping Other: ______

Physical Description of Sample :

☑ Wet Solid ☐ Tissue Colour: brown
☐ Dry Solid ☐ Blood/Serum Other: ______
☐ Moist Solid ☐ Aqueous

Containers Filled :

___ x 60 mL Jar ___ x 500 mL Jar Other: ______
___ x 120 mL Jar ___ x 40 mL Vial
1 x 250 mL Jar ___ x 60 mL Vial

Approximate Losses Upon Transfer :

Liquid 2-3 mL Cloudy ☑ or Clear ☐
Solid ~2 g

Observations RE: Sample Integrity (see note 3)
not compromised

☐ **Project Chemist Informed**

Notes to Chemist:

1. **Arrange for a photocopy of the form to accompany sample back to Sample Receiving dept.**
2. **Scan original to the 'Reporting Sample Prep' folder. Name the document as the sample's login number. Place original in Sample Prep's scanned paperwork folder once scanned.**
3. **Under "Observations RE: Sample Integrity" provide a comment if the sample integrity was clearly observed to be compromised.**

FOR AGRICULTURAL HAZARDS: Sample Receiving must perform LIMS entry regarding disposal of lost material.

SGS AXYS ANALYTICAL SERVICES LTD.

SAMPLE TRANSFER FORM

This form is to be used by Chemists in the Lab Services area when transferring a sample from a broken or damaged sample container to another container.

Date 03NOV2017	**Analyst** VMM
SGS AXYS Sample ID L28336-31	**Contract Number** 4819

Jar or Container Number : 1 **of** 1 ☑ **AGRICULTURAL HAZARD**

Description of Damage :
bottom of jar broken off.

Reason for Breakage :
☑ Freezing/Thawing ☐ Shipping Other: ______

Physical Description of Sample :
☑ Wet Solid ☐ Tissue Colour: Brown
☐ Dry Solid ☐ Blood/Serum Other: ______
☐ Moist Solid ☐ Aqueous

Containers Filled :
____ x 60 mL Jar 1 x 500 mL Jar Other: ______
____ x 120 mL Jar ____ x 40 mL Vial
____ x 250 mL Jar ____ x 60 mL Vial

Approximate Losses Upon Transfer :
Liquid 3 mL Cloudy ☑ or Clear ☐
Solid ~~0~~ 2 g
VMM 03NOV2017

Observations RE: Sample Integrity (see note 3)	☐ **Project Chemist Informed**
not compromised.	

Notes to Chemist:

1. **Arrange for a photocopy of the form to accompany sample back to Sample Receiving dept.**
2. **Scan original to the 'Reporting Sample Prep' folder. Name the document as the sample's login number. Place original in Sample Prep's scanned paperwork folder once scanned.**
3. **Under "Observations RE: Sample Integrity" provide a comment if the sample integrity was clearly observed to be compromised.**

FOR AGRICULTURAL HAZARDS: Sample Receiving must perform LIMS entry regarding disposal of lost material.

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-047-0.15-0.36
Sample Collection:
12-Oct-2017 13:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-18
Matrix:	SOLID	**Sample Size:**	11.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 18:09:58	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 85**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	46.4

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		11.3	0.0440 (Q)	0.80	1.001
1,2,3,7,8-PECDD [4]		29.9	0.0546 (S)	0.61	1.000
1,2,3,4,7,8-HXCDD		21.4	0.176 (S)	1.23	1.000
1,2,3,6,7,8-HXCDD		138	0.176 (S)	1.23	1.000
1,2,3,7,8,9-HXCDD		84.0	0.176 (S)	1.24	1.010
1,2,3,4,6,7,8-HPCDD		1820	0.289 (S)	1.02	1.000
OCDD	E				
2,3,7,8-TCDF		24.2	0.0636 (S)	0.79	1.001
1,2,3,7,8-PECDF		6.83	0.101 (S)	1.58	1.000
2,3,4,7,8-PECDF		11.7	0.101 (S)	1.58	1.001
1,2,3,4,7,8-HXCDF		55.6	0.177 (S)	1.25	1.001
1,2,3,6,7,8-HXCDF		98.9	0.177 (S)	1.25	1.000
1,2,3,7,8,9-HXCDF	J	2.59	0.177 (S)	1.16	1.000
2,3,4,6,7,8-HXCDF		18.4	0.177 (S)	1.26	1.000
1,2,3,4,6,7,8-HPCDF	E				
1,2,3,4,7,8,9-HPCDF		46.6	0.245 (S)	1.08	1.000
OCDF		1480	0.0471 (S)	0.91	1.002
TOTAL TETRA-DIOXINS		82.8	0.0440 (Q)		
TOTAL PENTA-DIOXINS	T	256	0.0546 (S)		
TOTAL HEXA-DIOXINS		1130	0.176 (S)		
TOTAL HEPTA-DIOXINS		4740	0.289 (S)		
TOTAL TETRA-FURANS		149	0.0636 (S)		
TOTAL PENTA-FURANS		393	0.101 (S)		
TOTAL HEXA-FURANS		2140	0.177 (S)		
TOTAL HEPTA-FURANS	X				

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; X = result reported separately; T = result recalculated against alternate labeled compound(s) or internal standard; E = exceeds calibrated linear range, see dilution data.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-18_Form1A_DX7M_137S85_SJ2310082.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-047-0.15-0.36
Sample Collection:
12-Oct-2017 13:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-18
Matrix:	SOLID	**Sample Size:**	11.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 18:09:58	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 85**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg absolute	**% Moisture:**	46.4

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1260	63.0	0.78	1.013
13C-1,2,3,7,8-PECDD [4]		2000	1920	95.9	0.64	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1270	63.7	1.26	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1740	86.9	1.26	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1270	63.7	1.03	1.093
13C-OCDD		4000	2740	68.5	0.89	1.177
13C-2,3,7,8-TCDF		2000	1250	62.5	0.76	0.965
13C-1,2,3,7,8-PECDF		2000	1160	58.0	1.56	1.285
13C-2,3,4,7,8-PECDF		2000	1170	58.6	1.57	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1270	63.5	0.53	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1230	61.5	0.53	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1240	62.0	0.54	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1310	65.6	0.52	0.981
13C-1,2,3,4,6,7,8-HPCDF		2000	1380	68.8	0.44	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1030	51.4	0.45	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	150	74.8		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-18_Form2_DX7M_137S85_SJ2310082.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-047-0.15-0.36
Sample Collection:
12-Oct-2017 13:30

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-18 W
Matrix:	SOLID	**Sample Size:**	11.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	03-Dec-2017 **Time:** 05:58:20	**GC Column ID:**	DB5
Extract Volume (uL):	200	**Sample Data Filename:**	**DX7M_142 S: 37**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	10	**Cal. Ver. Data Filename:**	DX7M_142 S: 33
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	46.4

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	X				
1,2,3,7,8-PECDD [4]	X				
1,2,3,4,7,8-HXCDD	X				
1,2,3,6,7,8-HXCDD	X				
1,2,3,7,8,9-HXCDD	X				
1,2,3,4,6,7,8-HPCDD	X				
OCDD	D	14400	2.26 (S)	0.89	1.000
2,3,7,8-TCDF	X				
1,2,3,7,8-PECDF	X				
2,3,4,7,8-PECDF	X				
1,2,3,4,7,8-HXCDF	X				
1,2,3,6,7,8-HXCDF	X				
1,2,3,7,8,9-HXCDF	X				
2,3,4,6,7,8-HXCDF	X				
1,2,3,4,6,7,8-HPCDF	D	3540	1.12 (S)	1.04	1.000
1,2,3,4,7,8,9-HPCDF	X				
OCDF	X				
TOTAL TETRA-DIOXINS	X				
TOTAL PENTA-DIOXINS	X				
TOTAL HEXA-DIOXINS	X				
TOTAL HEPTA-DIOXINS	X				
TOTAL TETRA-FURANS	X				
TOTAL PENTA-FURANS	X				
TOTAL HEXA-FURANS	X				
TOTAL HEPTA-FURANS	D	6990	1.12 (S)		

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-18_Form1A_DX7M_142S37_SJ2313074.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-047-0.15-0.36
Sample Collection:
12-Oct-2017 13:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-18 W
Matrix:	SOLID	**Sample Size:**	11.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	03-Dec-2017 **Time:** 05:58:20	**GC Column ID:**	DB5
Extract Volume (uL):	200	**Sample Data Filename:**	**DX7M_142 S: 37**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	10	**Cal. Ver. Data Filename:**	DX7M_142 S: 33
Concentration Units:	pg absolute	**% Moisture:**	46.4

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD	X					
13C-1,2,3,7,8-PECDD [4]	X					
13C-1,2,3,4,7,8-HXCDD	X					
13C-1,2,3,6,7,8-HXCDD	X					
13C-1,2,3,4,6,7,8-HPCDD	X					
13C-OCDD	D	4000	2660	66.5	0.87	1.177
13C-2,3,7,8-TCDF	X					
13C-1,2,3,7,8-PECDF	X					
13C-2,3,4,7,8-PECDF	X					
13C-1,2,3,4,7,8-HXCDF	X					
13C-1,2,3,6,7,8-HXCDF	X					
13C-1,2,3,7,8,9-HXCDF	X					
13C-2,3,4,6,7,8-HXCDF	X					
13C-1,2,3,4,6,7,8-HPCDF	D	2000	1380	68.9	0.48	1.062
13C-1,2,3,4,7,8,9-HPCDF	D	2000	1330	66.5	0.45	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD	X					

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-18_Form2_DX7M_142S37_SJ2313074.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-047-0.15-0.36
Sample Collection:
12-Oct-2017 13:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-18
Matrix:	SOLID	**Sample Size:**	11.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 02:06:06	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_217 S: 10**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_217 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	46.4

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		87.1	0.0530 (S)	1.25	1.062
2,3,7,8-TCDF		19.4	0.106 (S)	0.78	1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-18_Form1A_DB73_217S10_SJ2310253.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-047-0.15-0.36

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.:	4819	**Sample Collection:**	12-Oct-2017 13:30
		Project No.	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-18
Sample Size:	11.4 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_217 S: 10** **DX7M_137 S: 85** **DX7M_142 S: 37**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		11.3	0.0440	1	1.13e+01	1.13e+01	
1,2,3,7,8-PECDD		29.9	0.0546	1	2.99e+01	2.99e+01	
1,2,3,4,7,8-HXCDD		21.4	0.176	0.1	2.14e+00	2.14e+00	
1,2,3,6,7,8-HXCDD		138	0.176	0.1	1.38e+01	1.38e+01	
1,2,3,7,8,9-HXCDD		87.1	0.0530	0.1	8.71e+00	8.71e+00	
1,2,3,4,6,7,8-HPCDD		1820	0.289	0.01	1.82e+01	1.82e+01	
OCDD		14400	2.26	0.0003	4.32e+00	4.32e+00	
2,3,7,8-TCDF		19.4	0.106	0.1	1.94e+00	1.94e+00	
1,2,3,7,8-PECDF		6.83	0.101	0.03	2.05e-01	2.05e-01	
2,3,4,7,8-PECDF		11.7	0.101	0.3	3.51e+00	3.51e+00	
1,2,3,4,7,8-HXCDF		55.6	0.177	0.1	5.56e+00	5.56e+00	
1,2,3,6,7,8-HXCDF		98.9	0.177	0.1	9.89e+00	9.89e+00	
1,2,3,7,8,9-HXCDF		2.59	0.177	0.1	2.59e-01	2.59e-01	
2,3,4,6,7,8-HXCDF		18.4	0.177	0.1	1.84e+00	1.84e+00	
1,2,3,4,6,7,8-HPCDF		3540	1.12	0.01	3.54e+01	3.54e+01	
1,2,3,4,7,8,9-HPCDF		46.6	0.245	0.01	4.66e-01	4.66e-01	
OCDF		1480	0.0471	0.0003	4.44e-01	4.44e-01	
			TOTAL TEQ		148	148	

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_1613-TEQ_L28336-18_TEQ_SJ2310253.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20			**CLIENT SAMPLE NO.**
	Form 1A		**BW17ML-048-0.0-0.15**
	PCDD/PCDF ANALYSIS REPORT		**Sample Collection:**
			12-Oct-2017 13:45

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-19
Matrix:	SOLID	**Sample Size:**	8.98 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 19:05:06	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 86**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	56.1

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		2.06	0.0557 (Q)	0.71	1.001
1,2,3,7,8-PECDD [4]	J	4.99	0.0557 (Q)	0.62	1.000
1,2,3,4,7,8-HXCDD	J	4.26	0.113 (S)	1.32	1.000
1,2,3,6,7,8-HXCDD		23.3	0.113 (S)	1.25	1.000
1,2,3,7,8,9-HXCDD		13.9	0.113 (S)	1.23	1.010
1,2,3,4,6,7,8-HPCDD		299	0.257 (S)	1.00	1.000
OCDD		2630	0.235 (S)	0.88	1.000
2,3,7,8-TCDF		8.41	0.0557 (Q)	0.77	1.001
1,2,3,7,8-PECDF	J	3.34	0.0557 (Q)	1.51	1.000
2,3,4,7,8-PECDF	J	5.55	0.0557 (Q)	1.57	1.001
1,2,3,4,7,8-HXCDF		22.8	0.109 (S)	1.22	1.001
1,2,3,6,7,8-HXCDF		29.3	0.109 (S)	1.23	1.000
1,2,3,7,8,9-HXCDF	J	1.02	0.109 (S)	1.31	1.000
2,3,4,6,7,8-HXCDF	J	5.31	0.109 (S)	1.26	1.001
1,2,3,4,6,7,8-HPCDF		627	0.302 (S)	1.05	1.000
1,2,3,4,7,8,9-HPCDF		22.7	0.302 (S)	1.08	1.000
OCDF		372	0.253 (S)	0.91	1.002
TOTAL TETRA-DIOXINS		29.0	0.0557 (Q)		
TOTAL PENTA-DIOXINS	T	60.6	0.0557 (Q)		
TOTAL HEXA-DIOXINS		209	0.113 (S)		
TOTAL HEPTA-DIOXINS		754	0.257 (S)		
TOTAL TETRA-FURANS		114	0.0557 (Q)		
TOTAL PENTA-FURANS		183	0.0557 (Q)		
TOTAL HEXA-FURANS		465	0.109 (S)		
TOTAL HEPTA-FURANS		1310	0.302 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-19_Form1A_DX7M_137S86_SJ2310083.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-048-0.0-0.15
Sample Collection:
12-Oct-2017 13:45

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-19
Matrix:	SOLID	**Sample Size:**	8.98 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 19:05:06	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 86**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg absolute	**% Moisture:**	56.1

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1300	64.9	0.78	1.013
13C-1,2,3,7,8-PECDD [4]		2000	1750	87.6	0.64	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1250	62.6	1.28	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1540	77.2	1.25	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1060	52.9	1.02	1.093
13C-OCDD		4000	1590	39.8	0.91	1.177
13C-2,3,7,8-TCDF		2000	1270	63.3	0.77	0.966
13C-1,2,3,7,8-PECDF		2000	1160	57.8	1.55	1.285
13C-2,3,4,7,8-PECDF		2000	1170	58.5	1.59	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1260	62.9	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1200	60.2	0.52	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1160	58.1	0.53	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1210	60.4	0.51	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1100	54.8	0.46	1.061
13C-1,2,3,4,7,8,9-HPCDF		2000	952	47.6	0.44	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	147	73.3		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-19_Form2_DX7M_137S86_SJ2310083.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-048-0.0-0.15
Sample Collection:
12-Oct-2017 13:45

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-19
Matrix:	SOLID	**Sample Size:**	8.98 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 02:47:17	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_217 S: 11**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_217 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	56.1

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		13.2	0.132 (S)	1.21	1.061
2,3,7,8-TCDF		5.64	0.0658 (S)	0.75	1.002

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-19_Form1A_DB73_217S11_SJ2310254.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-048-0.0-0.15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Sample Collection:	12-Oct-2017 13:45
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-19
Sample Size:	8.98 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_217 S: 11** **DX7M_137 S: 86**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		2.06	0.0557	1	2.06e+00	2.06e+00	
1,2,3,7,8-PECDD		4.99	0.0557	1	4.99e+00	4.99e+00	
1,2,3,4,7,8-HXCDD		4.26	0.113	0.1	4.26e-01	4.26e-01	
1,2,3,6,7,8-HXCDD		23.3	0.113	0.1	2.33e+00	2.33e+00	
1,2,3,7,8,9-HXCDD		13.2	0.132	0.1	1.32e+00	1.32e+00	
1,2,3,4,6,7,8-HPCDD		299	0.257	0.01	2.99e+00	2.99e+00	
OCDD		2630	0.235	0.0003	7.89e-01	7.89e-01	
2,3,7,8-TCDF		5.64	0.0658	0.1	5.64e-01	5.64e-01	
1,2,3,7,8-PECDF		3.34	0.0557	0.03	1.00e-01	1.00e-01	
2,3,4,7,8-PECDF		5.55	0.0557	0.3	1.67e+00	1.67e+00	
1,2,3,4,7,8-HXCDF		22.8	0.109	0.1	2.28e+00	2.28e+00	
1,2,3,6,7,8-HXCDF		29.3	0.109	0.1	2.93e+00	2.93e+00	
1,2,3,7,8,9-HXCDF		1.02	0.109	0.1	1.02e-01	1.02e-01	
2,3,4,6,7,8-HXCDF		5.31	0.109	0.1	5.31e-01	5.31e-01	
1,2,3,4,6,7,8-HPCDF		627	0.302	0.01	6.27e+00	6.27e+00	
1,2,3,4,7,8,9-HPCDF		22.7	0.302	0.01	2.27e-01	2.27e-01	
OCDF		372	0.253	0.0003	1.12e-01	1.12e-01	
			TOTAL TEQ		29.7	29.7	

(1) Where applicable, custom lab flags have been used on this report.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-19_TEQ_SJ2310254.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-048-0.15-0.26
Sample Collection:
12-Oct-2017 13:45

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-20
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 20:00:14	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 87**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	43.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	J	0.446	0.0466 (Q)	0.73	1.001
1,2,3,7,8-PECDD [4]	J	0.886	0.0466 (Q)	0.62	1.001
1,2,3,4,7,8-HXCDD	J	0.639	0.0466 (Q)	1.20	1.000
1,2,3,6,7,8-HXCDD	X				
1,2,3,7,8,9-HXCDD	X				
1,2,3,4,6,7,8-HPCDD		38.3	0.0772 (S)	1.04	1.000
OCDD		316	0.0466 (Q)	0.89	1.000
2,3,7,8-TCDF		1.78	0.0466 (Q)	0.82	1.001
1,2,3,7,8-PECDF	J	0.533	0.0466 (Q)	1.61	1.001
2,3,4,7,8-PECDF	J	1.06	0.0466 (Q)	1.36	1.000
1,2,3,4,7,8-HXCDF	J	3.30	0.0466 (Q)	1.25	1.000
1,2,3,6,7,8-HXCDF	J	4.24	0.0466 (Q)	1.32	1.001
1,2,3,7,8,9-HXCDF	J	0.157	0.0466 (Q)	1.19	1.001
2,3,4,6,7,8-HXCDF	J	0.975	0.0466 (Q)	1.25	1.000
1,2,3,4,6,7,8-HPCDF		93.7	0.0519 (S)	1.09	1.000
1,2,3,4,7,8,9-HPCDF	J	2.47	0.0519 (S)	1.02	1.000
OCDF		42.6	0.0466 (Q)	0.93	1.002
TOTAL TETRA-DIOXINS		8.92	0.0466 (Q)		
TOTAL PENTA-DIOXINS	T	12.4	0.0466 (Q)		
TOTAL HEXA-DIOXINS	X				
TOTAL HEPTA-DIOXINS		95.4	0.0772 (S)		
TOTAL TETRA-FURANS		17.7	0.0466 (Q)		
TOTAL PENTA-FURANS		27.7	0.0466 (Q)		
TOTAL HEXA-FURANS		67.0	0.0466 (Q)		
TOTAL HEPTA-FURANS		190	0.0519 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; X = result reported separately; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-20_Form1A_DX7M_137S87_SJ2310084.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-048-0.15-0.26
Sample Collection:
12-Oct-2017 13:45

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-20
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 20:00:14	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 87**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg absolute	**% Moisture:**	43.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1470	73.4	0.78	1.014
13C-1,2,3,7,8-PECDD [4]		2000	2340	117	0.65	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1590	79.7	1.26	0.988
13C-1,2,3,6,7,8-HXCDD	X					
13C-1,2,3,4,6,7,8-HPCDD		2000	1570	78.3	1.02	1.093
13C-OCDD		4000	2680	67.0	0.89	1.177
13C-2,3,7,8-TCDF		2000	1490	74.7	0.75	0.966
13C-1,2,3,7,8-PECDF		2000	1370	68.5	1.55	1.285
13C-2,3,4,7,8-PECDF		2000	1430	71.3	1.56	1.353
13C-1,2,3,4,7,8-HXCDF		2000	1530	76.7	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1500	75.2	0.52	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1580	79.1	0.50	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1600	80.1	0.52	0.982
13C-1,2,3,4,6,7,8-HPCDF		2000	1490	74.5	0.45	1.061
13C-1,2,3,4,7,8,9-HPCDF		2000	1430	71.4	0.46	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	155	77.5		1.001

(1) Where applicable, custom lab flags have been used on this report; X = result reported separately.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-20_Form2_DX7M_137S87_SJ2310084.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-048-0.15-0.26
Sample Collection:
12-Oct-2017 13:45

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-20 Wi
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	04-Dec-2017 **Time:** 04:16:03	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 61**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 57
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	43.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	X				
1,2,3,7,8-PECDD [4]	X				
1,2,3,4,7,8-HXCDD	X				
1,2,3,6,7,8-HXCDD	D J	3.52	0.0706 (S)	1.33	1.000
1,2,3,7,8,9-HXCDD	D J	1.91	0.0706 (S)	1.18	1.010
1,2,3,4,6,7,8-HPCDD	X				
OCDD	X				
2,3,7,8-TCDF	X				
1,2,3,7,8-PECDF	X				
2,3,4,7,8-PECDF	X				
1,2,3,4,7,8-HXCDF	X				
1,2,3,6,7,8-HXCDF	X				
1,2,3,7,8,9-HXCDF	X				
2,3,4,6,7,8-HXCDF	X				
1,2,3,4,6,7,8-HPCDF	X				
1,2,3,4,7,8,9-HPCDF	X				
OCDF	X				
TOTAL TETRA-DIOXINS	X				
TOTAL PENTA-DIOXINS	X				
TOTAL HEXA-DIOXINS	D	31.9	0.0706 (S)		
TOTAL HEPTA-DIOXINS	X				
TOTAL TETRA-FURANS	X				
TOTAL PENTA-FURANS	X				
TOTAL HEXA-FURANS	X				
TOTAL HEPTA-FURANS	X				

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; J = concentration less than lowest calibration equivalent; X = result reported separately.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-20_Form1A_DX7M_142S61_SJ2312665.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-048-0.15-0.26
Sample Collection:
12-Oct-2017 13:45

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-20 Wi
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	04-Dec-2017 **Time:** 04:16:03	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 61**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 57
Concentration Units:	pg absolute	**% Moisture:**	43.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD	X					
13C-1,2,3,7,8-PECDD [4]	X					
13C-1,2,3,4,7,8-HXCDD	D	2000	1650	82.4	1.31	0.987
13C-1,2,3,6,7,8-HXCDD	D	2000	1760	88.0	1.27	0.990
13C-1,2,3,4,6,7,8-HPCDD	X					
13C-OCDD	X					
13C-2,3,7,8-TCDF	X					
13C-1,2,3,7,8-PECDF	X					
13C-2,3,4,7,8-PECDF	X					
13C-1,2,3,4,7,8-HXCDF	X					
13C-1,2,3,6,7,8-HXCDF	X					
13C-1,2,3,7,8,9-HXCDF	X					
13C-2,3,4,6,7,8-HXCDF	X					
13C-1,2,3,4,6,7,8-HPCDF	X					
13C-1,2,3,4,7,8,9-HPCDF	X					
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD	X					

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-20_Form2_DX7M_142S61_SJ2312665.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-048-0.15-0.26
Sample Collection:
12-Oct-2017 13:45

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-20
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 03:28:29	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_217 S: 12**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_217 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	43.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD	J	2.21	0.0773 (S)	1.26	1.062
2,3,7,8-TCDF		1.00	0.0466 (Q)	0.76	1.001

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-20_Form1A_DB73_217S12_SJ2310255.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-048-0.15-0.26

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Sample Collection:	12-Oct-2017 13:45
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-20
Sample Size:	10.7 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_217 S: 12** **DX7M_137 S: 87** **DX7M_142 S: 61**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		0.446	0.0466	1	4.46e-01	4.46e-01	
1,2,3,7,8-PECDD		0.886	0.0466	1	8.86e-01	8.86e-01	
1,2,3,4,7,8-HXCDD		0.639	0.0466	0.1	6.39e-02	6.39e-02	
1,2,3,6,7,8-HXCDD		3.52	0.0706	0.1	3.52e-01	3.52e-01	
1,2,3,7,8,9-HXCDD		2.21	0.0773	0.1	2.21e-01	2.21e-01	
1,2,3,4,6,7,8-HPCDD		38.3	0.0772	0.01	3.83e-01	3.83e-01	
OCDD		316	0.0466	0.0003	9.48e-02	9.48e-02	
2,3,7,8-TCDF		1.00	0.0466	0.1	1.00e-01	1.00e-01	
1,2,3,7,8-PECDF		0.533	0.0466	0.03	1.60e-02	1.60e-02	
2,3,4,7,8-PECDF		1.06	0.0466	0.3	3.18e-01	3.18e-01	
1,2,3,4,7,8-HXCDF		3.30	0.0466	0.1	3.30e-01	3.30e-01	
1,2,3,6,7,8-HXCDF		4.24	0.0466	0.1	4.24e-01	4.24e-01	
1,2,3,7,8,9-HXCDF		0.157	0.0466	0.1	1.57e-02	1.57e-02	
2,3,4,6,7,8-HXCDF		0.975	0.0466	0.1	9.75e-02	9.75e-02	
1,2,3,4,6,7,8-HPCDF		93.7	0.0519	0.01	9.37e-01	9.37e-01	
1,2,3,4,7,8,9-HPCDF		2.47	0.0519	0.01	2.47e-02	2.47e-02	
OCDF		42.6	0.0466	0.0003	1.28e-02	1.28e-02	
			TOTAL TEQ		4.72	4.72	

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-20_TEQ_SJ2310255.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-049-0.0-0.15
Sample Collection:
12-Oct-2017 14:00

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-21
Matrix:	SOLID	**Sample Size:**	10.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 20:55:22	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 88**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	49.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		2.41	0.0596 (S)	0.76	1.001
1,2,3,7,8-PECDD [4]	J	4.77	0.0665 (S)	0.61	1.000
1,2,3,4,7,8-HXCDD	J	4.49	0.0966 (S)	1.28	1.000
1,2,3,6,7,8-HXCDD		24.7	0.0966 (S)	1.25	1.000
1,2,3,7,8,9-HXCDD		15.2	0.0966 (S)	1.33	1.010
1,2,3,4,6,7,8-HPCDD		416	0.312 (S)	1.03	1.000
OCDD		3800	0.238 (S)	0.88	1.000
2,3,7,8-TCDF		8.62	0.0523 (S)	0.78	1.001
1,2,3,7,8-PECDF	J	2.15	0.124 (S)	1.44	1.000
2,3,4,7,8-PECDF	J	3.75	0.124 (S)	1.59	1.000
1,2,3,4,7,8-HXCDF		11.1	0.0899 (S)	1.21	1.000
1,2,3,6,7,8-HXCDF		20.3	0.0899 (S)	1.23	1.000
1,2,3,7,8,9-HXCDF	J	0.589	0.0899 (S)	1.09	1.001
2,3,4,6,7,8-HXCDF	J	3.90	0.0899 (S)	1.20	1.001
1,2,3,4,6,7,8-HPCDF		528	0.160 (S)	1.06	1.000
1,2,3,4,7,8,9-HPCDF		10.5	0.160 (S)	1.01	1.000
OCDF		279	0.0661 (S)	0.90	1.002
TOTAL TETRA-DIOXINS		27.9	0.0596 (S)		
TOTAL PENTA-DIOXINS	T	57.7	0.0665 (S)		
TOTAL HEXA-DIOXINS		214	0.0966 (S)		
TOTAL HEPTA-DIOXINS		949	0.312 (S)		
TOTAL TETRA-FURANS		70.1	0.0523 (S)		
TOTAL PENTA-FURANS		105	0.124 (S)		
TOTAL HEXA-FURANS		330	0.0899 (S)		
TOTAL HEPTA-FURANS		1110	0.160 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: ________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-21_Form1A_DX7M_137S88_SJ2310085.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-049-0.0-0.15
Sample Collection:
12-Oct-2017 14:00

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-21
Matrix:	SOLID	**Sample Size:**	10.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 20:55:22	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 88**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg absolute	**% Moisture:**	49.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1450	72.3	0.81	1.013
13C-1,2,3,7,8-PECDD [4]		2000	1890	94.4	0.64	1.383
13C-1,2,3,4,7,8-HXCDD		2000	1440	72.0	1.29	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1670	83.7	1.26	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1650	82.6	1.07	1.094
13C-OCDD		4000	3790	94.8	0.87	1.177
13C-2,3,7,8-TCDF		2000	1350	67.7	0.75	0.966
13C-1,2,3,7,8-PECDF		2000	1470	73.4	1.55	1.285
13C-2,3,4,7,8-PECDF		2000	1520	76.1	1.55	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1400	70.2	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1320	66.0	0.51	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1420	71.1	0.52	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1410	70.3	0.53	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1490	74.4	0.46	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1530	76.4	0.45	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	154	77.1		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-21_Form2_DX7M_137S88_SJ2310085.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-049-0.0-0.15
Sample Collection:
12-Oct-2017 14:00

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-21
Matrix:	SOLID	**Sample Size:**	10.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 04:09:42	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_217 S: 13**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_217 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	49.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		13.6	0.0798 (S)	1.28	1.060
2,3,7,8-TCDF		6.46	0.0479 (Q)	0.81	1.002

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-21_Form1A_DB73_217S13_SJ2310256.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-049-0.0-0.15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Sample Collection:	12-Oct-2017 14:00		
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-21
Sample Size:	10.4 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_217 S: 13** **DX7M_137 S: 88**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		2.41	0.0596	1	2.41e+00	2.41e+00	
1,2,3,7,8-PECDD		4.77	0.0665	1	4.77e+00	4.77e+00	
1,2,3,4,7,8-HXCDD		4.49	0.0966	0.1	4.49e-01	4.49e-01	
1,2,3,6,7,8-HXCDD		24.7	0.0966	0.1	2.47e+00	2.47e+00	
1,2,3,7,8,9-HXCDD		13.6	0.0798	0.1	1.36e+00	1.36e+00	
1,2,3,4,6,7,8-HPCDD		416	0.312	0.01	4.16e+00	4.16e+00	
OCDD		3800	0.238	0.0003	1.14e+00	1.14e+00	
2,3,7,8-TCDF		6.46	0.0479	0.1	6.46e-01	6.46e-01	
1,2,3,7,8-PECDF		2.15	0.124	0.03	6.45e-02	6.45e-02	
2,3,4,7,8-PECDF		3.75	0.124	0.3	1.13e+00	1.13e+00	
1,2,3,4,7,8-HXCDF		11.1	0.0899	0.1	1.11e+00	1.11e+00	
1,2,3,6,7,8-HXCDF		20.3	0.0899	0.1	2.03e+00	2.03e+00	
1,2,3,7,8,9-HXCDF		0.589	0.0899	0.1	5.89e-02	5.89e-02	
2,3,4,6,7,8-HXCDF		3.90	0.0899	0.1	3.90e-01	3.90e-01	
1,2,3,4,6,7,8-HPCDF		528	0.160	0.01	5.28e+00	5.28e+00	
1,2,3,4,7,8,9-HPCDF		10.5	0.160	0.01	1.05e-01	1.05e-01	
OCDF		279	0.0661	0.0003	8.37e-02	8.37e-02	
			TOTAL TEQ		27.7	27.7	

(1) Where applicable, custom lab flags have been used on this report.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: __________Kristen Bowes_________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_1613-TEQ_L28336-21_TEQ_SJ2310256.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-049-0.15-0.39
Sample Collection:
12-Oct-2017 14:00

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-22 LWi
Matrix:	SOLID	**Sample Size:**	10.3 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	04-Dec-2017 **Time:** 10:42:01	**GC Column ID:**	DB5
Extract Volume (uL):	200	**Sample Data Filename:**	**DX7M_142 S: 68**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	10	**Cal. Ver. Data Filename:**	DX7M_142 S: 57
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	46.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	D	12.1	0.255 (S)	0.78	1.001
1,2,3,7,8-PECDD [4]	D J	42.2	0.274 (S)	0.66	1.001
1,2,3,4,7,8-HXCDD	D J	34.3	0.502 (S)	1.23	1.000
1,2,3,6,7,8-HXCDD	D	222	0.502 (S)	1.23	1.000
1,2,3,7,8,9-HXCDD	D	148	0.502 (S)	1.21	1.010
1,2,3,4,6,7,8-HPCDD	D	2470	0.928 (S)	1.03	1.000
OCDD	D	18600	0.325 (S)	0.89	1.000
2,3,7,8-TCDF	D	24.5	0.187 (S)	0.77	1.001
1,2,3,7,8-PECDF	D J	12.0	0.982 (S)	1.44	1.000
2,3,4,7,8-PECDF	D J	21.1	0.982 (S)	1.52	1.000
1,2,3,4,7,8-HXCDF	D	99.6	0.405 (S)	1.24	1.000
1,2,3,6,7,8-HXCDF	D	213	0.405 (S)	1.17	1.000
1,2,3,7,8,9-HXCDF	D J	5.41	0.405 (S)	1.09	1.000
2,3,4,6,7,8-HXCDF	D J	33.8	0.405 (S)	1.22	1.000
1,2,3,4,6,7,8-HPCDF	D	7620	1.22 (S)	1.01	1.000
1,2,3,4,7,8,9-HPCDF	D	70.9	1.22 (S)	1.03	1.000
OCDF	D	3060	0.266 (S)	0.88	1.002
TOTAL TETRA-DIOXINS	D	116	0.255 (S)		
TOTAL PENTA-DIOXINS	D	351	0.274 (S)		
TOTAL HEXA-DIOXINS	D	1850	0.502 (S)		
TOTAL HEPTA-DIOXINS	D	5790	0.928 (S)		
TOTAL TETRA-FURANS	D	189	0.187 (S)		
TOTAL PENTA-FURANS	D	667	0.982 (S)		
TOTAL HEXA-FURANS	D	4060	0.405 (S)		
TOTAL HEPTA-FURANS	D	15000	1.22 (S)		

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; J = concentration less than lowest calibration equivalent.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-22_Form1A_DX7M_142S68_SJ2312672.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-049-0.15-0.39
Sample Collection:
12-Oct-2017 14:00

Form 2
PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-22 LWi
Matrix:	SOLID	**Sample Size:**	10.3 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	04-Dec-2017 **Time:** 10:42:01	**GC Column ID:**	DB5
Extract Volume (uL):	200	**Sample Data Filename:**	**DX7M_142 S: 68**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	10	**Cal. Ver. Data Filename:**	DX7M_142 S: 57
Concentration Units:	pg absolute	**% Moisture:**	46.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD	D	2000	1260	62.8	0.78	1.013
13C-1,2,3,7,8-PECDD [4]	D	2000	1620	81.1	0.64	1.385
13C-1,2,3,4,7,8-HXCDD	D	2000	1290	64.6	1.31	0.987
13C-1,2,3,6,7,8-HXCDD	D	2000	1390	69.6	1.29	0.990
13C-1,2,3,4,6,7,8-HPCDD	D	2000	1420	71.1	1.07	1.094
13C-OCDD	D	4000	2760	69.0	0.90	1.177
13C-2,3,7,8-TCDF	D	2000	1330	66.4	0.76	0.966
13C-1,2,3,7,8-PECDF	D	2000	1310	65.7	1.57	1.286
13C-2,3,4,7,8-PECDF	D	2000	1390	69.4	1.60	1.354
13C-1,2,3,4,7,8-HXCDF	D	2000	1300	64.8	0.50	0.954
13C-1,2,3,6,7,8-HXCDF	D	2000	1300	64.8	0.51	0.958
13C-1,2,3,7,8,9-HXCDF	D	2000	1250	62.3	0.51	1.005
13C-2,3,4,6,7,8-HXCDF	D	2000	1340	66.9	0.50	0.980
13C-1,2,3,4,6,7,8-HPCDF	D	2000	1400	70.2	0.45	1.062
13C-1,2,3,4,7,8,9-HPCDF	D	2000	1320	65.9	0.47	1.104
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD	D	200	144	71.9		1.001

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-22_Form2_DX7M_142S68_SJ2312672.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A
PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-049-0.15-0.39
Sample Collection:
12-Oct-2017 14:00

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-22 LW
Matrix:	SOLID	**Sample Size:**	10.3 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	02-Dec-2017 **Time:** 07:15:09	**GC Column ID:**	DB225
Extract Volume (uL):	100	**Sample Data Filename:**	**DB73_231A S: 16**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	10	**Cal. Ver. Data Filename:**	DB73_231A S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	46.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD	D	124	0.0487 (Q)	1.23	1.062
2,3,7,8-TCDF	D	15.4	0.124 (S)	0.74	1.001

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-22_Form1A_DB73_231AS16_SJ2314139.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-049-0.15-0.39

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Sample Collection:	12-Oct-2017 14:00		
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-22 LW
Sample Size:	10.3 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_231A S: 16** **DX7M_142 S: 68**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		12.1	0.255	1	1.21e+01	1.21e+01	
1,2,3,7,8-PECDD		42.2	0.274	1	4.22e+01	4.22e+01	
1,2,3,4,7,8-HXCDD		34.3	0.502	0.1	3.43e+00	3.43e+00	
1,2,3,6,7,8-HXCDD		222	0.502	0.1	2.22e+01	2.22e+01	
1,2,3,7,8,9-HXCDD		124	0.0487	0.1	1.24e+01	1.24e+01	
1,2,3,4,6,7,8-HPCDD		2470	0.928	0.01	2.47e+01	2.47e+01	
OCDD		18600	0.325	0.0003	5.58e+00	5.58e+00	
2,3,7,8-TCDF		15.4	0.124	0.1	1.54e+00	1.54e+00	
1,2,3,7,8-PECDF		12.0	0.982	0.03	3.60e-01	3.60e-01	
2,3,4,7,8-PECDF		21.1	0.982	0.3	6.33e+00	6.33e+00	
1,2,3,4,7,8-HXCDF		99.6	0.405	0.1	9.96e+00	9.96e+00	
1,2,3,6,7,8-HXCDF		213	0.405	0.1	2.13e+01	2.13e+01	
1,2,3,7,8,9-HXCDF		5.41	0.405	0.1	5.41e-01	5.41e-01	
2,3,4,6,7,8-HXCDF		33.8	0.405	0.1	3.38e+00	3.38e+00	
1,2,3,4,6,7,8-HPCDF		7620	1.22	0.01	7.62e+01	7.62e+01	
1,2,3,4,7,8,9-HPCDF		70.9	1.22	0.01	7.09e-01	7.09e-01	
OCDF		3060	0.266	0.0003	9.18e-01	9.18e-01	
			TOTAL TEQ		244	244	

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: __________Kristen Bowes_________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-22_TEQ_SJ2314139.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-050-0.0-0.15
Sample Collection:
12-Oct-2017 14:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-23
Matrix:	SOLID	**Sample Size:**	9.98 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 01:37:46	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 93**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	39.5

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		3.34	0.0501 (Q)	0.78	1.001
1,2,3,7,8-PECDD [4]		13.4	0.0501 (Q)	0.61	1.000
1,2,3,4,7,8-HXCDD		9.37	0.120 (S)	1.21	1.000
1,2,3,6,7,8-HXCDD		69.6	0.120 (S)	1.20	1.000
1,2,3,7,8,9-HXCDD		41.1	0.120 (S)	1.28	1.010
1,2,3,4,6,7,8-HPCDD		687	0.227 (S)	1.04	1.000
OCDD	E				
2,3,7,8-TCDF		6.53	0.0501 (Q)	0.77	1.001
1,2,3,7,8-PECDF	J	3.80	0.0637 (S)	1.46	1.001
2,3,4,7,8-PECDF		7.48	0.0637 (S)	1.59	1.001
1,2,3,4,7,8-HXCDF		31.5	0.127 (S)	1.25	1.001
1,2,3,6,7,8-HXCDF		66.0	0.127 (S)	1.25	1.000
1,2,3,7,8,9-HXCDF	J	1.46	0.127 (S)	1.22	1.001
2,3,4,6,7,8-HXCDF		13.2	0.127 (S)	1.25	1.001
1,2,3,4,6,7,8-HPCDF	E				
1,2,3,4,7,8,9-HPCDF		20.7	0.702 (S)	1.05	1.000
OCDF		857	0.0501 (Q)	0.91	1.002
TOTAL TETRA-DIOXINS		43.7	0.0501 (Q)		
TOTAL PENTA-DIOXINS	T	130	0.0501 (Q)		
TOTAL HEXA-DIOXINS		571	0.120 (S)		
TOTAL HEPTA-DIOXINS		1770	0.227 (S)		
TOTAL TETRA-FURANS		70.5	0.0501 (Q)		
TOTAL PENTA-FURANS		231	0.0637 (S)		
TOTAL HEXA-FURANS		1440	0.127 (S)		
TOTAL HEPTA-FURANS	X				

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; X = result reported separately; T = result recalculated against alternate labeled compound(s) or internal standard; E = exceeds calibrated linear range, see dilution data.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-23_Form1A_DX7M_137S93_SJ2310117.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-050-0.0-0.15
Sample Collection:
12-Oct-2017 14:30

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
		Lab Sample I.D.:	L28336-23
Matrix:	SOLID	**Sample Size:**	9.98 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 01:37:46	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 93**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg absolute	**% Moisture:**	39.5

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1340	67.2	0.79	1.013
13C-1,2,3,7,8-PECDD [4]		2000	2060	103	0.66	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1460	72.9	1.26	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1760	88.0	1.26	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1590	79.7	1.05	1.094
13C-OCDD		4000	3350	83.7	0.88	1.177
13C-2,3,7,8-TCDF		2000	1320	65.9	0.76	0.966
13C-1,2,3,7,8-PECDF		2000	1340	66.8	1.55	1.285
13C-2,3,4,7,8-PECDF		2000	1330	66.3	1.57	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1500	75.1	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1490	74.4	0.53	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1490	74.6	0.52	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1500	75.0	0.51	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1750	87.6	0.46	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1320	66.2	0.47	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	140	70.0		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-23_Form2_DX7M_137S93_SJ2310117.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-050-0.0-0.15
Sample Collection:
12-Oct-2017 14:30

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-23 Wi
Matrix:	SOLID	**Sample Size:**	9.98 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	04-Dec-2017 **Time:** 08:51:44	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 66**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 57
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	39.5

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	X				
1,2,3,7,8-PECDD [4]	X				
1,2,3,4,7,8-HXCDD	X				
1,2,3,6,7,8-HXCDD	X				
1,2,3,7,8,9-HXCDD	X				
1,2,3,4,6,7,8-HPCDD	X				
OCDD	D	5660	1.46 (S)	0.88	1.000
2,3,7,8-TCDF	X				
1,2,3,7,8-PECDF	X				
2,3,4,7,8-PECDF	X				
1,2,3,4,7,8-HXCDF	X				
1,2,3,6,7,8-HXCDF	X				
1,2,3,7,8,9-HXCDF	X				
2,3,4,6,7,8-HXCDF	X				
1,2,3,4,6,7,8-HPCDF	D	2560	0.730 (S)	1.01	1.000
1,2,3,4,7,8,9-HPCDF	X				
OCDF	X				
TOTAL TETRA-DIOXINS	X				
TOTAL PENTA-DIOXINS	X				
TOTAL HEXA-DIOXINS	X				
TOTAL HEPTA-DIOXINS	X				
TOTAL TETRA-FURANS	X				
TOTAL PENTA-FURANS	X				
TOTAL HEXA-FURANS	X				
TOTAL HEPTA-FURANS	D	4740	0.730 (S)		

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-23_Form1A_DX7M_142S66_SJ2312670.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-050-0.0-0.15
Sample Collection:
12-Oct-2017 14:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-23 Wi
Matrix:	SOLID	**Sample Size:**	9.98 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	04-Dec-2017 **Time:** 08:51:44	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 66**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 57
Concentration Units:	pg absolute	**% Moisture:**	39.5

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD	X					
13C-1,2,3,7,8-PECDD [4]	X					
13C-1,2,3,4,7,8-HXCDD	X					
13C-1,2,3,6,7,8-HXCDD	X					
13C-1,2,3,4,6,7,8-HPCDD	X					
13C-OCDD	D	4000	2790	69.8	0.92	1.177
13C-2,3,7,8-TCDF	X					
13C-1,2,3,7,8-PECDF	X					
13C-2,3,4,7,8-PECDF	X					
13C-1,2,3,4,7,8-HXCDF	X					
13C-1,2,3,6,7,8-HXCDF	X					
13C-1,2,3,7,8,9-HXCDF	X					
13C-2,3,4,6,7,8-HXCDF	X					
13C-1,2,3,4,6,7,8-HPCDF	D	2000	1550	77.6	0.46	1.062
13C-1,2,3,4,7,8,9-HPCDF	D	2000	1500	74.8	0.45	1.104
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD	X					

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-23_Form2_DX7M_142S66_SJ2312670.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-050-0.0-0.15
Sample Collection:
12-Oct-2017 14:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-23
Matrix:	SOLID	**Sample Size:**	9.98 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 05:32:09	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_217 S: 15**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_217 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	39.5

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		39.7	0.471 (S)	1.25	1.062
2,3,7,8-TCDF		3.43	0.0963 (S)	0.83	1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-23_Form1A_DB73_217S15_SJ2310258.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-050-0.0-0.15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Sample Collection:	12-Oct-2017 14:30
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-23
Sample Size:	9.98 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_217 S: 15** **DX7M_137 S: 93** **DX7M_142 S: 66**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		3.34	0.0501	1	3.34e+00	3.34e+00	
1,2,3,7,8-PECDD		13.4	0.0501	1	1.34e+01	1.34e+01	
1,2,3,4,7,8-HXCDD		9.37	0.120	0.1	9.37e-01	9.37e-01	
1,2,3,6,7,8-HXCDD		69.6	0.120	0.1	6.96e+00	6.96e+00	
1,2,3,7,8,9-HXCDD		39.7	0.471	0.1	3.97e+00	3.97e+00	
1,2,3,4,6,7,8-HPCDD		687	0.227	0.01	6.87e+00	6.87e+00	
OCDD		5660	1.46	0.0003	1.70e+00	1.70e+00	
2,3,7,8-TCDF		3.43	0.0963	0.1	3.43e-01	3.43e-01	
1,2,3,7,8-PECDF		3.80	0.0637	0.03	1.14e-01	1.14e-01	
2,3,4,7,8-PECDF		7.48	0.0637	0.3	2.24e+00	2.24e+00	
1,2,3,4,7,8-HXCDF		31.5	0.127	0.1	3.15e+00	3.15e+00	
1,2,3,6,7,8-HXCDF		66.0	0.127	0.1	6.60e+00	6.60e+00	
1,2,3,7,8,9-HXCDF		1.46	0.127	0.1	1.46e-01	1.46e-01	
2,3,4,6,7,8-HXCDF		13.2	0.127	0.1	1.32e+00	1.32e+00	
1,2,3,4,6,7,8-HPCDF		2560	0.730	0.01	2.56e+01	2.56e+01	
1,2,3,4,7,8,9-HPCDF		20.7	0.702	0.01	2.07e-01	2.07e-01	
OCDF		857	0.0501	0.0003	2.57e-01	2.57e-01	
			TOTAL TEQ		77.2	77.2	

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_1613-TEQ_L28336-23_TEQ_SJ2310258.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-051-0.0-0.15
Sample Collection:
12-Oct-2017 14:50

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-24
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 02:32:54	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 94**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	47.8

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		17.5	0.0571 (S)	0.79	1.001
1,2,3,7,8-PECDD [4]		48.1	0.0627 (S)	0.62	1.000
1,2,3,4,7,8-HXCDD		37.8	0.179 (S)	1.28	1.000
1,2,3,6,7,8-HXCDD		216	0.179 (S)	1.23	1.000
1,2,3,7,8,9-HXCDD		143	0.179 (S)	1.25	1.010
1,2,3,4,6,7,8-HPCDD	E				
OCDD	E				
2,3,7,8-TCDF		28.8	0.218 (S)	0.76	1.001
1,2,3,7,8-PECDF		8.26	0.109 (S)	1.54	1.000
2,3,4,7,8-PECDF		13.5	0.109 (S)	1.58	1.000
1,2,3,4,7,8-HXCDF		72.6	0.181 (S)	1.24	1.001
1,2,3,6,7,8-HXCDF		118	0.181 (S)	1.26	1.000
1,2,3,7,8,9-HXCDF	J	2.77	0.181 (S)	1.21	1.000
2,3,4,6,7,8-HXCDF		23.0	0.181 (S)	1.23	1.001
1,2,3,4,6,7,8-HPCDF	E				
1,2,3,4,7,8,9-HPCDF		54.8	0.382 (S)	1.06	1.000
OCDF		2110	0.269 (S)	0.90	1.002
TOTAL TETRA-DIOXINS		133	0.0571 (S)		
TOTAL PENTA-DIOXINS	T	420	0.0627 (S)		
TOTAL HEXA-DIOXINS		1860	0.179 (S)		
TOTAL HEPTA-DIOXINS	X				
TOTAL TETRA-FURANS		182	0.218 (S)		
TOTAL PENTA-FURANS		468	0.109 (S)		
TOTAL HEXA-FURANS		2960	0.181 (S)		
TOTAL HEPTA-FURANS	X				

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; X = result reported separately; T = result recalculated against alternate labeled compound(s) or internal standard; E = exceeds calibrated linear range, see dilution data.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-24_Form1A_DX7M_137S94_SJ2310118.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-051-0.0-0.15
Sample Collection:
12-Oct-2017 14:50

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-24
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 02:32:54	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 94**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg absolute	**% Moisture:**	47.8

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	807	40.3	0.77	1.014
13C-1,2,3,7,8-PECDD [4]		2000	1150	57.7	0.64	1.384
13C-1,2,3,4,7,8-HXCDD		2000	847	42.3	1.23	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1100	55.1	1.25	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	942	47.1	1.03	1.094
13C-OCDD		4000	2160	53.9	0.90	1.178
13C-2,3,7,8-TCDF		2000	766	38.3	0.74	0.966
13C-1,2,3,7,8-PECDF		2000	802	40.1	1.57	1.285
13C-2,3,4,7,8-PECDF		2000	811	40.5	1.58	1.353
13C-1,2,3,4,7,8-HXCDF		2000	834	41.7	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	801	40.0	0.52	0.959
13C-1,2,3,7,8,9-HXCDF		2000	812	40.6	0.51	1.005
13C-2,3,4,6,7,8-HXCDF		2000	848	42.4	0.52	0.981
13C-1,2,3,4,6,7,8-HPCDF		2000	995	49.8	0.46	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	753	37.6	0.43	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	84.6	42.3		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-24_Form2_DX7M_137S94_SJ2310118.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-051-0.0-0.15
Sample Collection:
12-Oct-2017 14:50

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-24 W
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	03-Dec-2017 **Time:** 09:39:18	**GC Column ID:**	DB5
Extract Volume (uL):	200	**Sample Data Filename:**	**DX7M_142 S: 41**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	10	**Cal. Ver. Data Filename:**	DX7M_142 S: 33
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	47.8

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	X				
1,2,3,7,8-PECDD [4]	X				
1,2,3,4,7,8-HXCDD	X				
1,2,3,6,7,8-HXCDD	X				
1,2,3,7,8,9-HXCDD	X				
1,2,3,4,6,7,8-HPCDD	D	2910	2.03 (S)	1.01	1.000
OCDD	D	21700	3.00 (S)	0.89	1.000
2,3,7,8-TCDF	X				
1,2,3,7,8-PECDF	X				
2,3,4,7,8-PECDF	X				
1,2,3,4,7,8-HXCDF	X				
1,2,3,6,7,8-HXCDF	X				
1,2,3,7,8,9-HXCDF	X				
2,3,4,6,7,8-HXCDF	X				
1,2,3,4,6,7,8-HPCDF	D	4990	1.46 (S)	1.02	1.000
1,2,3,4,7,8,9-HPCDF	X				
OCDF	X				
TOTAL TETRA-DIOXINS	X				
TOTAL PENTA-DIOXINS	X				
TOTAL HEXA-DIOXINS	X				
TOTAL HEPTA-DIOXINS	D	6770	2.03 (S)		
TOTAL TETRA-FURANS	X				
TOTAL PENTA-FURANS	X				
TOTAL HEXA-FURANS	X				
TOTAL HEPTA-FURANS	D	9620	1.46 (S)		

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-24_Form1A_DX7M_142S41_SJ2313078.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-051-0.0-0.15
Sample Collection:
12-Oct-2017 14:50

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-24 W
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	03-Dec-2017 **Time:** 09:39:18	**GC Column ID:**	DB5
Extract Volume (uL):	200	**Sample Data Filename:**	**DX7M_142 S: 41**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	10	**Cal. Ver. Data Filename:**	DX7M_142 S: 33
Concentration Units:	pg absolute	**% Moisture:**	47.8

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD	X					
13C-1,2,3,7,8-PECDD [4]	X					
13C-1,2,3,4,7,8-HXCDD	X					
13C-1,2,3,6,7,8-HXCDD	X					
13C-1,2,3,4,6,7,8-HPCDD	D	2000	891	44.5	0.98	1.094
13C-OCDD	D	4000	1730	43.3	0.91	1.177
13C-2,3,7,8-TCDF	X					
13C-1,2,3,7,8-PECDF	X					
13C-2,3,4,7,8-PECDF	X					
13C-1,2,3,4,7,8-HXCDF	X					
13C-1,2,3,6,7,8-HXCDF	X					
13C-1,2,3,7,8,9-HXCDF	X					
13C-2,3,4,6,7,8-HXCDF	X					
13C-1,2,3,4,6,7,8-HPCDF	D	2000	929	46.4	0.46	1.062
13C-1,2,3,4,7,8,9-HPCDF	D	2000	878	43.9	0.48	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD	X					

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-24_Form2_DX7M_142S41_SJ2313078.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-051-0.0-0.15
Sample Collection:
12-Oct-2017 14:50

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-24
Matrix:	SOLID	**Sample Size:**	10.7 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 06:13:21	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_217 S: 16**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_217 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	47.8

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		152	0.287 (S)	1.25	1.062
2,3,7,8-TCDF		22.2	0.0906 (S)	0.76	1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-24_Form1A_DB73_217S16_SJ2310259.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-051-0.0-0.15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Sample Collection:	12-Oct-2017 14:50
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-24
Sample Size:	10.7 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_217 S: 16 DX7M_137 S: 94 DX7M_142 S: 41**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		17.5	0.0571	1	1.75e+01	1.75e+01	
1,2,3,7,8-PECDD		48.1	0.0627	1	4.81e+01	4.81e+01	
1,2,3,4,7,8-HXCDD		37.8	0.179	0.1	3.78e+00	3.78e+00	
1,2,3,6,7,8-HXCDD		216	0.179	0.1	2.16e+01	2.16e+01	
1,2,3,7,8,9-HXCDD		152	0.287	0.1	1.52e+01	1.52e+01	
1,2,3,4,6,7,8-HPCDD		2910	2.03	0.01	2.91e+01	2.91e+01	
OCDD		21700	3.00	0.0003	6.51e+00	6.51e+00	
2,3,7,8-TCDF		22.2	0.0906	0.1	2.22e+00	2.22e+00	
1,2,3,7,8-PECDF		8.26	0.109	0.03	2.48e-01	2.48e-01	
2,3,4,7,8-PECDF		13.5	0.109	0.3	4.05e+00	4.05e+00	
1,2,3,4,7,8-HXCDF		72.6	0.181	0.1	7.26e+00	7.26e+00	
1,2,3,6,7,8-HXCDF		118	0.181	0.1	1.18e+01	1.18e+01	
1,2,3,7,8,9-HXCDF		2.77	0.181	0.1	2.77e-01	2.77e-01	
2,3,4,6,7,8-HXCDF		23.0	0.181	0.1	2.30e+00	2.30e+00	
1,2,3,4,6,7,8-HPCDF		4990	1.46	0.01	4.99e+01	4.99e+01	
1,2,3,4,7,8,9-HPCDF		54.8	0.382	0.01	5.48e-01	5.48e-01	
OCDF		2110	0.269	0.0003	6.33e-01	6.33e-01	
			TOTAL TEQ		221	221	

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-24_TEQ_SJ2310259.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-051-0.15-0.36
Sample Collection:
12-Oct-2017 14:50

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-25
Matrix:	SOLID	**Sample Size:**	10.9 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 03:28:01	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 95**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	39.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		1.45	0.0460 (Q)	0.79	1.001
1,2,3,7,8-PECDD [4]		7.52	0.0460 (Q)	0.64	1.001
1,2,3,4,7,8-HXCDD		5.27	0.108 (S)	1.20	1.000
1,2,3,6,7,8-HXCDD		46.0	0.108 (S)	1.21	1.000
1,2,3,7,8,9-HXCDD		24.3	0.108 (S)	1.22	1.010
1,2,3,4,6,7,8-HPCDD		381	0.216 (S)	1.05	1.000
OCDD		3660	0.0640 (S)	0.89	1.000
2,3,7,8-TCDF		2.46	0.0460 (Q)	0.74	1.002
1,2,3,7,8-PECDF	J	2.38	0.0659 (S)	1.63	1.001
2,3,4,7,8-PECDF	J	4.58	0.0659 (S)	1.53	1.000
1,2,3,4,7,8-HXCDF		22.2	0.117 (S)	1.23	1.000
1,2,3,6,7,8-HXCDF		47.1	0.117 (S)	1.26	1.000
1,2,3,7,8,9-HXCDF	J	1.05	0.117 (S)	1.27	1.001
2,3,4,6,7,8-HXCDF		9.14	0.117 (S)	1.27	1.001
1,2,3,4,6,7,8-HPCDF	E				
1,2,3,4,7,8,9-HPCDF		14.7	0.182 (S)	1.10	1.000
OCDF		715	0.105 (S)	0.89	1.002
TOTAL TETRA-DIOXINS		28.6	0.0460 (Q)		
TOTAL PENTA-DIOXINS	T	58.6	0.0460 (Q)		
TOTAL HEXA-DIOXINS		374	0.108 (S)		
TOTAL HEPTA-DIOXINS		1090	0.216 (S)		
TOTAL TETRA-FURANS		31.9	0.0460 (Q)		
TOTAL PENTA-FURANS		151	0.0659 (S)		
TOTAL HEXA-FURANS		1220	0.117 (S)		
TOTAL HEPTA-FURANS	X				

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; X = result reported separately; T = result recalculated against alternate labeled compound(s) or internal standard; E = exceeds calibrated linear range, see dilution data.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-25_Form1A_DX7M_137S95_SJ2310119.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-051-0.15-0.36
Sample Collection:
12-Oct-2017 14:50

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-25
Matrix:	SOLID	**Sample Size:**	10.9 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 03:28:01	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 95**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg absolute	**% Moisture:**	39.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1500	75.0	0.77	1.013
13C-1,2,3,7,8-PECDD [4]		2000	2170	109	0.64	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1380	69.0	1.27	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1690	84.3	1.23	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1390	69.5	1.03	1.094
13C-OCDD		4000	2580	64.5	0.92	1.177
13C-2,3,7,8-TCDF		2000	1470	73.6	0.76	0.966
13C-1,2,3,7,8-PECDF		2000	1430	71.3	1.57	1.286
13C-2,3,4,7,8-PECDF		2000	1430	71.6	1.57	1.353
13C-1,2,3,4,7,8-HXCDF		2000	1440	71.9	0.51	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1420	70.8	0.52	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1380	69.2	0.51	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1430	71.4	0.52	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1590	79.6	0.45	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1190	59.4	0.46	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	167	83.3		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-25_Form2_DX7M_137S95_SJ2310119.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-051-0.15-0.36
Sample Collection:
12-Oct-2017 14:50

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-25 W
Matrix:	SOLID	**Sample Size:**	10.9 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	03-Dec-2017 **Time:** 10:34:26	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 42**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 33
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	39.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	X				
1,2,3,7,8-PECDD [4]	X				
1,2,3,4,7,8-HXCDD	X				
1,2,3,6,7,8-HXCDD	X				
1,2,3,7,8,9-HXCDD	X				
1,2,3,4,6,7,8-HPCDD	X				
OCDD	X				
2,3,7,8-TCDF	X				
1,2,3,7,8-PECDF	X				
2,3,4,7,8-PECDF	X				
1,2,3,4,7,8-HXCDF	X				
1,2,3,6,7,8-HXCDF	X				
1,2,3,7,8,9-HXCDF	X				
2,3,4,6,7,8-HXCDF	X				
1,2,3,4,6,7,8-HPCDF	D	2310	0.548 (S)	1.02	1.000
1,2,3,4,7,8,9-HPCDF	X				
OCDF	X				
TOTAL TETRA-DIOXINS	X				
TOTAL PENTA-DIOXINS	X				
TOTAL HEXA-DIOXINS	X				
TOTAL HEPTA-DIOXINS	X				
TOTAL TETRA-FURANS	X				
TOTAL PENTA-FURANS	X				
TOTAL HEXA-FURANS	X				
TOTAL HEPTA-FURANS	D	4200	0.548 (S)		

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-25_Form1A_DX7M_142S42_SJ2313079.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-051-0.15-0.36
Sample Collection:
12-Oct-2017 14:50

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-25 W
Matrix:	SOLID	**Sample Size:**	10.9 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	03-Dec-2017 **Time:** 10:34:26	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 42**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 33
Concentration Units:	pg absolute	**% Moisture:**	39.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD	X					
13C-1,2,3,7,8-PECDD [4]	X					
13C-1,2,3,4,7,8-HXCDD	X					
13C-1,2,3,6,7,8-HXCDD	X					
13C-1,2,3,4,6,7,8-HPCDD	X					
13C-OCDD	X					
13C-2,3,7,8-TCDF	X					
13C-1,2,3,7,8-PECDF	X					
13C-2,3,4,7,8-PECDF	X					
13C-1,2,3,4,7,8-HXCDF	X					
13C-1,2,3,6,7,8-HXCDF	X					
13C-1,2,3,7,8,9-HXCDF	X					
13C-2,3,4,6,7,8-HXCDF	X					
13C-1,2,3,4,6,7,8-HPCDF	D	2000	1470	73.6	0.44	1.062
13C-1,2,3,4,7,8,9-HPCDF	D	2000	1390	69.5	0.47	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD	X					

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-25_Form2_DX7M_142S42_SJ2313079.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-051-0.15-0.36
Sample Collection:
12-Oct-2017 14:50

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-25
Sample Receipt Date:	16-Oct-2017	**Sample Size:**	10.9 g (dry)
Extraction Date:	03-Nov-2017	**Initial Calibration Date:**	19-Sep-2017
Analysis Date:	18-Nov-2017 **Time:** 11:02:57	**Instrument ID:**	HR GC/MS
Extract Volume (uL):	20	**GC Column ID:**	DB225
Injection Volume (uL):	2.0	**Sample Data Filename:**	**DB73_218 S: 6**
Dilution Factor:	N/A	**Blank Data Filename:**	DX7M_137 S: 82
Concentration Units:	pg/g (dry weight basis)	**Cal. Ver. Data Filename:**	DB73_218 S: 2
		% Moisture:	39.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		23.0	0.0460 (Q)	1.22	1.062
2,3,7,8-TCDF	J	0.732	0.0460 (Q)	0.87	1.002

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-25_Form1A_DB73_218S6_SJ2310281.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-051-0.15-0.36

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Sample Collection:	12-Oct-2017 14:50		
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-25
Sample Size:	10.9 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DX73_218 S: 6 DX7M_137 S: 95 DX7M_142 S: 42**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		1.45	0.0460	1	1.45e+00	1.45e+00	
1,2,3,7,8-PECDD		7.52	0.0460	1	7.52e+00	7.52e+00	
1,2,3,4,7,8-HXCDD		5.27	0.108	0.1	5.27e-01	5.27e-01	
1,2,3,6,7,8-HXCDD		46.0	0.108	0.1	4.60e+00	4.60e+00	
1,2,3,7,8,9-HXCDD		23.0	0.0460	0.1	2.30e+00	2.30e+00	
1,2,3,4,6,7,8-HPCDD		381	0.216	0.01	3.81e+00	3.81e+00	
OCDD		3660	0.0640	0.0003	1.10e+00	1.10e+00	
2,3,7,8-TCDF		0.732	0.0460	0.1	7.32e-02	7.32e-02	
1,2,3,7,8-PECDF		2.38	0.0659	0.03	7.14e-02	7.14e-02	
2,3,4,7,8-PECDF		4.58	0.0659	0.3	1.37e+00	1.37e+00	
1,2,3,4,7,8-HXCDF		22.2	0.117	0.1	2.22e+00	2.22e+00	
1,2,3,6,7,8-HXCDF		47.1	0.117	0.1	4.71e+00	4.71e+00	
1,2,3,7,8,9-HXCDF		1.05	0.117	0.1	1.05e-01	1.05e-01	
2,3,4,6,7,8-HXCDF		9.14	0.117	0.1	9.14e-01	9.14e-01	
1,2,3,4,6,7,8-HPCDF		2310	0.548	0.01	2.31e+01	2.31e+01	
1,2,3,4,7,8,9-HPCDF		14.7	0.182	0.01	1.47e-01	1.47e-01	
OCDF		715	0.105	0.0003	2.15e-01	2.15e-01	
			TOTAL TEQ		54.2	54.2	

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-25_TEQ_SJ2310281.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.0-0.15
Sample Collection:
12-Oct-2017 15:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-26
Matrix:	SOLID	**Sample Size:**	10.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 04:23:10	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 96**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	34.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		1.15	0.0480 (Q)	0.76	1.001
1,2,3,7,8-PECDD [4]	J	2.70	0.0480 (Q)	0.60	1.000
1,2,3,4,7,8-HXCDD	J	2.44	0.0772 (S)	1.16	1.000
1,2,3,6,7,8-HXCDD		14.3	0.0772 (S)	1.26	1.000
1,2,3,7,8,9-HXCDD		9.44	0.0772 (S)	1.24	1.010
1,2,3,4,6,7,8-HPCDD		197	0.200 (S)	1.04	1.000
OCDD		1690	0.0660 (S)	0.89	1.000
2,3,7,8-TCDF		3.27	0.0480 (Q)	0.80	1.001
1,2,3,7,8-PECDF	J	1.46	0.0482 (S)	1.56	1.000
2,3,4,7,8-PECDF	J	2.00	0.0482 (S)	1.59	1.001
1,2,3,4,7,8-HXCDF		8.15	0.0625 (S)	1.21	1.001
1,2,3,6,7,8-HXCDF		15.8	0.0625 (S)	1.27	1.000
1,2,3,7,8,9-HXCDF	J	0.457	0.0625 (S)	1.41	1.000
2,3,4,6,7,8-HXCDF	J	2.68	0.0625 (S)	1.12	1.000
1,2,3,4,6,7,8-HPCDF		373	0.138 (S)	1.05	1.000
1,2,3,4,7,8,9-HPCDF		7.60	0.138 (S)	0.97	1.000
OCDF		179	0.0480 (Q)	0.90	1.002
TOTAL TETRA-DIOXINS		15.3	0.0480 (Q)		
TOTAL PENTA-DIOXINS	T	32.2	0.0480 (Q)		
TOTAL HEXA-DIOXINS		128	0.0772 (S)		
TOTAL HEPTA-DIOXINS		476	0.200 (S)		
TOTAL TETRA-FURANS		35.5	0.0480 (Q)		
TOTAL PENTA-FURANS		65.8	0.0482 (S)		
TOTAL HEXA-FURANS		218	0.0625 (S)		
TOTAL HEPTA-FURANS		719	0.138 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-26_Form1A_DX7M_137S96_SJ2310120.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-052-0.0-0.15
Sample Collection:
12-Oct-2017 15:15

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-26
Matrix:	SOLID	**Sample Size:**	10.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 04:23:10	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 96**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg absolute	**% Moisture:**	34.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	**LAB FLAG** [1]	**SPIKE CONC.**	**CONC. FOUND**	**R(%)** [2]	**ION ABUND. RATIO** [3]	**RRT** [3]
13C-2,3,7,8-TCDD		2000	1660	82.8	0.78	1.013
13C-1,2,3,7,8-PECDD [4]		2000	2140	107	0.65	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1610	80.5	1.27	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1840	92.1	1.24	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1660	83.1	1.03	1.094
13C-OCDD		4000	3290	82.4	0.90	1.177
13C-2,3,7,8-TCDF		2000	1610	80.3	0.76	0.966
13C-1,2,3,7,8-PECDF		2000	1560	77.8	1.56	1.285
13C-2,3,4,7,8-PECDF		2000	1580	78.8	1.57	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1630	81.3	0.51	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1610	80.3	0.52	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1630	81.3	0.51	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1660	82.8	0.52	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1640	82.1	0.45	1.061
13C-1,2,3,4,7,8,9-HPCDF		2000	1550	77.5	0.45	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	170	84.8		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: ________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-26_Form2_DX7M_137S96_SJ2310120.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.0-0.15
Sample Collection:
12-Oct-2017 15:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No.	MUNGER LANDING SEDIMENT J170470		
Contract No.:	4819	**Lab Sample I.D.:**	L28336-26
Matrix:	SOLID	**Sample Size:**	10.4 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 11:44:13	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_218 S: 7**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_218 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	34.9

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		8.66	0.0966 (S)	1.28	1.060
2,3,7,8-TCDF		2.36	0.0480 (Q)	0.77	1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-26_Form1A_DB73_218S7_SJ2310282.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.0-0.15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Sample Collection:	12-Oct-2017 15:15		
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-26
Sample Size:	10.4 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_218 S: 7** **DX7M_137 S: 96**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		1.15	0.0480	1	1.15e+00	1.15e+00	
1,2,3,7,8-PECDD		2.70	0.0480	1	2.70e+00	2.70e+00	
1,2,3,4,7,8-HXCDD		2.44	0.0772	0.1	2.44e-01	2.44e-01	
1,2,3,6,7,8-HXCDD		14.3	0.0772	0.1	1.43e+00	1.43e+00	
1,2,3,7,8,9-HXCDD		8.66	0.0966	0.1	8.66e-01	8.66e-01	
1,2,3,4,6,7,8-HPCDD		197	0.200	0.01	1.97e+00	1.97e+00	
OCDD		1690	0.0660	0.0003	5.07e-01	5.07e-01	
2,3,7,8-TCDF		2.36	0.0480	0.1	2.36e-01	2.36e-01	
1,2,3,7,8-PECDF		1.46	0.0482	0.03	4.38e-02	4.38e-02	
2,3,4,7,8-PECDF		2.00	0.0482	0.3	6.00e-01	6.00e-01	
1,2,3,4,7,8-HXCDF		8.15	0.0625	0.1	8.15e-01	8.15e-01	
1,2,3,6,7,8-HXCDF		15.8	0.0625	0.1	1.58e+00	1.58e+00	
1,2,3,7,8,9-HXCDF		0.457	0.0625	0.1	4.57e-02	4.57e-02	
2,3,4,6,7,8-HXCDF		2.68	0.0625	0.1	2.68e-01	2.68e-01	
1,2,3,4,6,7,8-HPCDF		373	0.138	0.01	3.73e+00	3.73e+00	
1,2,3,4,7,8,9-HPCDF		7.60	0.138	0.01	7.60e-02	7.60e-02	
OCDF		179	0.0480	0.0003	5.37e-02	5.37e-02	
			TOTAL TEQ		16.3	16.3	

(1) Where applicable, custom lab flags have been used on this report.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_1613-TEQ_L28336-26_TEQ_SJ2310282.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44
Sample Collection:
12-Oct-2017 15:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No.	MUNGER LANDING SEDIMENT J170470		
Contract No.:	4819	**Lab Sample I.D.:**	L28336-27 (A)
Matrix:	SOLID	**Sample Size:**	9.92 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 13:49:39	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 7**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	33.6

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	J	0.438	0.0504 (Q)	0.84	1.001
1,2,3,7,8-PECDD [4]	J	1.11	0.0670 (S)	0.68	1.000
1,2,3,4,7,8-HXCDD	J	1.20	0.103 (S)	1.25	1.000
1,2,3,6,7,8-HXCDD		5.67	0.103 (S)	1.23	1.000
1,2,3,7,8,9-HXCDD	J	3.96	0.103 (S)	1.14	1.010
1,2,3,4,6,7,8-HPCDD		81.6	0.151 (S)	1.05	1.000
OCDD		665	0.0532 (S)	0.89	1.000
2,3,7,8-TCDF		1.19	0.0939 (S)	0.73	1.001
1,2,3,7,8-PECDF	J	0.574	0.0504 (Q)	1.35	1.000
2,3,4,7,8-PECDF	J	0.788	0.0504 (Q)	1.66	1.000
1,2,3,4,7,8-HXCDF	J	3.19	0.0504 (Q)	1.25	1.001
1,2,3,6,7,8-HXCDF		7.07	0.0504 (Q)	1.31	1.000
1,2,3,7,8,9-HXCDF	J	0.189	0.0504 (Q)	1.21	1.001
2,3,4,6,7,8-HXCDF	J	1.12	0.0504 (Q)	1.42	1.000
1,2,3,4,6,7,8-HPCDF		148	0.0739 (S)	1.05	1.000
1,2,3,4,7,8,9-HPCDF	J	2.96	0.0739 (S)	1.05	1.000
OCDF		71.2	0.0584 (S)	0.89	1.002
TOTAL TETRA-DIOXINS		8.68	0.0504 (Q)		
TOTAL PENTA-DIOXINS	T	15.4	0.0670 (S)		
TOTAL HEXA-DIOXINS		52.0	0.103 (S)		
TOTAL HEPTA-DIOXINS		190	0.151 (S)		
TOTAL TETRA-FURANS		12.3	0.0939 (S)		
TOTAL PENTA-FURANS		24.3	0.0504 (Q)		
TOTAL HEXA-FURANS		85.8	0.0504 (Q)		
TOTAL HEPTA-FURANS		293	0.0739 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: ________Kristen Bowes_______

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-27_Form1A_DX7M_138DS7_SJ2310182.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44
Sample Collection:
12-Oct-2017 15:15

Form 2
PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-27 (A)
Matrix:	SOLID	**Sample Size:**	9.92 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 13:49:39	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 7**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg absolute	**% Moisture:**	33.6

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1570	78.6	0.78	1.013
13C-1,2,3,7,8-PECDD [4]		2000	2180	109	0.64	1.383
13C-1,2,3,4,7,8-HXCDD		2000	1680	84.2	1.28	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1680	84.0	1.23	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1830	91.6	1.06	1.094
13C-OCDD		4000	3860	96.5	0.89	1.177
13C-2,3,7,8-TCDF		2000	1560	77.9	0.77	0.966
13C-1,2,3,7,8-PECDF		2000	1640	81.9	1.59	1.284
13C-2,3,4,7,8-PECDF		2000	1700	85.1	1.54	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1720	85.8	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1580	79.2	0.53	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1640	81.8	0.52	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1590	79.4	0.53	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1740	87.2	0.45	1.061
13C-1,2,3,4,7,8,9-HPCDF		2000	1760	87.8	0.45	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	164	82.2		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-27_Form2_DX7M_138DS7_SJ2310182.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44
Sample Collection:
12-Oct-2017 15:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-27 (A)
Matrix:	SOLID	**Sample Size:**	9.92 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 12:25:29	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_218 S: 8**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_218 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	33.6

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD	J	3.39	0.106 (S)	1.33	1.062
2,3,7,8-TCDF	J	0.784	0.0504 (Q)	0.79	1.001

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-27_Form1A_DB73_218S8_SJ2310283.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Sample Collection:	12-Oct-2017 15:15
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-27 (A)
Sample Size:	9.92 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_218 S: 8** **DX7M_138D S: 7**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		0.438	0.0504	1	4.38e-01	4.38e-01	
1,2,3,7,8-PECDD		1.11	0.0670	1	1.11e+00	1.11e+00	
1,2,3,4,7,8-HXCDD		1.20	0.103	0.1	1.20e-01	1.20e-01	
1,2,3,6,7,8-HXCDD		5.67	0.103	0.1	5.67e-01	5.67e-01	
1,2,3,7,8,9-HXCDD		3.39	0.106	0.1	3.39e-01	3.39e-01	
1,2,3,4,6,7,8-HPCDD		81.6	0.151	0.01	8.16e-01	8.16e-01	
OCDD		665	0.0532	0.0003	2.00e-01	2.00e-01	
2,3,7,8-TCDF		0.784	0.0504	0.1	7.84e-02	7.84e-02	
1,2,3,7,8-PECDF		0.574	0.0504	0.03	1.72e-02	1.72e-02	
2,3,4,7,8-PECDF		0.788	0.0504	0.3	2.36e-01	2.36e-01	
1,2,3,4,7,8-HXCDF		3.19	0.0504	0.1	3.19e-01	3.19e-01	
1,2,3,6,7,8-HXCDF		7.07	0.0504	0.1	7.07e-01	7.07e-01	
1,2,3,7,8,9-HXCDF		0.189	0.0504	0.1	1.89e-02	1.89e-02	
2,3,4,6,7,8-HXCDF		1.12	0.0504	0.1	1.12e-01	1.12e-01	
1,2,3,4,6,7,8-HPCDF		148	0.0739	0.01	1.48e+00	1.48e+00	
1,2,3,4,7,8,9-HPCDF		2.96	0.0739	0.01	2.96e-02	2.96e-02	
OCDF		71.2	0.0584	0.0003	2.14e-02	2.14e-02	
			TOTAL TEQ		6.61	6.61	

(1) Where applicable, custom lab flags have been used on this report.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-27_TEQ_SJ2310283.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-054-0.0-0.15
Sample Collection:
12-Oct-2017 15:30

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-28
Matrix:	SOLID	**Sample Size:**	10.1 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 05:18:17	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 97**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	49.4

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		7.08	0.0530 (S)	0.79	1.001
1,2,3,7,8-PECDD [4]		17.2	0.0846 (S)	0.60	1.001
1,2,3,4,7,8-HXCDD		14.6	0.173 (S)	1.15	1.000
1,2,3,6,7,8-HXCDD		90.1	0.173 (S)	1.23	1.000
1,2,3,7,8,9-HXCDD		50.8	0.173 (S)	1.22	1.010
1,2,3,4,6,7,8-HPCDD		1240	0.384 (S)	1.03	1.000
OCDD	E				
2,3,7,8-TCDF		21.1	0.0596 (S)	0.79	1.002
1,2,3,7,8-PECDF		6.81	0.130 (S)	1.46	1.001
2,3,4,7,8-PECDF		12.4	0.130 (S)	1.57	1.001
1,2,3,4,7,8-HXCDF		76.1	0.122 (S)	1.26	1.001
1,2,3,6,7,8-HXCDF		75.0	0.122 (S)	1.25	1.000
1,2,3,7,8,9-HXCDF	J	2.55	0.122 (S)	1.27	1.000
2,3,4,6,7,8-HXCDF		14.8	0.122 (S)	1.23	1.000
1,2,3,4,6,7,8-HPCDF		2230	0.198 (S)	1.05	1.000
1,2,3,4,7,8,9-HPCDF		70.4	0.198 (S)	1.05	1.000
OCDF		1180	0.0495 (Q)	0.92	1.002
TOTAL TETRA-DIOXINS		52.9	0.0530 (S)		
TOTAL PENTA-DIOXINS	T	160	0.0846 (S)		
TOTAL HEXA-DIOXINS		656	0.173 (S)		
TOTAL HEPTA-DIOXINS		3040	0.384 (S)		
TOTAL TETRA-FURANS		179	0.0596 (S)		
TOTAL PENTA-FURANS		358	0.130 (S)		
TOTAL HEXA-FURANS		1370	0.122 (S)		
TOTAL HEPTA-FURANS		4620	0.198 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard; E = exceeds calibrated linear range, see dilution data.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: ________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-28_Form1A_DX7M_137S97_SJ2310121.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-054-0.0-0.15
Sample Collection:
12-Oct-2017 15:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-28
Matrix:	SOLID	**Sample Size:**	10.1 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 05:18:17	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 97**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg absolute	**% Moisture:**	49.4

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1060	52.9	0.77	1.014
13C-1,2,3,7,8-PECDD [4]		2000	1510	75.7	0.66	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1060	52.9	1.27	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1740	87.2	1.22	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1110	55.3	0.99	1.094
13C-OCDD		4000	2270	56.7	0.89	1.177
13C-2,3,7,8-TCDF		2000	921	46.0	0.76	0.966
13C-1,2,3,7,8-PECDF		2000	933	46.7	1.59	1.285
13C-2,3,4,7,8-PECDF		2000	933	46.6	1.55	1.353
13C-1,2,3,4,7,8-HXCDF		2000	1070	53.3	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1060	52.8	0.52	0.959
13C-1,2,3,7,8,9-HXCDF		2000	1110	55.7	0.51	1.005
13C-2,3,4,6,7,8-HXCDF		2000	1150	57.5	0.52	0.981
13C-1,2,3,4,6,7,8-HPCDF		2000	1080	54.2	0.45	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	932	46.6	0.45	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	120	60.2		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-28_Form2_DX7M_137S97_SJ2310121.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-054-0.0-0.15
Sample Collection:
12-Oct-2017 15:30

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-28 W
Matrix:	SOLID	**Sample Size:**	10.1 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	03-Dec-2017 **Time:** 11:29:39	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 43**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 33
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	49.4

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	X				
1,2,3,7,8-PECDD [4]	X				
1,2,3,4,7,8-HXCDD	X				
1,2,3,6,7,8-HXCDD	X				
1,2,3,7,8,9-HXCDD	X				
1,2,3,4,6,7,8-HPCDD	X				
OCDD	D	11100	1.25 (S)	0.89	1.000
2,3,7,8-TCDF	X				
1,2,3,7,8-PECDF	X				
2,3,4,7,8-PECDF	X				
1,2,3,4,7,8-HXCDF	X				
1,2,3,6,7,8-HXCDF	X				
1,2,3,7,8,9-HXCDF	X				
2,3,4,6,7,8-HXCDF	X				
1,2,3,4,6,7,8-HPCDF	X				
1,2,3,4,7,8,9-HPCDF	X				
OCDF	X				
TOTAL TETRA-DIOXINS	X				
TOTAL PENTA-DIOXINS	X				
TOTAL HEXA-DIOXINS	X				
TOTAL HEPTA-DIOXINS	X				
TOTAL TETRA-FURANS	X				
TOTAL PENTA-FURANS	X				
TOTAL HEXA-FURANS	X				
TOTAL HEPTA-FURANS	X				

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-28_Form1A_DX7M_142S43_SJ2313080.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20	Form 2 PCDD/PCDF ANALYSIS REPORT	CLIENT SAMPLE NO. BW17ML-054-0.0-0.15 Sample Collection: 12-Oct-2017 15:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-28 W
Matrix:	SOLID	**Sample Size:**	10.1 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	03-Dec-2017 **Time:** 11:29:39	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 43**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 33
Concentration Units:	pg absolute	**% Moisture:**	49.4

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD	X					
13C-1,2,3,7,8-PECDD [4]	X					
13C-1,2,3,4,7,8-HXCDD	X					
13C-1,2,3,6,7,8-HXCDD	X					
13C-1,2,3,4,6,7,8-HPCDD	X					
13C-OCDD	D	4000	2240	56.0	0.87	1.177
13C-2,3,7,8-TCDF	X					
13C-1,2,3,7,8-PECDF	X					
13C-2,3,4,7,8-PECDF	X					
13C-1,2,3,4,7,8-HXCDF	X					
13C-1,2,3,6,7,8-HXCDF	X					
13C-1,2,3,7,8,9-HXCDF	X					
13C-2,3,4,6,7,8-HXCDF	X					
13C-1,2,3,4,6,7,8-HPCDF	X					
13C-1,2,3,4,7,8,9-HPCDF	X					
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD	X					

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-28_Form2_DX7M_142S43_SJ2313080.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-054-0.0-0.15
Sample Collection:
12-Oct-2017 15:30

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No.			MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-28
Matrix:	SOLID	**Sample Size:**	10.1 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 13:06:45	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_218 S: 9**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_218 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	49.4

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		60.3	0.0890 (S)	1.25	1.061
2,3,7,8-TCDF		15.2	0.147 (S)	0.78	1.002

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-28_Form1A_DB73_218S9_SJ2310284.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-054-0.0-0.15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Sample Collection:	12-Oct-2017 15:30
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-28
Sample Size:	10.1 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_218 S: 9** **DX7M_137 S: 97** **DX7M_142 S: 43**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		7.08	0.0530	1	7.08e+00	7.08e+00	
1,2,3,7,8-PECDD		17.2	0.0846	1	1.72e+01	1.72e+01	
1,2,3,4,7,8-HXCDD		14.6	0.173	0.1	1.46e+00	1.46e+00	
1,2,3,6,7,8-HXCDD		90.1	0.173	0.1	9.01e+00	9.01e+00	
1,2,3,7,8,9-HXCDD		60.3	0.0890	0.1	6.03e+00	6.03e+00	
1,2,3,4,6,7,8-HPCDD		1240	0.384	0.01	1.24e+01	1.24e+01	
OCDD		11100	1.25	0.0003	3.33e+00	3.33e+00	
2,3,7,8-TCDF		15.2	0.147	0.1	1.52e+00	1.52e+00	
1,2,3,7,8-PECDF		6.81	0.130	0.03	2.04e-01	2.04e-01	
2,3,4,7,8-PECDF		12.4	0.130	0.3	3.72e+00	3.72e+00	
1,2,3,4,7,8-HXCDF		76.1	0.122	0.1	7.61e+00	7.61e+00	
1,2,3,6,7,8-HXCDF		75.0	0.122	0.1	7.50e+00	7.50e+00	
1,2,3,7,8,9-HXCDF		2.55	0.122	0.1	2.55e-01	2.55e-01	
2,3,4,6,7,8-HXCDF		14.8	0.122	0.1	1.48e+00	1.48e+00	
1,2,3,4,6,7,8-HPCDF		2230	0.198	0.01	2.23e+01	2.23e+01	
1,2,3,4,7,8,9-HPCDF		70.4	0.198	0.01	7.04e-01	7.04e-01	
OCDF		1180	0.0495	0.0003	3.54e-01	3.54e-01	
			TOTAL TEQ		102	102	

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-28_TEQ_SJ2310284.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-054-0.15-0.40
Sample Collection:
12-Oct-2017 15:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-29
Matrix:	SOLID	**Sample Size:**	11.0 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 06:13:25	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 98**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	36.2

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	J	0.876	0.119 (S)	0.75	1.001
1,2,3,7,8-PECDD [4]	J	3.30	0.0597 (S)	0.62	1.001
1,2,3,4,7,8-HXCDD	J	2.67	0.0907 (S)	1.06	1.000
1,2,3,6,7,8-HXCDD		17.2	0.0907 (S)	1.25	1.000
1,2,3,7,8,9-HXCDD		12.3	0.0907 (S)	1.27	1.010
1,2,3,4,6,7,8-HPCDD		162	0.147 (S)	1.02	1.000
OCDD		1130	0.208 (S)	0.88	1.000
2,3,7,8-TCDF		1.46	0.0454 (Q)	0.73	1.001
1,2,3,7,8-PECDF	K J	0.778	0.0813 (S)	1.13	1.001
2,3,4,7,8-PECDF	J	1.54	0.0813 (S)	1.48	1.000
1,2,3,4,7,8-HXCDF		7.28	0.0831 (S)	1.22	1.000
1,2,3,6,7,8-HXCDF		12.6	0.0831 (S)	1.25	1.000
1,2,3,7,8,9-HXCDF	J	0.270	0.0831 (S)	1.08	1.001
2,3,4,6,7,8-HXCDF	J	3.20	0.0831 (S)	1.29	1.001
1,2,3,4,6,7,8-HPCDF		594	0.230 (S)	1.04	1.000
1,2,3,4,7,8,9-HPCDF		4.64	0.230 (S)	1.01	1.000
OCDF		209	0.0673 (S)	0.90	1.002
TOTAL TETRA-DIOXINS		16.2	0.119 (S)		
TOTAL PENTA-DIOXINS	T	21.8	0.0597 (S)		
TOTAL HEXA-DIOXINS		146	0.0907 (S)		
TOTAL HEPTA-DIOXINS		389	0.147 (S)		
TOTAL TETRA-FURANS		15.9	0.0454 (Q)		
TOTAL PENTA-FURANS		53.1	0.0813 (S)		
TOTAL HEXA-FURANS		313	0.0831 (S)		
TOTAL HEPTA-FURANS		1170	0.230 (S)		

(1) Where applicable, custom lab flags have been used on this report; K = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-29_Form1A_DX7M_137S98_SJ2310122.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20	**Form 2** **PCDD/PCDF ANALYSIS REPORT**	**CLIENT SAMPLE NO.** **BW17ML-054-0.15-0.40** **Sample Collection:** **12-Oct-2017 15:30**

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-29
Matrix:	SOLID	**Sample Size:**	11.0 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 06:13:25	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 98**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg absolute	**% Moisture:**	36.2

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1680	83.9	0.75	1.013
13C-1,2,3,7,8-PECDD [4]		2000	2480	124	0.65	1.383
13C-1,2,3,4,7,8-HXCDD		2000	1660	83.2	1.26	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1770	88.5	1.28	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1870	93.6	1.02	1.093
13C-OCDD		4000	3570	89.3	0.88	1.177
13C-2,3,7,8-TCDF		2000	1670	83.7	0.77	0.966
13C-1,2,3,7,8-PECDF		2000	1810	90.7	1.53	1.285
13C-2,3,4,7,8-PECDF		2000	1820	91.1	1.53	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1650	82.6	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1640	82.1	0.51	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1700	84.9	0.51	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1690	84.6	0.51	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1780	88.9	0.45	1.061
13C-1,2,3,4,7,8,9-HPCDF		2000	1640	81.9	0.47	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	172	86.1		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-29_Form2_DX7M_137S98_SJ2310122.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-054-0.15-0.40
Sample Collection:
12-Oct-2017 15:30

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-29
Matrix:	SOLID	**Sample Size:**	11.0 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 13:48:02	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_218 S: 10**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_218 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	36.2

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		10.7	0.0967 (S)	1.23	1.062
2,3,7,8-TCDF	J	0.759	0.0454 (Q)	0.81	1.002

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-29_Form1A_DB73_218S10_SJ2310285.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-054-0.15-0.40

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Sample Collection:	12-Oct-2017 15:30
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-29
Sample Size:	11.0 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_218 S: 10** **DX7M_137 S: 98**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		0.876	0.119	1	8.76e-01	8.76e-01	
1,2,3,7,8-PECDD		3.30	0.0597	1	3.30e+00	3.30e+00	
1,2,3,4,7,8-HXCDD		2.67	0.0907	0.1	2.67e-01	2.67e-01	
1,2,3,6,7,8-HXCDD		17.2	0.0907	0.1	1.72e+00	1.72e+00	
1,2,3,7,8,9-HXCDD		10.7	0.0967	0.1	1.07e+00	1.07e+00	
1,2,3,4,6,7,8-HPCDD		162	0.147	0.01	1.62e+00	1.62e+00	
OCDD		1130	0.208	0.0003	3.39e-01	3.39e-01	
2,3,7,8-TCDF		0.759	0.0454	0.1	7.59e-02	7.59e-02	
1,2,3,7,8-PECDF	U		0.0813	0.03	0.00e+00	1.22e-03	
2,3,4,7,8-PECDF		1.54	0.0813	0.3	4.62e-01	4.62e-01	
1,2,3,4,7,8-HXCDF		7.28	0.0831	0.1	7.28e-01	7.28e-01	
1,2,3,6,7,8-HXCDF		12.6	0.0831	0.1	1.26e+00	1.26e+00	
1,2,3,7,8,9-HXCDF		0.270	0.0831	0.1	2.70e-02	2.70e-02	
2,3,4,6,7,8-HXCDF		3.20	0.0831	0.1	3.20e-01	3.20e-01	
1,2,3,4,6,7,8-HPCDF		594	0.230	0.01	5.94e+00	5.94e+00	
1,2,3,4,7,8,9-HPCDF		4.64	0.230	0.01	4.64e-02	4.64e-02	
OCDF		209	0.0673	0.0003	6.27e-02	6.27e-02	
			TOTAL TEQ		18.1	18.1	

(1) Where applicable, custom lab flags have been used on this report.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_1613-TEQ_L28336-29_TEQ_SJ2310285.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-056-0.0-0.15
Sample Collection:
12-Oct-2017 15:45

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-30
Matrix:	SOLID	**Sample Size:**	10.3 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 07:08:34	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 99**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	47.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		2.01	0.0691 (S)	0.75	1.001
1,2,3,7,8-PECDD [4]	J	3.57	0.0836 (S)	0.64	1.001
1,2,3,4,7,8-HXCDD	J	3.76	0.132 (S)	1.28	1.000
1,2,3,6,7,8-HXCDD		19.2	0.132 (S)	1.29	1.000
1,2,3,7,8,9-HXCDD		13.4	0.132 (S)	1.18	1.010
1,2,3,4,6,7,8-HPCDD		333	0.198 (S)	1.02	1.000
OCDD		3100	0.180 (S)	0.88	1.000
2,3,7,8-TCDF		9.72	0.0486 (Q)	0.76	1.001
1,2,3,7,8-PECDF	J	2.53	0.0675 (S)	1.45	1.001
2,3,4,7,8-PECDF		5.35	0.0675 (S)	1.48	1.001
1,2,3,4,7,8-HXCDF		14.7	0.0926 (S)	1.23	1.000
1,2,3,6,7,8-HXCDF		18.0	0.0926 (S)	1.24	1.001
1,2,3,7,8,9-HXCDF	J	0.712	0.0926 (S)	1.27	1.000
2,3,4,6,7,8-HXCDF	J	3.80	0.0926 (S)	1.32	1.000
1,2,3,4,6,7,8-HPCDF		317	0.222 (S)	1.04	1.000
1,2,3,4,7,8,9-HPCDF		16.2	0.222 (S)	0.97	1.000
OCDF		260	0.211 (S)	0.92	1.002
TOTAL TETRA-DIOXINS		21.1	0.0691 (S)		
TOTAL PENTA-DIOXINS	T	41.5	0.0836 (S)		
TOTAL HEXA-DIOXINS		183	0.132 (S)		
TOTAL HEPTA-DIOXINS		864	0.198 (S)		
TOTAL TETRA-FURANS		121	0.0486 (Q)		
TOTAL PENTA-FURANS		148	0.0675 (S)		
TOTAL HEXA-FURANS		254	0.0926 (S)		
TOTAL HEPTA-FURANS		768	0.222 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-30_Form1A_DX7M_137S99_SJ2310123.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-056-0.0-0.15
Sample Collection:
12-Oct-2017 15:45

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-30
Matrix:	SOLID	**Sample Size:**	10.3 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 07:08:34	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 99**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg absolute	**% Moisture:**	47.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1160	58.1	0.77	1.013
13C-1,2,3,7,8-PECDD [4]		2000	1680	83.8	0.64	1.383
13C-1,2,3,4,7,8-HXCDD		2000	1200	59.8	1.28	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1270	63.5	1.22	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1150	57.4	1.02	1.094
13C-OCDD		4000	2060	51.5	0.89	1.177
13C-2,3,7,8-TCDF		2000	1150	57.6	0.76	0.966
13C-1,2,3,7,8-PECDF		2000	1170	58.3	1.56	1.285
13C-2,3,4,7,8-PECDF		2000	1140	57.0	1.56	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1140	57.1	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1170	58.4	0.52	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1160	58.0	0.52	1.005
13C-2,3,4,6,7,8-HXCDF		2000	1200	59.9	0.51	0.981
13C-1,2,3,4,6,7,8-HPCDF		2000	1140	57.2	0.45	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	976	48.8	0.45	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	117	58.5		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-30_Form2_DX7M_137S99_SJ2310123.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-056-0.0-0.15
Sample Collection:
12-Oct-2017 15:45

Form 1A

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-30
Matrix:	SOLID	**Sample Size:**	10.3 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 14:29:18	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_218 S: 11**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_218 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	47.0

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		11.6	0.233 (S)	1.20	1.059
2,3,7,8-TCDF		7.04	0.0922 (S)	0.79	1.002

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-30_Form1A_DB73_218S11_SJ2310286.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-056-0.0-0.15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Sample Collection: 12-Oct-2017 15:45

Contract No.: 4819

Project No. MUNGER LANDING SEDIMENT
J170470

Matrix: SOLID

Lab Sample I.D.: L28336-30

Sample Size: 10.3 g (dry)

GC Column ID(s): DB225
DB5

Concentration Units: pg/g (dry weight basis)

Sample Data Filenames: **DB73_218 S: 11**
DX7M_137 S: 99

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		2.01	0.0691	1	2.01e+00	2.01e+00	
1,2,3,7,8-PECDD		3.57	0.0836	1	3.57e+00	3.57e+00	
1,2,3,4,7,8-HXCDD		3.76	0.132	0.1	3.76e-01	3.76e-01	
1,2,3,6,7,8-HXCDD		19.2	0.132	0.1	1.92e+00	1.92e+00	
1,2,3,7,8,9-HXCDD		11.6	0.233	0.1	1.16e+00	1.16e+00	
1,2,3,4,6,7,8-HPCDD		333	0.198	0.01	3.33e+00	3.33e+00	
OCDD		3100	0.180	0.0003	9.30e-01	9.30e-01	
2,3,7,8-TCDF		7.04	0.0922	0.1	7.04e-01	7.04e-01	
1,2,3,7,8-PECDF		2.53	0.0675	0.03	7.59e-02	7.59e-02	
2,3,4,7,8-PECDF		5.35	0.0675	0.3	1.61e+00	1.61e+00	
1,2,3,4,7,8-HXCDF		14.7	0.0926	0.1	1.47e+00	1.47e+00	
1,2,3,6,7,8-HXCDF		18.0	0.0926	0.1	1.80e+00	1.80e+00	
1,2,3,7,8,9-HXCDF		0.712	0.0926	0.1	7.12e-02	7.12e-02	
2,3,4,6,7,8-HXCDF		3.80	0.0926	0.1	3.80e-01	3.80e-01	
1,2,3,4,6,7,8-HPCDF		317	0.222	0.01	3.17e+00	3.17e+00	
1,2,3,4,7,8,9-HPCDF		16.2	0.222	0.01	1.62e-01	1.62e-01	
OCDF		260	0.211	0.0003	7.80e-02	7.80e-02	
			TOTAL TEQ		22.8	22.8	

(1) Where applicable, custom lab flags have been used on this report.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: __________Kristen Bowes_________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-30_TEQ_SJ2310286.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-056-0.15-0.34
Sample Collection:
12-Oct-2017 15:45

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-31
Matrix:	SOLID	**Sample Size:**	10.8 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 08:03:42	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 100**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	45.7

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		4.45	0.0463 (Q)	0.77	1.001
1,2,3,7,8-PECDD [4]		14.2	0.0463 (Q)	0.61	1.001
1,2,3,4,7,8-HXCDD		11.5	0.161 (S)	1.42	1.000
1,2,3,6,7,8-HXCDD		63.2	0.161 (S)	1.21	1.000
1,2,3,7,8,9-HXCDD		46.1	0.161 (S)	1.25	1.010
1,2,3,4,6,7,8-HPCDD		787	0.385 (S)	1.02	1.000
OCDD	E				
2,3,7,8-TCDF		8.87	0.129 (S)	0.79	1.001
1,2,3,7,8-PECDF	J	3.10	0.0894 (S)	1.53	1.001
2,3,4,7,8-PECDF		6.16	0.0894 (S)	1.53	1.000
1,2,3,4,7,8-HXCDF		25.6	0.102 (S)	1.28	1.000
1,2,3,6,7,8-HXCDF		42.0	0.102 (S)	1.26	1.000
1,2,3,7,8,9-HXCDF	J	1.03	0.102 (S)	1.08	1.001
2,3,4,6,7,8-HXCDF		9.79	0.102 (S)	1.27	1.001
1,2,3,4,6,7,8-HPCDF	E				
1,2,3,4,7,8,9-HPCDF		20.1	0.205 (S)	1.05	1.000
OCDF		602	0.0557 (S)	0.90	1.002
TOTAL TETRA-DIOXINS		43.6	0.0463 (Q)		
TOTAL PENTA-DIOXINS	T	128	0.0463 (Q)		
TOTAL HEXA-DIOXINS		590	0.161 (S)		
TOTAL HEPTA-DIOXINS		2070	0.385 (S)		
TOTAL TETRA-FURANS		87.8	0.129 (S)		
TOTAL PENTA-FURANS		227	0.0894 (S)		
TOTAL HEXA-FURANS		906	0.102 (S)		
TOTAL HEPTA-FURANS	X				

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; X = result reported separately; T = result recalculated against alternate labeled compound(s) or internal standard; E = exceeds calibrated linear range, see dilution data.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-31_Form1A_DX7M_137S100_SJ2310111.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-056-0.15-0.34
Sample Collection:
12-Oct-2017 15:45

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-31
Matrix:	SOLID	**Sample Size:**	10.8 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 08:03:42	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 100**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg absolute	**% Moisture:**	45.7

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1570	78.5	0.78	1.013
13C-1,2,3,7,8-PECDD [4]		2000	2650	132	0.65	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1560	78.0	1.26	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1870	93.6	1.24	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1690	84.3	1.04	1.094
13C-OCDD		4000	3490	87.4	0.89	1.177
13C-2,3,7,8-TCDF		2000	1530	76.7	0.75	0.966
13C-1,2,3,7,8-PECDF		2000	1470	73.6	1.58	1.285
13C-2,3,4,7,8-PECDF		2000	1510	75.4	1.57	1.353
13C-1,2,3,4,7,8-HXCDF		2000	1610	80.6	0.51	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1610	80.4	0.52	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1640	82.0	0.51	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1670	83.4	0.53	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1710	85.7	0.45	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1480	74.2	0.44	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	165	82.5		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-31_Form2_DX7M_137S100_SJ2310111.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-056-0.15-0.34
Sample Collection:
12-Oct-2017 15:45

Form 1A
PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-31 Wi
Matrix:	SOLID	**Sample Size:**	10.8 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	04-Dec-2017 **Time:** 07:56:36	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 65**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 57
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	45.7

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	X				
1,2,3,7,8-PECDD [4]	X				
1,2,3,4,7,8-HXCDD	X				
1,2,3,6,7,8-HXCDD	X				
1,2,3,7,8,9-HXCDD	X				
1,2,3,4,6,7,8-HPCDD	X				
OCDD	D	5540	0.794 (S)	0.88	1.000
2,3,7,8-TCDF	X				
1,2,3,7,8-PECDF	X				
2,3,4,7,8-PECDF	X				
1,2,3,4,7,8-HXCDF	X				
1,2,3,6,7,8-HXCDF	X				
1,2,3,7,8,9-HXCDF	X				
2,3,4,6,7,8-HXCDF	X				
1,2,3,4,6,7,8-HPCDF	D	1490	0.581 (S)	1.03	1.000
1,2,3,4,7,8,9-HPCDF	X				
OCDF	X				
TOTAL TETRA-DIOXINS	X				
TOTAL PENTA-DIOXINS	X				
TOTAL HEXA-DIOXINS	X				
TOTAL HEPTA-DIOXINS	X				
TOTAL TETRA-FURANS	X				
TOTAL PENTA-FURANS	X				
TOTAL HEXA-FURANS	X				
TOTAL HEPTA-FURANS	D	2910	0.581 (S)		

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-31_Form1A_DX7M_142S65_SJ2312669.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-056-0.15-0.34
Sample Collection:
12-Oct-2017 15:45

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-31 Wi
Matrix:	SOLID	**Sample Size:**	10.8 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	04-Dec-2017 **Time:** 07:56:36	**GC Column ID:**	DB5
Extract Volume (uL):	100	**Sample Data Filename:**	**DX7M_142 S: 65**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	5	**Cal. Ver. Data Filename:**	DX7M_142 S: 57
Concentration Units:	pg absolute	**% Moisture:**	45.7

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD	X					
13C-1,2,3,7,8-PECDD [4]	X					
13C-1,2,3,4,7,8-HXCDD	X					
13C-1,2,3,6,7,8-HXCDD	X					
13C-1,2,3,4,6,7,8-HPCDD	X					
13C-OCDD	D	4000	3330	83.3	0.90	1.177
13C-2,3,7,8-TCDF	X					
13C-1,2,3,7,8-PECDF	X					
13C-2,3,4,7,8-PECDF	X					
13C-1,2,3,4,7,8-HXCDF	X					
13C-1,2,3,6,7,8-HXCDF	X					
13C-1,2,3,7,8,9-HXCDF	X					
13C-2,3,4,6,7,8-HXCDF	X					
13C-1,2,3,4,6,7,8-HPCDF	D	2000	1760	87.9	0.45	1.062
13C-1,2,3,4,7,8,9-HPCDF	D	2000	1640	81.8	0.44	1.104
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD	X					

(1) Where applicable, custom lab flags have been used on this report; D = dilution data; X = result reported separately.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-31_Form2_DX7M_142S65_SJ2312669.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-056-0.15-0.34
Sample Collection:
12-Oct-2017 15:45

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-31
Matrix:	SOLID	**Sample Size:**	10.8 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 15:10:34	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_218 S: 12**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_218 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	45.7

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		43.0	0.0670 (S)	1.24	1.062
2,3,7,8-TCDF		6.12	0.0583 (S)	0.80	1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-31_Form1A_DB73_218S12_SJ2310287.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-056-0.15-0.34

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Sample Collection:	12-Oct-2017 15:45
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-31
Sample Size:	10.8 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_218 S: 12 DX7M_137 S: 100 DX7M_142 S: 65**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		4.45	0.0463	1	4.45e+00	4.45e+00	
1,2,3,7,8-PECDD		14.2	0.0463	1	1.42e+01	1.42e+01	
1,2,3,4,7,8-HXCDD		11.5	0.161	0.1	1.15e+00	1.15e+00	
1,2,3,6,7,8-HXCDD		63.2	0.161	0.1	6.32e+00	6.32e+00	
1,2,3,7,8,9-HXCDD		43.0	0.0670	0.1	4.30e+00	4.30e+00	
1,2,3,4,6,7,8-HPCDD		787	0.385	0.01	7.87e+00	7.87e+00	
OCDD		5540	0.794	0.0003	1.66e+00	1.66e+00	
2,3,7,8-TCDF		6.12	0.0583	0.1	6.12e-01	6.12e-01	
1,2,3,7,8-PECDF		3.10	0.0894	0.03	9.30e-02	9.30e-02	
2,3,4,7,8-PECDF		6.16	0.0894	0.3	1.85e+00	1.85e+00	
1,2,3,4,7,8-HXCDF		25.6	0.102	0.1	2.56e+00	2.56e+00	
1,2,3,6,7,8-HXCDF		42.0	0.102	0.1	4.20e+00	4.20e+00	
1,2,3,7,8,9-HXCDF		1.03	0.102	0.1	1.03e-01	1.03e-01	
2,3,4,6,7,8-HXCDF		9.79	0.102	0.1	9.79e-01	9.79e-01	
1,2,3,4,6,7,8-HPCDF		1490	0.581	0.01	1.49e+01	1.49e+01	
1,2,3,4,7,8,9-HPCDF		20.1	0.205	0.01	2.01e-01	2.01e-01	
OCDF		602	0.0557	0.0003	1.81e-01	1.81e-01	
			TOTAL TEQ		65.6	65.6	

(1) Where applicable, custom lab flags have been used on this report; D = dilution data.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: __________Kristen Bowes_________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-31_TEQ_SJ2310287.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-058-0.0-0.15
Sample Collection:
12-Oct-2017 16:00

Form 1A
PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-32
Matrix:	SOLID	**Sample Size:**	10.5 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 08:58:51	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 101**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	54.3

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		1.41	0.0477 (Q)	0.77	1.001
1,2,3,7,8-PECDD [4]	J	3.03	0.0477 (Q)	0.64	1.001
1,2,3,4,7,8-HXCDD	J	3.14	0.0811 (S)	1.32	1.000
1,2,3,6,7,8-HXCDD		16.3	0.0811 (S)	1.29	1.000
1,2,3,7,8,9-HXCDD		10.8	0.0811 (S)	1.23	1.010
1,2,3,4,6,7,8-HPCDD		295	0.154 (S)	1.00	1.000
OCDD		2410	0.0701 (S)	0.89	1.000
2,3,7,8-TCDF		10.1	0.0702 (S)	0.78	1.001
1,2,3,7,8-PECDF	J	3.45	0.0863 (S)	1.56	1.000
2,3,4,7,8-PECDF		9.04	0.0863 (S)	1.60	1.000
1,2,3,4,7,8-HXCDF		12.1	0.112 (S)	1.27	1.000
1,2,3,6,7,8-HXCDF		13.1	0.112 (S)	1.22	1.000
1,2,3,7,8,9-HXCDF	J	0.638	0.112 (S)	1.06	1.000
2,3,4,6,7,8-HXCDF	J	4.72	0.112 (S)	1.21	1.001
1,2,3,4,6,7,8-HPCDF		171	0.0844 (S)	1.05	1.000
1,2,3,4,7,8,9-HPCDF		10.9	0.0844 (S)	1.03	1.000
OCDF		169	0.154 (S)	0.91	1.002
TOTAL TETRA-DIOXINS		15.4	0.0477 (Q)		
TOTAL PENTA-DIOXINS	T	32.2	0.0477 (Q)		
TOTAL HEXA-DIOXINS		131	0.0811 (S)		
TOTAL HEPTA-DIOXINS		653	0.154 (S)		
TOTAL TETRA-FURANS		183	0.0702 (S)		
TOTAL PENTA-FURANS		222	0.0863 (S)		
TOTAL HEXA-FURANS		190	0.112 (S)		
TOTAL HEPTA-FURANS		393	0.0844 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-32_Form1A_DX7M_137S101_SJ2310112.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-058-0.0-0.15
Sample Collection:
12-Oct-2017 16:00

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-32
Matrix:	SOLID	**Sample Size:**	10.5 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	21-Nov-2017 **Time:** 08:58:51	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 101**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 90
Concentration Units:	pg absolute	**% Moisture:**	54.3

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1380	68.8	0.79	1.014
13C-1,2,3,7,8-PECDD [4]		2000	2160	108	0.66	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1320	66.2	1.23	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1420	71.2	1.26	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1310	65.6	1.03	1.094
13C-OCDD		4000	2320	58.1	0.91	1.177
13C-2,3,7,8-TCDF		2000	1370	68.3	0.75	0.966
13C-1,2,3,7,8-PECDF		2000	1410	70.4	1.56	1.285
13C-2,3,4,7,8-PECDF		2000	1430	71.6	1.56	1.353
13C-1,2,3,4,7,8-HXCDF		2000	1350	67.6	0.53	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1370	68.7	0.51	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1350	67.6	0.51	1.005
13C-2,3,4,6,7,8-HXCDF		2000	1390	69.5	0.53	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1290	64.3	0.46	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1160	57.9	0.47	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	159	79.4		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-32_Form2_DX7M_137S101_SJ2310112.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-058-0.0-0.15
Sample Collection:
12-Oct-2017 16:00

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-32
Matrix:	SOLID	**Sample Size:**	10.5 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 15:51:50	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_218 S: 13**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_218 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	54.3

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		8.81	0.142 (S)	1.18	1.062
2,3,7,8-TCDF		6.36	0.0477 (Q)	0.74	1.002

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-32_Form1A_DB73_218S13_SJ2310288.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-058-0.0-0.15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.:	4819	**Sample Collection:**	12-Oct-2017 16:00
		Project No.	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-32
Sample Size:	10.5 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_218 S: 13** **DX7M_137 S: 101**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		1.41	0.0477	1	1.41e+00	1.41e+00	
1,2,3,7,8-PECDD		3.03	0.0477	1	3.03e+00	3.03e+00	
1,2,3,4,7,8-HXCDD		3.14	0.0811	0.1	3.14e-01	3.14e-01	
1,2,3,6,7,8-HXCDD		16.3	0.0811	0.1	1.63e+00	1.63e+00	
1,2,3,7,8,9-HXCDD		8.81	0.142	0.1	8.81e-01	8.81e-01	
1,2,3,4,6,7,8-HPCDD		295	0.154	0.01	2.95e+00	2.95e+00	
OCDD		2410	0.0701	0.0003	7.23e-01	7.23e-01	
2,3,7,8-TCDF		6.36	0.0477	0.1	6.36e-01	6.36e-01	
1,2,3,7,8-PECDF		3.45	0.0863	0.03	1.04e-01	1.04e-01	
2,3,4,7,8-PECDF		9.04	0.0863	0.3	2.71e+00	2.71e+00	
1,2,3,4,7,8-HXCDF		12.1	0.112	0.1	1.21e+00	1.21e+00	
1,2,3,6,7,8-HXCDF		13.1	0.112	0.1	1.31e+00	1.31e+00	
1,2,3,7,8,9-HXCDF		0.638	0.112	0.1	6.38e-02	6.38e-02	
2,3,4,6,7,8-HXCDF		4.72	0.112	0.1	4.72e-01	4.72e-01	
1,2,3,4,6,7,8-HPCDF		171	0.0844	0.01	1.71e+00	1.71e+00	
1,2,3,4,7,8,9-HPCDF		10.9	0.0844	0.01	1.09e-01	1.09e-01	
OCDF		169	0.154	0.0003	5.07e-02	5.07e-02	
			TOTAL TEQ		19.3	19.3	

(1) Where applicable, custom lab flags have been used on this report.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-32_TEQ_SJ2310288.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-058-0.15-0.45
Sample Collection:
12-Oct-2017 16:00

Form 1A
PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-33
Matrix:	SOLID	**Sample Size:**	10.0 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 11:59:12	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 5**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	49.3

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		1.39	0.0498 (Q)	0.69	1.001
1,2,3,7,8-PECDD [4]	J	3.53	0.0498 (Q)	0.66	1.001
1,2,3,4,7,8-HXCDD	J	2.84	0.0747 (S)	1.29	1.000
1,2,3,6,7,8-HXCDD		14.9	0.0747 (S)	1.25	1.000
1,2,3,7,8,9-HXCDD		10.5	0.0747 (S)	1.30	1.010
1,2,3,4,6,7,8-HPCDD		194	0.130 (S)	1.05	1.000
OCDD		1550	0.178 (S)	0.90	1.000
2,3,7,8-TCDF		7.43	0.0498 (Q)	0.77	1.001
1,2,3,7,8-PECDF	J	2.89	0.0511 (S)	1.66	1.000
2,3,4,7,8-PECDF		7.11	0.0511 (S)	1.51	1.000
1,2,3,4,7,8-HXCDF		15.5	0.0656 (S)	1.28	1.001
1,2,3,6,7,8-HXCDF		16.2	0.0656 (S)	1.26	1.000
1,2,3,7,8,9-HXCDF	J	0.573	0.0656 (S)	1.14	1.000
2,3,4,6,7,8-HXCDF		5.43	0.0656 (S)	1.26	1.000
1,2,3,4,6,7,8-HPCDF		278	0.125 (S)	1.03	1.000
1,2,3,4,7,8,9-HPCDF		12.5	0.125 (S)	1.00	1.000
OCDF		181	0.0727 (S)	0.90	1.002
TOTAL TETRA-DIOXINS		14.3	0.0498 (Q)		
TOTAL PENTA-DIOXINS	T	34.4	0.0498 (Q)		
TOTAL HEXA-DIOXINS		122	0.0747 (S)		
TOTAL HEPTA-DIOXINS		426	0.130 (S)		
TOTAL TETRA-FURANS		131	0.0498 (Q)		
TOTAL PENTA-FURANS		214	0.0511 (S)		
TOTAL HEXA-FURANS		248	0.0656 (S)		
TOTAL HEPTA-FURANS		565	0.125 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-33_Form1A_DX7M_138DS5_SJ2310180.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-058-0.15-0.45
Sample Collection:
12-Oct-2017 16:00

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-33
Matrix:	SOLID	**Sample Size:**	10.0 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 11:59:12	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 5**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg absolute	**% Moisture:**	49.3

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1340	67.1	0.80	1.013
13C-1,2,3,7,8-PECDD [4]		2000	1860	92.9	0.65	1.383
13C-1,2,3,4,7,8-HXCDD		2000	1340	67.2	1.27	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1430	71.7	1.26	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1390	69.6	1.03	1.094
13C-OCDD		4000	2590	64.7	0.89	1.177
13C-2,3,7,8-TCDF		2000	1310	65.6	0.78	0.965
13C-1,2,3,7,8-PECDF		2000	1280	64.1	1.56	1.285
13C-2,3,4,7,8-PECDF		2000	1300	64.8	1.56	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1320	65.8	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1310	65.6	0.52	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1300	65.2	0.53	1.004
13C-2,3,4,6,7,8-HXCDF		2000	1370	68.4	0.52	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1360	67.9	0.44	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1280	63.9	0.45	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	148	74.0		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-33_Form2_DX7M_138DS5_SJ2310180.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-058-0.15-0.45
Sample Collection:
12-Oct-2017 16:00

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-33
Matrix:	SOLID	**Sample Size:**	10.0 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 16:33:05	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_218 S: 14**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_218 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	49.3

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		8.82	0.143 (S)	1.30	1.060
2,3,7,8-TCDF		4.27	0.0498 (Q)	0.78	1.002

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-33_Form1A_DB73_218S14_SJ2310289.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-058-0.15-0.45

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Sample Collection:	12-Oct-2017 16:00
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-33
Sample Size:	10.0 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_218 S: 14** **DX7M_138D S: 5**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		1.39	0.0498	1	1.39e+00	1.39e+00	
1,2,3,7,8-PECDD		3.53	0.0498	1	3.53e+00	3.53e+00	
1,2,3,4,7,8-HXCDD		2.84	0.0747	0.1	2.84e-01	2.84e-01	
1,2,3,6,7,8-HXCDD		14.9	0.0747	0.1	1.49e+00	1.49e+00	
1,2,3,7,8,9-HXCDD		8.82	0.143	0.1	8.82e-01	8.82e-01	
1,2,3,4,6,7,8-HPCDD		194	0.130	0.01	1.94e+00	1.94e+00	
OCDD		1550	0.178	0.0003	4.65e-01	4.65e-01	
2,3,7,8-TCDF		4.27	0.0498	0.1	4.27e-01	4.27e-01	
1,2,3,7,8-PECDF		2.89	0.0511	0.03	8.67e-02	8.67e-02	
2,3,4,7,8-PECDF		7.11	0.0511	0.3	2.13e+00	2.13e+00	
1,2,3,4,7,8-HXCDF		15.5	0.0656	0.1	1.55e+00	1.55e+00	
1,2,3,6,7,8-HXCDF		16.2	0.0656	0.1	1.62e+00	1.62e+00	
1,2,3,7,8,9-HXCDF		0.573	0.0656	0.1	5.73e-02	5.73e-02	
2,3,4,6,7,8-HXCDF		5.43	0.0656	0.1	5.43e-01	5.43e-01	
1,2,3,4,6,7,8-HPCDF		278	0.125	0.01	2.78e+00	2.78e+00	
1,2,3,4,7,8,9-HPCDF		12.5	0.125	0.01	1.25e-01	1.25e-01	
OCDF		181	0.0727	0.0003	5.43e-02	5.43e-02	
			TOTAL TEQ		19.4	19.4	

(1) Where applicable, custom lab flags have been used on this report.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_L28336-33_TEQ_SJ2310289.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-062-0.0-0.15
Sample Collection:
12-Oct-2017 16:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-34
Matrix:	SOLID	**Sample Size:**	10.6 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 12:54:26	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 6**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	67.3

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		2.66	0.0473 (Q)	0.84	1.001
1,2,3,7,8-PECDD [4]		6.21	0.0473 (Q)	0.61	1.001
1,2,3,4,7,8-HXCDD		5.50	0.0679 (S)	1.23	1.000
1,2,3,6,7,8-HXCDD		27.4	0.0679 (S)	1.26	1.000
1,2,3,7,8,9-HXCDD		19.2	0.0679 (S)	1.22	1.010
1,2,3,4,6,7,8-HPCDD		393	0.194 (S)	1.03	1.000
OCDD		2990	0.216 (S)	0.88	1.000
2,3,7,8-TCDF		19.2	0.0473 (Q)	0.79	1.001
1,2,3,7,8-PECDF		5.39	0.0745 (S)	1.51	1.001
2,3,4,7,8-PECDF		15.5	0.0745 (S)	1.55	1.000
1,2,3,4,7,8-HXCDF		17.8	0.0625 (S)	1.25	1.001
1,2,3,6,7,8-HXCDF		25.2	0.0625 (S)	1.27	1.000
1,2,3,7,8,9-HXCDF	J	1.07	0.0625 (S)	1.41	1.000
2,3,4,6,7,8-HXCDF		7.57	0.0625 (S)	1.31	1.000
1,2,3,4,6,7,8-HPCDF		424	0.128 (S)	1.05	1.000
1,2,3,4,7,8,9-HPCDF		15.9	0.128 (S)	1.00	1.000
OCDF		260	0.0872 (S)	0.88	1.002
TOTAL TETRA-DIOXINS		27.7	0.0473 (Q)		
TOTAL PENTA-DIOXINS	T	66.4	0.0473 (Q)		
TOTAL HEXA-DIOXINS		238	0.0679 (S)		
TOTAL HEPTA-DIOXINS		880	0.194 (S)		
TOTAL TETRA-FURANS		331	0.0473 (Q)		
TOTAL PENTA-FURANS		367	0.0745 (S)		
TOTAL HEXA-FURANS		382	0.0625 (S)		
TOTAL HEPTA-FURANS		868	0.128 (S)		

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent; T = result recalculated against alternate labeled compound(s) or internal standard.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-34_Form1A_DX7M_138DS6_SJ2310181.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-062-0.0-0.15
Sample Collection:
12-Oct-2017 16:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
		Lab Sample I.D.:	L28336-34
Matrix:	SOLID	**Sample Size:**	10.6 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 12:54:26	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 6**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg absolute	**% Moisture:**	67.3

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1260	63.1	0.78	1.013
13C-1,2,3,7,8-PECDD [4]		2000	1900	95.0	0.66	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1340	66.8	1.25	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1420	71.1	1.24	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1310	65.7	1.03	1.094
13C-OCDD		4000	2570	64.3	0.90	1.178
13C-2,3,7,8-TCDF		2000	1220	60.9	0.78	0.966
13C-1,2,3,7,8-PECDF		2000	1260	63.1	1.56	1.285
13C-2,3,4,7,8-PECDF		2000	1270	63.3	1.59	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1350	67.5	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1300	65.1	0.54	0.959
13C-1,2,3,7,8,9-HXCDF		2000	1210	60.7	0.53	1.005
13C-2,3,4,6,7,8-HXCDF		2000	1310	65.7	0.53	0.981
13C-1,2,3,4,6,7,8-HPCDF		2000	1290	64.5	0.46	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1210	60.6	0.46	1.104
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	147	73.3		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_L28336-34_Form2_DX7M_138DS6_SJ2310181.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-062-0.0-0.15
Sample Collection:
12-Oct-2017 16:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	L28336-34
Matrix:	SOLID	**Sample Size:**	10.6 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	19-Sep-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	18-Nov-2017 **Time:** 17:14:21	**GC Column ID:**	DB225
Extract Volume (uL):	20	**Sample Data Filename:**	**DB73_218 S: 15**
Injection Volume (uL):	2.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DB73_218 S: 2
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	67.3

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
1,2,3,7,8,9-HXCDD		16.4	0.138 (S)	1.19	1.062
2,3,7,8-TCDF		13.0	0.0682 (S)	0.77	1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB225_L28336-34_Form1A_DB73_218S15_SJ2310290.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
BW17ML-062-0.0-0.15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Sample Collection:	12-Oct-2017 16:15		
Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
Matrix:	SOLID	**Lab Sample I.D.:**	L28336-34
Sample Size:	10.6 g (dry)	**GC Column ID(s):**	DB225 DB5
Concentration Units:	pg/g (dry weight basis)	**Sample Data Filenames:**	**DB73_218 S: 15** **DX7M_138D S: 6**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD		2.66	0.0473	1	2.66e+00	2.66e+00	
1,2,3,7,8-PECDD		6.21	0.0473	1	6.21e+00	6.21e+00	
1,2,3,4,7,8-HXCDD		5.50	0.0679	0.1	5.50e-01	5.50e-01	
1,2,3,6,7,8-HXCDD		27.4	0.0679	0.1	2.74e+00	2.74e+00	
1,2,3,7,8,9-HXCDD		16.4	0.138	0.1	1.64e+00	1.64e+00	
1,2,3,4,6,7,8-HPCDD		393	0.194	0.01	3.93e+00	3.93e+00	
OCDD		2990	0.216	0.0003	8.97e-01	8.97e-01	
2,3,7,8-TCDF		13.0	0.0682	0.1	1.30e+00	1.30e+00	
1,2,3,7,8-PECDF		5.39	0.0745	0.03	1.62e-01	1.62e-01	
2,3,4,7,8-PECDF		15.5	0.0745	0.3	4.65e+00	4.65e+00	
1,2,3,4,7,8-HXCDF		17.8	0.0625	0.1	1.78e+00	1.78e+00	
1,2,3,6,7,8-HXCDF		25.2	0.0625	0.1	2.52e+00	2.52e+00	
1,2,3,7,8,9-HXCDF		1.07	0.0625	0.1	1.07e-01	1.07e-01	
2,3,4,6,7,8-HXCDF		7.57	0.0625	0.1	7.57e-01	7.57e-01	
1,2,3,4,6,7,8-HPCDF		424	0.128	0.01	4.24e+00	4.24e+00	
1,2,3,4,7,8,9-HPCDF		15.9	0.128	0.01	1.59e-01	1.59e-01	
OCDF		260	0.0872	0.0003	7.80e-02	7.80e-02	
			TOTAL TEQ		34.4	34.4	

(1) Where applicable, custom lab flags have been used on this report.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_1613-TEQ_L28336-34_TEQ_SJ2310290.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
Lab Blank
Sample Collection:
N/A

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	N/A
Contract No.:	4819	**Lab Sample I.D.:**	WG61707-101
Matrix:	SOLID	**Sample Size:**	10.0 g
Sample Receipt Date:	N/A	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 15:24:23	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 82**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg/g		

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD	U		0.0500 (Q)		
1,2,3,7,8-PECDD [4]	U		0.0500 (Q)		
1,2,3,4,7,8-HXCDD	U		0.0500 (Q)		
1,2,3,6,7,8-HXCDD	U		0.0500 (Q)		
1,2,3,7,8,9-HXCDD	U		0.0500 (Q)		
1,2,3,4,6,7,8-HPCDD	K J	0.0726	0.0674 (S)	0.86	1.000
OCDD	K J	0.364	0.0500 (Q)	0.75	1.000
2,3,7,8-TCDF	U		0.0500 (Q)		
1,2,3,7,8-PECDF	U		0.0500 (Q)		
2,3,4,7,8-PECDF	U		0.0500 (Q)		
1,2,3,4,7,8-HXCDF	U		0.0500 (Q)		
1,2,3,6,7,8-HXCDF	U		0.0500 (Q)		
1,2,3,7,8,9-HXCDF	U		0.0500 (Q)		
2,3,4,6,7,8-HXCDF	U		0.0500 (Q)		
1,2,3,4,6,7,8-HPCDF	J	0.169	0.0707 (S)	1.15	1.000
1,2,3,4,7,8,9-HPCDF	U		0.0707 (S)		
OCDF	K J	0.0738	0.0508 (S)	0.68	1.002
TOTAL TETRA-DIOXINS	U		0.0500 (Q)		
TOTAL PENTA-DIOXINS	U		0.0500 (Q)		
TOTAL HEXA-DIOXINS	U		0.0500 (Q)		
TOTAL HEPTA-DIOXINS		0.105	0.0674 (S)		
TOTAL TETRA-FURANS	U		0.0500 (Q)		
TOTAL PENTA-FURANS	U		0.0500 (Q)		
TOTAL HEXA-FURANS	U		0.0500 (Q)		
TOTAL HEPTA-FURANS		0.329	0.0707 (S)		

(1) Where applicable, custom lab flags have been used on this report; U = not detected at RL; K = peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration; J = concentration less than lowest calibration equivalent.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_WG61707-101_Form1A_DX7M_137S82_SJ2310080.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
Lab Blank
Sample Collection:
N/A

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	N/A
Contract No.:	4819	**Lab Sample I.D.:**	WG61707-101
Matrix:	SOLID	**Sample Size:**	10.0 g
Sample Receipt Date:	N/A	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	20-Nov-2017 **Time:** 15:24:23	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_137 S: 82**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_137 S: 78
Concentration Units:	pg absolute		

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1230	61.5	0.79	1.013
13C-1,2,3,7,8-PECDD [4]		2000	1850	92.3	0.66	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1480	74.0	1.25	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1450	72.5	1.27	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1370	68.3	1.02	1.094
13C-OCDD		4000	2240	56.1	0.86	1.177
13C-2,3,7,8-TCDF		2000	1210	60.4	0.74	0.966
13C-1,2,3,7,8-PECDF		2000	1330	66.6	1.54	1.285
13C-2,3,4,7,8-PECDF		2000	1290	64.5	1.55	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1440	72.0	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1460	72.9	0.52	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1410	70.4	0.52	1.005
13C-2,3,4,6,7,8-HXCDF		2000	1480	74.2	0.52	0.981
13C-1,2,3,4,6,7,8-HPCDF		2000	1340	67.0	0.46	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1210	60.6	0.47	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	126	62.9		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: ________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_WG61707-101_Form2_DX7M_137S82_SJ2310080.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

PCDD/PCDF ANALYSIS TEQ DATA REPORT

CLIENT SAMPLE NO.
Lab Blank

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Sample Collection: N/A

Contract No.:	4819	**Project No.**	N/A
Matrix:	SOLID	**Lab Sample I.D.:**	WG61707-101
Sample Size:	10.0 g	**GC Column ID:**	DB5
Concentration Units:	pg/g	**Sample Data Filename:**	**DX7M_137 S: 82**

COMPOUND	LAB FLAG [1]	CONC. FOUND	REPORTING LIMIT (RL)	WHO 2005 TEF	TEQ ND=0	TEQ ND=1/2 RL	TEQ ND=RL
2,3,7,8-TCDD	U		0.0500	1	0.00e+00	2.50e-02	
1,2,3,7,8-PECDD	U		0.0500	1	0.00e+00	2.50e-02	
1,2,3,4,7,8-HXCDD	U		0.0500	0.1	0.00e+00	2.50e-03	
1,2,3,6,7,8-HXCDD	U		0.0500	0.1	0.00e+00	2.50e-03	
1,2,3,7,8,9-HXCDD	U		0.0500	0.1	0.00e+00	2.50e-03	
1,2,3,4,6,7,8-HPCDD	U		0.0674	0.01	0.00e+00	3.37e-04	
OCDD	U		0.0500	0.0003	0.00e+00	7.50e-06	
2,3,7,8-TCDF	U		0.0500	0.1	0.00e+00	2.50e-03	
1,2,3,7,8-PECDF	U		0.0500	0.03	0.00e+00	7.50e-04	
2,3,4,7,8-PECDF	U		0.0500	0.3	0.00e+00	7.50e-03	
1,2,3,4,7,8-HXCDF	U		0.0500	0.1	0.00e+00	2.50e-03	
1,2,3,6,7,8-HXCDF	U		0.0500	0.1	0.00e+00	2.50e-03	
1,2,3,7,8,9-HXCDF	U		0.0500	0.1	0.00e+00	2.50e-03	
2,3,4,6,7,8-HXCDF	U		0.0500	0.1	0.00e+00	2.50e-03	
1,2,3,4,6,7,8-HPCDF		0.169	0.0707	0.01	1.69e-03	1.69e-03	
1,2,3,4,7,8,9-HPCDF	U		0.0707	0.01	0.00e+00	3.54e-04	
OCDF	U		0.0508	0.0003	0.00e+00	7.62e-06	
			TOTAL TEQ		0.00169	0.0806	

(1) Where applicable, custom lab flags have been used on this report; U = not detected at RL.
(2) Concentrations that do not meet quantification criteria are not included in the TEQ calculations.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: TEQ.xsl; Created: 15-Dec-2017 15:00:13; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613-TEQ_WG61707-101_TEQ_SJ2310080.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 8A
PCDD/PCDF ONGOING PRECISION AND RECOVERY (OPR)

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.:	4819	**OPR Data Filename:**	**DX7M_142 S: 34**
Matrix:	SOLID	**Lab Sample I.D.:**	WG61707-102 L
Extraction Date:	03-Nov-2017	**Analysis Date:**	02-Dec-2017 **Time:** 17:56:30

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 20 uL EXTRACT VOLUME.

COMPOUND	LAB FLAG [1]	ION ABUND. RATIO [2]	SPIKE CONC. (ng/mL)	CONC. FOUND (ng/mL)	OPR CONC. LIMITS [3] (ng/mL)	% RECOVERY
2,3,7,8-TCDD		0.80	10.6	10.2	7.10 - 16.7	95.8
1,2,3,7,8-PECDD [4]		0.63	56.6	53.6	39.6 - 80.4	94.6
1,2,3,4,7,8-HXCDD		1.23	59.2	48.5	41.4 - 97.1	81.9
1,2,3,6,7,8-HXCDD		1.26	51.8	48.2	39.4 - 69.4	93.1
1,2,3,7,8,9-HXCDD		1.26	56.7	50.1	36.3 - 91.9	88.4
1,2,3,4,6,7,8-HPCDD		1.02	50.0	49.2	35.0 - 70.0	98.5
OCDD		0.90	108	95.6	84.2 - 155	88.6
2,3,7,8-TCDF		0.76	10.9	9.81	8.18 - 17.2	90.0
1,2,3,7,8-PECDF		1.53	50.0	47.6	40.0 - 67.0	95.3
2,3,4,7,8-PECDF		1.54	50.0	48.0	34.0 - 80.0	95.9
1,2,3,4,7,8-HXCDF		1.25	54.4	47.8	39.2 - 72.9	87.8
1,2,3,6,7,8-HXCDF		1.20	50.0	48.2	42.0 - 65.0	96.3
1,2,3,7,8,9-HXCDF		1.24	50.0	49.0	39.0 - 65.0	98.0
2,3,4,6,7,8-HXCDF		1.23	53.1	48.8	37.2 - 82.8	92.0
1,2,3,4,6,7,8-HPCDF		1.03	50.0	51.4	41.0 - 61.0	103
1,2,3,4,7,8,9-HPCDF		1.04	50.0	48.0	39.0 - 69.0	96.0
OCDF		0.89	109	91.1	68.4 - 185	83.9

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required Ion Abundance Ratios are specified in Table 9, Method 1613.
(3) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under OPR.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: Form8A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_WG61707-102_Form8A_SJ2313070.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 8B
PCDD/PCDF ONGOING PRECISION AND RECOVERY (OPR)

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.:	4819	**OPR Data Filename:**	**DX7M_142 S: 34**
Matrix:	SOLID	**Lab Sample I.D.:**	WG61707-102 L
Extraction Date:	03-Nov-2017	**Analysis Date:**	02-Dec-2017 **Time:** 17:56:30

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 20 uL EXTRACT VOLUME.

LABELED COMPOUND	LAB FLAG [1]	ION ABUND. RATIO [2]	SPIKE CONC. (ng/mL)	CONC. FOUND (ng/mL)	OPR CONC. LIMITS [3] (ng/mL)	% RECOVERY
13C-2,3,7,8-TCDD		0.78	100	76.7	20.0-175	76.7
13C-1,2,3,7,8-PECDD [4]		0.64	100	112	21.0-227	112
13C-1,2,3,4,7,8-HXCDD		1.26	100	81.2	21.0-193	81.2
13C-1,2,3,6,7,8-HXCDD		1.23	100	81.9	25.0-163	81.9
13C-1,2,3,4,6,7,8-HPCDD		1.02	100	89.5	26.0-166	89.5
13C-OCDD		0.89	200	168	26.0-397	83.9
13C-2,3,7,8-TCDF		0.78	100	78.4	22.0-152	78.4
13C-1,2,3,7,8-PECDF		1.55	100	79.1	21.0-192	79.1
13C-2,3,4,7,8-PECDF		1.57	100	80.2	13.0-328	80.2
13C-1,2,3,4,7,8-HXCDF		0.51	100	78.1	19.0-202	78.1
13C-1,2,3,6,7,8-HXCDF		0.53	100	77.3	21.0-159	77.3
13C-1,2,3,7,8,9-HXCDF		0.52	100	80.8	17.0-205	80.8
13C-2,3,4,6,7,8-HXCDF		0.53	100	78.9	22.0-176	78.9
13C-1,2,3,4,6,7,8-HPCDF		0.45	100	81.7	21.0-158	81.7
13C-1,2,3,4,7,8,9-HPCDF		0.45	100	86.7	20.0-186	86.7
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD			10.0	8.18	3.10-19.1	81.8

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required Ion Abundance Ratios are specified in Table 9, Method 1613.
(3) Contract-required concentration limits for OPR as specified in Table 6, Method 1613. Labeled compound concentrations limits are based on required percent recovery (Section 15.5, Method 1613).
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: Form8B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_WG61707-102_Form8B_SJ2313070.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 8C
PCDD/PCDF MATRIX SPIKE (MS)
ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44 (MS)
Sample Collection:
12-Oct-2017 15:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	WG61707-103 (MS)
Matrix:	SOLID	**Sample Size:**	10.1 g (dry)
Extraction Date:	03-Nov-2017	**Initial Calibration Date:**	06-Nov-2017
Analysis Date:	22-Nov-2017 **Time:** 14:44:53	**Instrument ID:**	HR GC/MS
Extract Volume (uL):	20	**GC Column ID:**	DB5
Injection Volume (uL):	1.0	**MS Data Filename:**	**DX7M_138D S: 8**
Dilution Factor:	N/A	**Blank Data Filename:**	DX7M_137 S: 82
		Cal. Ver. Data Filename:	DX7M_138D S: 1

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS ON SAMPLE SIZE BASIS

COMPOUND	LAB FLAG [1]	ION ABUND. RATIO	SPIKE CONC (pg/g)	SAMPLE LAB FLAG [1]	SAMPLE CONC (pg/g)	CONC. FOUND (pg/g)	MS R% [2]	REL % DIFF
2,3,7,8-TCDD		0.79	19.8	J	0.438	20.3	100	0.485
1,2,3,7,8-PECDD		0.61	99.1	J	1.11	108	108	2.37
1,2,3,4,7,8-HXCDD		1.22	99.1	J	1.20	97.4	97.1	3.66
1,2,3,6,7,8-HXCDD		1.25	99.1		5.67	99.9	95.1	4.57
1,2,3,7,8,9-HXCDD		1.24	99.1	J	3.96	95.7	92.6	5.78
1,2,3,4,6,7,8-HPCDD		1.03	99.1		81.6	187	106	1.84
OCDD		0.88	198		665	947	143	20.8
2,3,7,8-TCDF		0.78	19.8		1.19	20.9	99.7	4.38
1,2,3,7,8-PECDF		1.55	99.1	J	0.574	98.0	98.3	2.21
2,3,4,7,8-PECDF		1.56	99.1	J	0.788	98.2	98.3	2.29
1,2,3,4,7,8-HXCDF		1.24	99.1	J	3.19	146	144	32.9
1,2,3,6,7,8-HXCDF		1.23	99.1		7.07	108	102	2.75
1,2,3,7,8,9-HXCDF		1.27	99.1	J	0.189	96.8	97.5	1.93
2,3,4,6,7,8-HXCDF		1.25	99.1	J	1.12	102	102	1.20
1,2,3,4,6,7,8-HPCDF		1.05	99.1		148	358	212	64.3
1,2,3,4,7,8,9-HPCDF		1.05	99.1	J	2.96	159	157	42.3
OCDF		0.90	198		71.2	740	338	109

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent.
(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: MS.xsl; Created: 15-Dec-2017 15:00:56; Application: XMLTransformer-1.16.21;
Report Filename: MS_DIOXINS_1613-MS-MSD_WG61707-103_L28336-27_Form8C.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44 (MS)
Sample Collection:
12-Oct-2017 15:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.:	4819	**Project No.**	MUNGER LANDING SEDIMENT J170470
		Lab Sample I.D.:	WG61707-103 (MS)
Matrix:	SOLID	**Sample Size:**	10.1 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 14:44:53	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 8**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	33.9

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		20.3	0.0308 (S)	0.79	1.001
1,2,3,7,8-PECDD [4]		108	0.0405 (S)	0.61	1.000
1,2,3,4,7,8-HXCDD		97.4	0.0856 (S)	1.22	1.000
1,2,3,6,7,8-HXCDD		99.9	0.0780 (S)	1.25	1.000
1,2,3,7,8,9-HXCDD		95.7	0.0819 (S)	1.24	1.010
1,2,3,4,6,7,8-HPCDD		187	0.140 (S)	1.03	1.000
OCDD		947	0.130 (S)	0.88	1.000
2,3,7,8-TCDF		20.9	0.0696 (S)	0.78	1.001
1,2,3,7,8-PECDF		98.0	0.0521 (S)	1.55	1.001
2,3,4,7,8-PECDF		98.2	0.0454 (S)	1.56	1.000
1,2,3,4,7,8-HXCDF		146	0.0701 (S)	1.24	1.001
1,2,3,6,7,8-HXCDF		108	0.0730 (S)	1.23	1.000
1,2,3,7,8,9-HXCDF		96.8	0.0804 (S)	1.27	1.000
2,3,4,6,7,8-HXCDF		102	0.0727 (S)	1.25	1.000
1,2,3,4,6,7,8-HPCDF		358	0.244 (S)	1.05	1.000
1,2,3,4,7,8,9-HPCDF		159	0.293 (S)	1.05	1.000
OCDF		740	0.0738 (S)	0.90	1.002

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_WG61707-103_Form1A_DX7M_138DS8_SJ2310183.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44 (MS)
Sample Collection:
12-Oct-2017 15:15

Form 2

PCDD/PCDF ANALYSIS REPORT

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	WG61707-103 (MS)
Matrix:	SOLID	**Sample Size:**	10.1 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 14:44:53	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 8**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg absolute	**% Moisture:**	33.9

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1550	77.5	0.78	1.013
13C-1,2,3,7,8-PECDD [4]		2000	2410	121	0.65	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1540	76.8	1.26	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1610	80.3	1.24	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1530	76.6	1.04	1.094
13C-OCDD		4000	2850	71.2	0.88	1.178
13C-2,3,7,8-TCDF		2000	1520	75.8	0.75	0.966
13C-1,2,3,7,8-PECDF		2000	1520	76.1	1.59	1.285
13C-2,3,4,7,8-PECDF		2000	1550	77.6	1.58	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1530	76.3	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1480	74.1	0.52	0.959
13C-1,2,3,7,8,9-HXCDF		2000	1470	73.6	0.51	1.005
13C-2,3,4,6,7,8-HXCDF		2000	1500	74.8	0.51	0.981
13C-1,2,3,4,6,7,8-HPCDF		2000	1540	77.1	0.44	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1480	74.2	0.43	1.104
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	159	79.4		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_WG61707-103_Form2_DX7M_138DS8_SJ2310183.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 8E
PCDD/PCDF MATRIX SPIKE DUPLICATE (MSD)
ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44 (MSD)
Sample Collection:
12-Oct-2017 15:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	WG61707-104 (MSD)
Matrix:	SOLID	**Sample Size:**	9.91 g (dry)
Extraction Date:	03-Nov-2017	**Initial Calibration Date:**	06-Nov-2017
Analysis Date:	22-Nov-2017 **Time:** 15:40:07	**Instrument ID:**	HR GC/MS
Extract Volume (uL):	20	**GC Column ID:**	DB5
Injection Volume (uL):	1.0	**MSD Data Filename:**	**DX7M_138D S: 9**
Dilution Factor:	N/A	**Blank Data Filename:**	DX7M_137 S: 82
		Cal. Ver. Data Filename:	DX7M_138D S: 1

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS ON SAMPLE SIZE BASIS

COMPOUND	LAB FLAG [1]	ION ABUND. RATIO	SPIKE CONC (pg/g)	SAMPLE LAB FLAG [1]	SAMPLE CONC (pg/g)	CONC. FOUND (pg/g)	MSD R% [2]	REL % DIFF
2,3,7,8-TCDD		0.79	20.2	J	0.438	20.7	101	0.485
1,2,3,7,8-PECDD		0.62	101	J	1.11	113	111	2.37
1,2,3,4,7,8-HXCDD		1.24	101	J	1.20	103	101	3.66
1,2,3,6,7,8-HXCDD		1.25	101		5.67	106	99.6	4.57
1,2,3,7,8,9-HXCDD		1.25	101	J	3.96	103	98.1	5.78
1,2,3,4,6,7,8-HPCDD		1.02	101		81.6	191	108	1.84
OCDD		0.89	202		665	1020	176	20.8
2,3,7,8-TCDF		0.76	20.2		1.19	22.2	104	4.38
1,2,3,7,8-PECDF		1.55	101	J	0.574	102	101	2.21
2,3,4,7,8-PECDF		1.58	101	J	0.788	102	101	2.29
1,2,3,4,7,8-HXCDF		1.25	101	J	3.19	108	103	32.9
1,2,3,6,7,8-HXCDF		1.24	101		7.07	107	99.1	2.75
1,2,3,7,8,9-HXCDF		1.24	101	J	0.189	100	99.4	1.93
2,3,4,6,7,8-HXCDF		1.24	101	J	1.12	105	103	1.20
1,2,3,4,6,7,8-HPCDF		1.04	101		148	257	109	64.3
1,2,3,4,7,8,9-HPCDF		1.03	101	J	2.96	106	102	42.3
OCDF		0.92	202		71.2	272	99.5	109

(1) Where applicable, custom lab flags have been used on this report; J = concentration less than lowest calibration equivalent.
(2) R% = percent recovery.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested.

For Axys Internal Use Only [XSL Template: MS.xsl; Created: 15-Dec-2017 15:00:56; Application: XMLTransformer-1.16.21;
Report Filename: MS_DIOXINS_1613-MS-MSD_WG61707-104_L28336-27_Form8E.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 1A

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44 (MSD)
Sample Collection:
12-Oct-2017 15:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	WG61707-104 (MSD)
Matrix:	SOLID	**Sample Size:**	9.91 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 15:40:07	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 9**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg/g (dry weight basis)	**% Moisture:**	34.8

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG [1]	CONCENTRATION FOUND	REPORTING LIMIT (RL)[2]	ION ABUND. RATIO [3]	RRT [3]
2,3,7,8-TCDD		20.7	0.0270 (S)	0.79	1.001
1,2,3,7,8-PECDD [4]		113	0.0797 (S)	0.62	1.000
1,2,3,4,7,8-HXCDD		103	0.115 (S)	1.24	1.000
1,2,3,6,7,8-HXCDD		106	0.107 (S)	1.25	1.000
1,2,3,7,8,9-HXCDD		103	0.111 (S)	1.25	1.010
1,2,3,4,6,7,8-HPCDD		191	0.156 (S)	1.02	1.000
OCDD		1020	0.148 (S)	0.89	1.000
2,3,7,8-TCDF		22.2	0.0431 (S)	0.76	1.001
1,2,3,7,8-PECDF		102	0.0724 (S)	1.55	1.001
2,3,4,7,8-PECDF		102	0.0637 (S)	1.58	1.001
1,2,3,4,7,8-HXCDF		108	0.0955 (S)	1.25	1.000
1,2,3,6,7,8-HXCDF		107	0.0908 (S)	1.24	1.000
1,2,3,7,8,9-HXCDF		100	0.107 (S)	1.24	1.000
2,3,4,6,7,8-HXCDF		105	0.0891 (S)	1.24	1.000
1,2,3,4,6,7,8-HPCDF		257	0.103 (S)	1.04	1.000
1,2,3,4,7,8,9-HPCDF		106	0.126 (S)	1.03	1.000
OCDF		272	0.0982 (S)	0.92	1.002

(1) Where applicable, custom lab flags have been used on this report.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = minimum reporting level.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form1A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_WG61707-104_Form1A_DX7M_138DS9_SJ2310184.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 2

PCDD/PCDF ANALYSIS REPORT

CLIENT SAMPLE NO.
BW17ML-052-0.15-0.44 (MSD)
Sample Collection:
12-Oct-2017 15:15

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		Project No.	MUNGER LANDING SEDIMENT J170470
Contract No.:	4819	**Lab Sample I.D.:**	WG61707-104 (MSD)
Matrix:	SOLID	**Sample Size:**	9.91 g (dry)
Sample Receipt Date:	16-Oct-2017	**Initial Calibration Date:**	06-Nov-2017
Extraction Date:	03-Nov-2017	**Instrument ID:**	HR GC/MS
Analysis Date:	22-Nov-2017 **Time:** 15:40:07	**GC Column ID:**	DB5
Extract Volume (uL):	20	**Sample Data Filename:**	**DX7M_138D S: 9**
Injection Volume (uL):	1.0	**Blank Data Filename:**	DX7M_137 S: 82
Dilution Factor:	N/A	**Cal. Ver. Data Filename:**	DX7M_138D S: 1
Concentration Units:	pg absolute	**% Moisture:**	34.8

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with NELAP accreditation described in the total report. Sample results relate only to the sample tested.

LABELED COMPOUND	LAB FLAG [1]	SPIKE CONC.	CONC. FOUND	R(%) [2]	ION ABUND. RATIO [3]	RRT [3]
13C-2,3,7,8-TCDD		2000	1520	76.2	0.78	1.013
13C-1,2,3,7,8-PECDD [4]		2000	2480	124	0.66	1.384
13C-1,2,3,4,7,8-HXCDD		2000	1470	73.4	1.27	0.987
13C-1,2,3,6,7,8-HXCDD		2000	1640	82.0	1.22	0.990
13C-1,2,3,4,6,7,8-HPCDD		2000	1590	79.3	1.03	1.094
13C-OCDD		4000	2910	72.7	0.90	1.177
13C-2,3,7,8-TCDF		2000	1440	72.2	0.75	0.966
13C-1,2,3,7,8-PECDF		2000	1470	73.4	1.57	1.284
13C-2,3,4,7,8-PECDF		2000	1510	75.4	1.57	1.352
13C-1,2,3,4,7,8-HXCDF		2000	1470	73.4	0.52	0.954
13C-1,2,3,6,7,8-HXCDF		2000	1520	76.1	0.52	0.958
13C-1,2,3,7,8,9-HXCDF		2000	1510	75.5	0.52	1.005
13C-2,3,4,6,7,8-HXCDF		2000	1540	76.8	0.51	0.980
13C-1,2,3,4,6,7,8-HPCDF		2000	1560	77.9	0.45	1.062
13C-1,2,3,4,7,8,9-HPCDF		2000	1480	74.2	0.45	1.103
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD		200	161	80.5		1.001

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for percent recovery (R) are specified in Section 9.3.3, Method 1613.
(3) Contract-required limits for RRTs and ion abundance ratios are specified in Tables 2 and 9, respectively, Method 1613. NOTE: There is no ion abundance ratio for 37Cl4-2,3,7,8-TCDD
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Kristen Bowes________

For Axys Internal Use Only [XSL Template: Form2.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_1613DB5_WG61707-104_Form2_DX7M_138DS9_SJ2310184.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 3A
PCDD/PCDF INITIAL CALIBRATION RELATIVE RESPONSES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**CS0 Data Filename:**	N/A
Instrument ID:	HR GC/MS	**CS1 Data Filename:**	DB73_166 S: 4
GC Column ID:	DB225	**CS2 Data Filename:**	DB73_166 S: 3
		CS3 Data Filename:	DB73_166 S: 8
		CS4 Data Filename:	DB73_166 S: 7
		CS5 Data Filename:	DB73_166 S: 6
		CS6 Data Filename:	N/A

COMPOUND	LAB FLAG [1]	RELATIVE RESPONSE (RR) CS0	CS1	CS2	CS3	CS4	CS5	CS6	MEAN RR	CV (%RSD)[2]
1,2,3,7,8,9-HXCDD			0.83	0.86	0.96	0.96	0.93		0.91	6.71
2,3,7,8-TCDF			0.82	0.79	0.88	0.85	0.86		0.84	3.89

(1) Where applicable, custom lab flags have been used on this report.
(2) For contract CV specifications, see Section 10.5.4, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Bjorn Arvi________

For Axys Internal Use Only [XSL Template: Form3A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_19-Sep-2017_DB73__Form3A_GS73490.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 3C
PCDD/PCDF INITIAL CALIBRATION ION ABUNDANCE RATIOS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 19-Sep-2017

Instrument ID: HR GC/MS

GC Column ID: DB225

CS0 Data Filename: N/A

CS1 Data Filename: DB73_166 S: 4

CS2 Data Filename: DB73_166 S: 3

CS3 Data Filename: DB73_166 S: 8

CS4 Data Filename: DB73_166 S: 7

CS5 Data Filename: DB73_166 S: 6

CS6 Data Filename: N/A

COMPOUND	LAB FLAG [1]	M/Z's FORMING RATIO [2]	ION ABUNDANCE RATIO CS0	CS1	CS2	CS3	CS4	CS5	CS6	QC LIMITS[3]
1,2,3,7,8,9-HXCDD		**M+2/M+4**		1.25	1.25	1.24	1.23	1.24		1.05-1.43
2,3,7,8-TCDF		**M/M+2**		0.85	0.75	0.76	0.77	0.77		0.65-0.89

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits from Table 9, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Bjorn Arvi________

For Axys Internal Use Only [XSL Template: Form3C.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_19-Sep-2017_DB73__Form3C_GS73490.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5

PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		19-Sep-2017	
RT Window Data Filename:		**Analysis Date:**		**Time:**	
DB-5 IS Data Filename:		**Analysis Date:**		**Time:**	
DB-225 IS Data Filename:	DB73_166 S: 1	**Analysis Date:**	19-Sep-2017	**Time:**	08:34:26

DB225 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	N/A	**1,3,6,8-TCDF (F)**	N/A
1,2,8,9-TCDD (L)	N/A	**1,2,8,9-TCDF (L)**	N/A
1,2,4,7,9-PECDD (F)	N/A	**1,3,4,6,8-PECDF (F)**	N/A
1,2,3,8,9-PECDD (L)	N/A	**1,2,3,8,9-PECDF (L)**	N/A
1,2,4,6,7,9-HXCDD (F)	N/A	**1,2,3,4,6,8-HXCDF (F)**	N/A
1,2,3,4,6,7-HXCDD (L)	N/A	**1,2,3,4,8,9-HXCDF (L)**	N/A
1,2,3,4,6,7,9-HPCDD (F)	N/A	**1,2,3,4,6,7,8-HPCDF (F)**	N/A
1,2,3,4,6,7,8-HPCDD (L)	N/A	**1,2,3,4,7,8,9-HPCDF (L)**	N/A

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	N/A	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	N/A
1,2,7,8-TCDD **1,4,7,8-TCDD**	N/A	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	3.5
1,4,7,8-TCDD **1,2,3,7-TCDD**	N/A	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	3.5
1,2,3,7-TCDD **1,2,3,8-TCDD**	N/A		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Leanne Henley________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS__DB73_166S1_Form5_SJ2271074.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 3A
PCDD/PCDF INITIAL CALIBRATION RELATIVE RESPONSES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**CS0 Data Filename:**	N/A
Instrument ID:	HR GC/MS	**CS1 Data Filename:**	DX7M_134B S: 3
GC Column ID:	DB5	**CS2 Data Filename:**	DX7M_134B S: 4
		CS3 Data Filename:	DX7M_134B S: 7
		CS4 Data Filename:	DX7M_134B S: 6
		CS5 Data Filename:	DX7M_134B S: 5
		CS6 Data Filename:	N/A

		RELATIVE RESPONSE (RR)								
COMPOUND	**LAB FLAG [1]**	**CS0**	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**	**CS6**	**MEAN RR**	**CV (%RSD)[2]**
2,3,7,8-TCDD			1.07	0.95	1.05	1.02	0.99		1.02	4.78
1,2,3,7,8-PECDD [3]			0.99	1.01	1.04	1.01	1.03		1.02	2.12
1,2,3,4,7,8-HXCDD			1.04	0.97	1.05	1.06	1.03		1.03	3.23
1,2,3,6,7,8-HXCDD			1.07	0.93	1.01	0.97	0.97		0.99	5.24
1,2,3,7,8,9-HXCDD [4]			1.03	0.96	1.02	1.01	1.00		1.01	2.91
1,2,3,4,6,7,8-HPCDD			1.02	0.97	1.05	1.05	1.00		1.02	3.34
OCDD			1.01	0.99	1.08	1.08	1.03		1.04	3.83
2,3,7,8-TCDF			0.92	0.93	0.97	0.96	0.93		0.94	2.14
1,2,3,7,8-PECDF			0.91	0.91	0.99	0.95	0.95		0.94	3.60
2,3,4,7,8-PECDF			0.98	0.91	0.98	0.97	0.97		0.96	3.16
1,2,3,4,7,8-HXCDF			1.15	1.11	1.20	1.16	1.16		1.16	2.84
1,2,3,6,7,8-HXCDF			1.13	1.06	1.12	1.07	1.10		1.10	2.61
1,2,3,7,8,9-HXCDF			1.06	0.99	1.06	1.03	1.01		1.03	2.79
2,3,4,6,7,8-HXCDF			1.13	1.10	1.18	1.18	1.16		1.15	3.26
1,2,3,4,6,7,8-HPCDF			1.26	1.23	1.31	1.27	1.24		1.26	2.33
1,2,3,4,7,8,9-HPCDF			1.36	1.24	1.29	1.30	1.26		1.29	3.52
OCDF [5]			1.16	1.12	1.32	1.34	1.32		1.25	8.25

(1) Where applicable, custom lab flags have been used on this report.
(2) For contract CV specifications, see Section 10.5.4, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(4) Response ratios are calculated relative to the labeled analogs of the other two HXCDDs (Section 17.1.2, Method 1613).
(5) Response ratios are calculated relative to the labeled analog of OCDD (Section 17.1.1, Method 1613).

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Matthew Ou________

For Axys Internal Use Only [XSL Template: Form3A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_06-Nov-2017_DX7M__Form3A_GS73481.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 3B
PCDD/PCDF INITIAL CALIBRATION RELATIVE RESPONSES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**CS0 Data Filename:**	N/A
		CS1 Data Filename:	DX7M_134B S: 3
Instrument ID:	HR GC/MS	**CS2 Data Filename:**	DX7M_134B S: 4
GC Column ID:	DB5	**CS3 Data Filename:**	DX7M_134B S: 7
		CS4 Data Filename:	DX7M_134B S: 6
		CS5 Data Filename:	DX7M_134B S: 5
		CS6 Data Filename:	N/A

		RELATIVE RESPONSE (RR)								
LABELED COMPOUND	**LAB FLAG [1]**	**CS0**	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**	**CS6**	**MEAN RR**	**CV (%RSD)[2]**
13C-2,3,7,8-TCDD			0.98	1.03	1.03	1.04	1.10		1.04	4.13
13C-1,2,3,7,8-PECDD [3]			0.60	0.62	0.60	0.66	0.72		0.64	8.09
13C-1,2,3,4,7,8-HXCDD			0.94	0.96	0.98	0.94	0.94		0.95	1.72
13C-1,2,3,6,7,8-HXCDD			0.99	1.04	1.04	1.05	1.03		1.03	2.22
13C-1,2,3,4,6,7,8-HPCDD			0.76	0.81	0.79	0.78	0.81		0.79	2.53
13C-OCDD			0.65	0.70	0.67	0.71	0.84		0.71	10.5
13C-2,3,7,8-TCDF			1.43	1.52	1.58	1.57	1.55		1.53	3.81
13C-1,2,3,7,8-PECDF			1.05	1.08	1.09	1.16	1.26		1.13	7.38
13C-2,3,4,7,8-PECDF			0.98	1.03	1.03	1.10	1.23		1.07	8.87
13C-1,2,3,4,7,8-HXCDF			1.20	1.25	1.26	1.19	1.17		1.21	3.35
13C-1,2,3,6,7,8-HXCDF			1.33	1.34	1.39	1.36	1.34		1.35	1.62
13C-1,2,3,7,8,9-HXCDF			1.13	1.15	1.17	1.21	1.22		1.18	3.37
13C-2,3,4,6,7,8-HXCDF			1.18	1.21	1.22	1.19	1.18		1.20	1.71
13C-1,2,3,4,6,7,8-HPCDF			0.93	1.02	0.97	0.99	0.98		0.98	3.27
13C-1,2,3,4,7,8,9-HPCDF			0.76	0.77	0.78	0.77	0.83		0.78	3.35
CLEANUP STANDARD										
37CL-2,3,7,8-TCDD			1.13	1.15	1.11	1.12	1.16		1.14	1.77

(1) Where applicable, custom lab flags have been used on this report.
(2) For contract CV specifications, see Section 10.5.4, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Matthew Ou________

For Axys Internal Use Only [XSL Template: Form3B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_06-Nov-2017_DX7M__Form3B_GS73481.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 3C
PCDD/PCDF INITIAL CALIBRATION ION ABUNDANCE RATIOS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

		CS0 Data Filename:	N/A
Initial Calibration Date:	06-Nov-2017	**CS1 Data Filename:**	DX7M_134B S: 3
Instrument ID:	HR GC/MS	**CS2 Data Filename:**	DX7M_134B S: 4
GC Column ID:	DB5	**CS3 Data Filename:**	DX7M_134B S: 7
		CS4 Data Filename:	DX7M_134B S: 6
		CS5 Data Filename:	DX7M_134B S: 5
		CS6 Data Filename:	N/A

COMPOUND	**LAB FLAG [1]**	**M/Z's FORMING RATIO [2]**	**ION ABUNDANCE RATIO** CS0	CS1	CS2	CS3	CS4	CS5	CS6	**QC LIMITS[3]**
2,3,7,8-TCDD		**M/M+2**		0.76	0.77	0.76	0.78	0.78		0.65-0.89
1,2,3,7,8-PECDD [4]		**M/M+2**		0.64	0.60	0.63	0.63	0.63		0.52-0.70
1,2,3,4,7,8-HXCDD		**M+2/M+4**		1.30	1.20	1.23	1.24	1.25		1.05-1.43
1,2,3,6,7,8-HXCDD		**M+2/M+4**		1.29	1.28	1.24	1.23	1.24		1.05-1.43
1,2,3,7,8,9-HXCDD		**M+2/M+4**		1.34	1.25	1.24	1.23	1.23		1.05-1.43
1,2,3,4,6,7,8-HPCDD		**M+2/M+4**		1.09	1.01	1.03	1.04	1.04		0.88-1.20
OCDD		**M+2/M+4**		0.92	0.88	0.89	0.90	0.89		0.76-1.02
2,3,7,8-TCDF		**M/M+2**		0.66	0.79	0.76	0.77	0.77		0.65-0.89
1,2,3,7,8-PECDF		**M+2/M+4**		1.58	1.55	1.55	1.55	1.54		1.32-1.78
2,3,4,7,8-PECDF		**M+2/M+4**		1.53	1.48	1.55	1.56	1.55		1.32-1.78
1,2,3,4,7,8-HXCDF		**M+2/M+4**		1.12	1.20	1.22	1.24	1.26		1.05-1.43
1,2,3,6,7,8-HXCDF		**M+2/M+4**		1.24	1.23	1.27	1.24	1.26		1.05-1.43
1,2,3,7,8,9-HXCDF		**M+2/M+4**		1.27	1.25	1.27	1.26	1.25		1.05-1.43
2,3,4,6,7,8-HXCDF		**M+2/M+4**		1.26	1.25	1.24	1.22	1.24		1.05-1.43
1,2,3,4,6,7,8-HPCDF		**M+2/M+4**		0.96	1.05	1.03	1.05	1.05		0.88-1.20
1,2,3,4,7,8,9-HPCDF		**M+2/M+4**		1.09	1.06	1.05	1.02	1.04		0.88-1.20
OCDF		**M+2/M+4**		0.91	0.90	0.89	0.91	0.90		0.76-1.02

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits from Table 9, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Matthew Ou________

For Axys Internal Use Only [XSL Template: Form3C.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_06-Nov-2017_DX7M__Form3C_GS73481.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 3D
PCDD/PCDF INITIAL CALIBRATION ION ABUNDANCE RATIOS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**CS0 Data Filename:**	N/A
Instrument ID:	HR GC/MS	**CS1 Data Filename:**	DX7M_134B S: 3
GC Column ID:	DB5	**CS2 Data Filename:**	DX7M_134B S: 4
		CS3 Data Filename:	DX7M_134B S: 7
		CS4 Data Filename:	DX7M_134B S: 6
		CS5 Data Filename:	DX7M_134B S: 5
		CS6 Data Filename:	N/A

LABELED COMPOUND	LAB FLAG[1]	M/Z's FORMING RATIO [2]	ION ABUNDANCE RATIO CS0	CS1	CS2	CS3	CS4	CS5	CS6	QC LIMITS[3]
13C-2,3,7,8-TCDD		M/M+2		0.77	0.78	0.80	0.79	0.77		0.65-0.89
13C-1,2,3,7,8-PECDD [4]		M/M+2		0.68	0.65	0.67	0.66	0.66		0.52-0.70
13C-1,2,3,4,7,8-HXCDD		M+2/M+4		1.24	1.25	1.25	1.27	1.24		1.05-1.43
13C-1,2,3,6,7,8-HXCDD		M+2/M+4		1.24	1.26	1.26	1.25	1.24		1.05-1.43
13C-1,2,3,4,6,7,8-HPCDD		M+2/M+4		1.02	1.03	1.01	1.05	1.04		0.88-1.20
13C-OCDD		M+2/M+4		0.92	0.90	0.87	0.90	0.91		0.76-1.02
13C-2,3,7,8-TCDF		M/M+2		0.77	0.76	0.74	0.78	0.78		0.65-0.89
13C-1,2,3,7,8-PECDF		M+2/M+4		1.59	1.61	1.57	1.56	1.60		1.32-1.78
13C-2,3,4,7,8-PECDF		M+2/M+4		1.55	1.55	1.56	1.57	1.60		1.32-1.78
13C-1,2,3,4,7,8-HXCDF		M/M+2		0.52	0.52	0.52	0.52	0.52		0.43-0.59
13C-1,2,3,6,7,8-HXCDF		M/M+2		0.52	0.51	0.53	0.52	0.54		0.43-0.59
13C-1,2,3,7,8,9-HXCDF		M/M+2		0.52	0.51	0.52	0.52	0.52		0.43-0.59
13C-2,3,4,6,7,8-HXCDF		M/M+2		0.52	0.52	0.52	0.52	0.52		0.43-0.59
13C-1,2,3,4,6,7,8-HPCDF		M/M+2		0.46	0.46	0.46	0.45	0.45		0.37-0.51
13C-1,2,3,4,7,8,9-HPCDF		M/M+2		0.46	0.45	0.45	0.45	0.45		0.37-0.51

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits from Table 9, Method 1613.
(4) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Matthew Ou________

For Axys Internal Use Only [XSL Template: Form3D.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_06-Nov-2017_DX7M__Form3D_GS73481.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5
PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		06-Nov-2017
RT Window Data Filename:	DX7M_134B S: 1	**Analysis Date:**	06-Nov-2017	**Time:** 15:04:09
DB-5 IS Data Filename:	DX7M_134B S: 1	**Analysis Date:**	06-Nov-2017	**Time:** 15:04:09
DB-225 IS Data Filename:		**Analysis Date:**		**Time:**

DB5 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	23:06	**1,3,6,8-TCDF (F)**	21:32
1,2,8,9-TCDD (L)	28:30	**1,2,8,9-TCDF (L)**	28:21
1,2,4,7,9-PECDD (F)	32:16	**1,3,4,6,8-PECDF (F)**	29:04
1,2,3,8,9-PECDD (L)	37:11	**1,2,3,8,9-PECDF (L)**	37:15
1,2,4,6,7,9-HXCDD (F)	40:09	**1,2,3,4,6,8-HXCDF (F)**	39:07
1,2,3,4,6,7-HXCDD (L)	42:45	**1,2,3,4,8,9-HXCDF (L)**	43:06
1,2,3,4,6,7,9-HPCDD (F)	45:50	**1,2,3,4,6,7,8-HPCDF (F)**	45:23
1,2,3,4,6,7,8-HPCDD (L)	46:45	**1,2,3,4,7,8,9-HPCDF (L)**	47:09

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	0	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	10
1,2,7,8-TCDD **1,4,7,8-TCDD**	0	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	N/A
1,4,7,8-TCDD **1,2,3,7-TCDD**	0	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	N/A
1,2,3,7-TCDD **1,2,3,8-TCDD**	DB-5 column; co-elute as per Figure 6 in Method		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Leanne Henley________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS__DX7M_134BS1_Form5_SJ2295985.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_217 S: 2
Instrument ID:	HR GC/MS	**Analysis Date:**	17-Nov-2017
GC Column ID:	DB225	**Analysis Time:**	20:36:15

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.23	1.05-1.43	50.6	41 - 61
2,3,7,8-TCDF		**M/M+2**	0.77	0.65-0.89	10.1	8.4 - 12

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DB73_217S2__Form4A_SJ2310250.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_217 S: 2
Instrument ID:	HR GC/MS	**Analysis Date:**	17-Nov-2017
GC Column ID:	DB225	**Analysis Time:**	20:36:15

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.061	1.052-1.075
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DB73_217S2__Form6A_SJ2310250.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_217 S: 17
Instrument ID:	HR GC/MS	**Analysis Date:**	18-Nov-2017
GC Column ID:	DB225	**Analysis Time:**	06:54:37

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.25	1.05-1.43	50.9	41 - 61
2,3,7,8-TCDF		**M/M+2**	0.78	0.65-0.89	10.3	8.4 - 12

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DB73_217S17__Form4A_SJ2310260.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_217 S: 17
Instrument ID:	HR GC/MS	**Analysis Date:**	18-Nov-2017
GC Column ID:	DB225	**Analysis Time:**	06:54:37

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.061	1.052-1.075
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DB73_217S17__Form6A_SJ2310260.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5

PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		19-Sep-2017
RT Window Data Filename:		**Analysis Date:**		**Time:**
DB-5 IS Data Filename:		**Analysis Date:**		**Time:**
DB-225 IS Data Filename:	DB73_217 S: 1	**Analysis Date:**	17-Nov-2017	**Time:** 19:55:03

DB225 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	N/A	**1,3,6,8-TCDF (F)**	N/A
1,2,8,9-TCDD (L)	N/A	**1,2,8,9-TCDF (L)**	N/A
1,2,4,7,9-PECDD (F)	N/A	**1,3,4,6,8-PECDF (F)**	N/A
1,2,3,8,9-PECDD (L)	N/A	**1,2,3,8,9-PECDF (L)**	N/A
1,2,4,6,7,9-HXCDD (F)	N/A	**1,2,3,4,6,8-HXCDF (F)**	N/A
1,2,3,4,6,7-HXCDD (L)	N/A	**1,2,3,4,8,9-HXCDF (L)**	N/A
1,2,3,4,6,7,9-HPCDD (F)	N/A	**1,2,3,4,6,7,8-HPCDF (F)**	N/A
1,2,3,4,6,7,8-HPCDD (L)	N/A	**1,2,3,4,7,8,9-HPCDF (L)**	N/A

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	N/A	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	N/A
1,2,7,8-TCDD **1,4,7,8-TCDD**	N/A	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	3.3
1,4,7,8-TCDD **1,2,3,7-TCDD**	N/A	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	2
1,2,3,7-TCDD **1,2,3,8-TCDD**	N/A		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS__DB73_217S1_Form5_SJ2309805.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_218 S: 2
Instrument ID:	HR GC/MS	**Analysis Date:**	18-Nov-2017
GC Column ID:	DB225	**Analysis Time:**	08:18:02

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.22	1.05-1.43	51.4	41 - 61
2,3,7,8-TCDF		**M/M+2**	0.77	0.65-0.89	10.5	8.4 - 12

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DB73_218S2__Form4A_SJ2310280.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_218 S: 2
Instrument ID:	HR GC/MS	**Analysis Date:**	18-Nov-2017
GC Column ID:	DB225	**Analysis Time:**	08:18:02

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.061	1.052-1.075
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.002	0.999-1.003

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DB73_218S2__Form6A_SJ2310280.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_218 S: 17
Instrument ID:	HR GC/MS	**Analysis Date:**	18-Nov-2017
GC Column ID:	DB225	**Analysis Time:**	18:36:53

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.23	1.05-1.43	48.1	41 - 61
2,3,7,8-TCDF		**M/M+2**	0.76	0.65-0.89	9.90	8.4 - 12

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DB73_218S17__Form4A_SJ2310291.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_218 S: 17
Instrument ID:	HR GC/MS	**Analysis Date:**	18-Nov-2017
GC Column ID:	DB225	**Analysis Time:**	18:36:53

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.063	1.052-1.075
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DB73_218S17__Form6A_SJ2310291.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5

PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		19-Sep-2017
RT Window Data Filename:		**Analysis Date:**		**Time:**
DB-5 IS Data Filename:		**Analysis Date:**		**Time:**
DB-225 IS Data Filename:	DB73_218 S: 1	**Analysis Date:**	18-Nov-2017	**Time:** 07:36:51

DB225 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	N/A	**1,3,6,8-TCDF (F)**	N/A
1,2,8,9-TCDD (L)	N/A	**1,2,8,9-TCDF (L)**	N/A
1,2,4,7,9-PECDD (F)	N/A	**1,3,4,6,8-PECDF (F)**	N/A
1,2,3,8,9-PECDD (L)	N/A	**1,2,3,8,9-PECDF (L)**	N/A
1,2,4,6,7,9-HXCDD (F)	N/A	**1,2,3,4,6,8-HXCDF (F)**	N/A
1,2,3,4,6,7-HXCDD (L)	N/A	**1,2,3,4,8,9-HXCDF (L)**	N/A
1,2,3,4,6,7,9-HPCDD (F)	N/A	**1,2,3,4,6,7,8-HPCDF (F)**	N/A
1,2,3,4,6,7,8-HPCDD (L)	N/A	**1,2,3,4,7,8,9-HPCDF (L)**	N/A

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	N/A	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	N/A
1,2,7,8-TCDD **1,4,7,8-TCDD**	N/A	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	5.1
1,4,7,8-TCDD **1,2,3,7-TCDD**	N/A	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	2.5
1,2,3,7-TCDD **1,2,3,8-TCDD**	N/A		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS__DB73_218S1_Form5_SJ2303327.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 78
Instrument ID:	HR GC/MS	**Analysis Date:**	20-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	11:35:50

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
2,3,7,8-TCDD		**M/M+2**	0.77	0.65-0.89	9.82	7.8 - 12.9
1,2,3,7,8-PECDD [5]		**M/M+2**	0.63	0.52-0.70	48.3	39 - 65
1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.24	1.05-1.43	48.7	39 - 64
1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.27	1.05-1.43	48.9	39 - 64
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.25	1.05-1.43	49.1	41 - 61
1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.04	0.88-1.20	49.8	43 - 58
OCDD		**M+2/M+4**	0.86	0.76-1.02	96.4	79 - 126
2,3,7,8-TCDF		**M/M+2**	0.79	0.65-0.89	10.0	8.4 - 12
1,2,3,7,8-PECDF		**M+2/M+4**	1.56	1.32-1.78	51.2	41 - 60
2,3,4,7,8-PECDF		**M+2/M+4**	1.58	1.32-1.78	50.5	41 - 61
1,2,3,4,7,8-HXCDF		**M+2/M+4**	1.25	1.05-1.43	51.0	45 - 56
1,2,3,6,7,8-HXCDF		**M+2/M+4**	1.27	1.05-1.43	51.2	44 - 57
1,2,3,7,8,9-HXCDF		**M+2/M+4**	1.24	1.05-1.43	48.5	45 - 56
2,3,4,6,7,8-HXCDF		**M+2/M+4**	1.27	1.05-1.43	51.4	44 - 57
1,2,3,4,6,7,8-HPCDF		**M+2/M+4**	1.05	0.88-1.20	51.7	45 - 55
1,2,3,4,7,8,9-HPCDF		**M+2/M+4**	1.08	0.88-1.20	50.4	43 - 58
OCDF		**M+2/M+4**	0.92	0.76-1.02	95.3	63 - 159

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_137S78__Form4A_SJ2313657.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4B
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 78
Instrument ID:	HR GC/MS	**Analysis Date:**	20-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	11:35:50

	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
LABELED COMPOUND						
13C-2,3,7,8-TCDD		**M/M+2**	0.79	0.65-0.89	101	82 - 121
13C-1,2,3,7,8-PECDD [5]		**M/M+2**	0.66	0.52-0.70	104	62 - 160
13C-1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.23	1.05-1.43	101	85 - 117
13C-1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.22	1.05-1.43	101	85 - 118
13C-1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	0.98	0.88-1.20	110	72 - 138
13C-OCDD		**M+2/M+4**	0.90	0.76-1.02	185	96 - 415
13C-2,3,7,8-TCDF		**M/M+2**	0.74	0.65-0.89	102	71 - 140
13C-1,2,3,7,8-PECDF		**M+2/M+4**	1.55	1.32-1.78	98.8	76 - 130
13C-2,3,4,7,8-PECDF		**M+2/M+4**	1.57	1.32-1.78	99.9	77 - 130
13C-1,2,3,4,7,8-HXCDF		**M/M+2**	0.53	0.43-0.59	98.5	76 - 131
13C-1,2,3,6,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	97.6	70 - 143
13C-1,2,3,7,8,9-HXCDF		**M/M+2**	0.51	0.43-0.59	97.3	74 - 135
13C-2,3,4,6,7,8-HXCDF		**M/M+2**	0.53	0.43-0.59	99.5	73 - 137
13C-1,2,3,4,6,7,8-HPCDF		**M/M+2**	0.45	0.37-0.51	97.2	78 - 129
13C-1,2,3,4,7,8,9-HPCDF		**M/M+2**	0.45	0.37-0.51	99.7	77 - 129
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD [6]					9.97	7.9 - 12.7

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(6) No ion abundance ratio for 37Cl4-2,3,7,8-TCDD; concentration reported.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_137S78__Form4B_SJ2313657.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 78
Instrument ID:	HR GC/MS	**Analysis Date:**	20-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	11:35:50

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
2,3,7,8-TCDD		13C-2,3,7,8-TCDD	1.001	0.999-1.002
1,2,3,7,8-PECDD [3]		13C-1,2,3,7,8-PECDD	1.001	0.999-1.002
1,2,3,4,7,8-HXCDD		13C-1,2,3,4,7,8-HXCDD	1.000	0.999-1.001
1,2,3,6,7,8-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.000	0.998-1.004
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.010	1.000-1.019
1,2,3,4,6,7,8-HPCDD		13C-1,2,3,4,6,7,8-HPCDD	1.000	0.999-1.001
OCDD		13C-OCDD	1.000	0.999-1.001
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003
1,2,3,7,8-PECDF		13C-1,2,3,7,8-PECDF	1.001	0.999-1.002
2,3,4,7,8-PECDF		13C-2,3,4,7,8-PECDF	1.001	0.999-1.002
1,2,3,4,7,8-HXCDF		13C-1,2,3,4,7,8-HXCDF	1.000	0.999-1.001
1,2,3,6,7,8-HXCDF		13C-1,2,3,6,7,8-HXCDF	1.000	0.997-1.005
1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDF	1.001	0.999-1.001
2,3,4,6,7,8-HXCDF		13C-2,3,4,6,7,8-HXCDF	1.001	0.999-1.001
1,2,3,4,6,7,8-HPCDF		13C-1,2,3,4,6,7,8-HPCDF	1.000	0.999-1.001
1,2,3,4,7,8,9-HPCDF		13C-1,2,3,4,7,8,9-HPCDF	1.000	0.999-1.001
OCDF		13C-OCDD	1.002	0.999-1.008

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_137S78__Form6A_SJ2313657.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6B
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 78
Instrument ID:	HR GC/MS	**Analysis Date:**	20-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	11:35:50

	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
LABELED COMPOUND				
13C-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.013	0.976-1.043
13C-1,2,3,7,8-PECDD		13C-1,2,3,4-TCDD	1.383	1.000-1.567
13C-1,2,3,4,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.987	0.977-1.000
13C-1,2,3,6,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.990	0.981-1.003
13C-1,2,3,4,6,7,8-HPCDD		13C-1,2,3,7,8,9-HXCDD	1.094	1.086-1.110
13C-OCDD		13C-1,2,3,7,8,9-HXCDD	1.177	1.032-1.311
13C-2,3,7,8-TCDF		13C-1,2,3,4-TCDD	0.966	0.923-1.103
13C-1,2,3,7,8-PECDF		13C-1,2,3,4-TCDD	1.285	1.000-1.425
13C-2,3,4,7,8-PECDF		13C-1,2,3,4-TCDD	1.352	1.011-1.526
13C-1,2,3,4,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.954	0.944-0.970
13C-1,2,3,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.958	0.949-0.975
13C-1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDD	1.004	0.977-1.047
13C-2,3,4,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.980	0.959-1.021
13C-1,2,3,4,6,7,8-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.061	1.043-1.085
13C-1,2,3,4,7,8,9-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.103	1.057-1.151
CLEANUP STANDARD				
37CL-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.001	0.989-1.052

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_137S78__Form6B_SJ2313657.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 90
Instrument ID:	HR GC/MS	**Analysis Date:**	20-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	22:45:44

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
2,3,7,8-TCDD		**M/M+2**	0.79	0.65-0.89	10.2	7.8 - 12.9
1,2,3,7,8-PECDD [5]		**M/M+2**	0.62	0.52-0.70	50.3	39 - 65
1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.27	1.05-1.43	50.2	39 - 64
1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.20	1.05-1.43	47.5	39 - 64
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.23	1.05-1.43	48.9	41 - 61
1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.05	0.88-1.20	50.2	43 - 58
OCDD		**M+2/M+4**	0.91	0.76-1.02	98.4	79 - 126
2,3,7,8-TCDF		**M/M+2**	0.80	0.65-0.89	10.1	8.4 - 12
1,2,3,7,8-PECDF		**M+2/M+4**	1.55	1.32-1.78	51.5	41 - 60
2,3,4,7,8-PECDF		**M+2/M+4**	1.59	1.32-1.78	49.8	41 - 61
1,2,3,4,7,8-HXCDF		**M+2/M+4**	1.24	1.05-1.43	52.1	45 - 56
1,2,3,6,7,8-HXCDF		**M+2/M+4**	1.23	1.05-1.43	49.7	44 - 57
1,2,3,7,8,9-HXCDF		**M+2/M+4**	1.23	1.05-1.43	47.4	45 - 56
2,3,4,6,7,8-HXCDF		**M+2/M+4**	1.23	1.05-1.43	51.5	44 - 57
1,2,3,4,6,7,8-HPCDF		**M+2/M+4**	1.08	0.88-1.20	52.0	45 - 55
1,2,3,4,7,8,9-HPCDF		**M+2/M+4**	1.02	0.88-1.20	50.0	43 - 58
OCDF		**M+2/M+4**	0.89	0.76-1.02	94.7	63 - 159

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_137S90__Form4A_SJ2313662.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4B
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 90
Instrument ID:	HR GC/MS	**Analysis Date:**	20-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	22:45:44

LABELED COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
13C-2,3,7,8-TCDD		**M/M+2**	0.78	0.65-0.89	99.3	82 - 121
13C-1,2,3,7,8-PECDD [5]		**M/M+2**	0.65	0.52-0.70	104	62 - 160
13C-1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.29	1.05-1.43	98.9	85 - 117
13C-1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.24	1.05-1.43	104	85 - 118
13C-1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.02	0.88-1.20	100	72 - 138
13C-OCDD		**M+2/M+4**	0.92	0.76-1.02	196	96 - 415
13C-2,3,7,8-TCDF		**M/M+2**	0.74	0.65-0.89	101	71 - 140
13C-1,2,3,7,8-PECDF		**M+2/M+4**	1.57	1.32-1.78	101	76 - 130
13C-2,3,4,7,8-PECDF		**M+2/M+4**	1.54	1.32-1.78	104	77 - 130
13C-1,2,3,4,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	99.5	76 - 131
13C-1,2,3,6,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	99.8	70 - 143
13C-1,2,3,7,8,9-HXCDF		**M/M+2**	0.52	0.43-0.59	98.7	74 - 135
13C-2,3,4,6,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	98.0	73 - 137
13C-1,2,3,4,6,7,8-HPCDF		**M/M+2**	0.46	0.37-0.51	95.4	78 - 129
13C-1,2,3,4,7,8,9-HPCDF		**M/M+2**	0.46	0.37-0.51	95.7	77 - 129
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD [6]					9.71	7.9 - 12.7

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(6) No ion abundance ratio for 37Cl4-2,3,7,8-TCDD; concentration reported.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_137S90__Form4B_SJ2313662.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 90
Instrument ID:	HR GC/MS	**Analysis Date:**	20-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	22:45:44

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
2,3,7,8-TCDD		13C-2,3,7,8-TCDD	1.001	0.999-1.002
1,2,3,7,8-PECDD [3]		13C-1,2,3,7,8-PECDD	1.000	0.999-1.002
1,2,3,4,7,8-HXCDD		13C-1,2,3,4,7,8-HXCDD	1.000	0.999-1.001
1,2,3,6,7,8-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.000	0.998-1.004
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.010	1.000-1.019
1,2,3,4,6,7,8-HPCDD		13C-1,2,3,4,6,7,8-HPCDD	1.000	0.999-1.001
OCDD		13C-OCDD	1.000	0.999-1.001
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003
1,2,3,7,8-PECDF		13C-1,2,3,7,8-PECDF	1.001	0.999-1.002
2,3,4,7,8-PECDF		13C-2,3,4,7,8-PECDF	1.001	0.999-1.002
1,2,3,4,7,8-HXCDF		13C-1,2,3,4,7,8-HXCDF	1.000	0.999-1.001
1,2,3,6,7,8-HXCDF		13C-1,2,3,6,7,8-HXCDF	1.001	0.997-1.005
1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDF	1.000	0.999-1.001
2,3,4,6,7,8-HXCDF		13C-2,3,4,6,7,8-HXCDF	1.000	0.999-1.001
1,2,3,4,6,7,8-HPCDF		13C-1,2,3,4,6,7,8-HPCDF	1.000	0.999-1.001
1,2,3,4,7,8,9-HPCDF		13C-1,2,3,4,7,8,9-HPCDF	1.000	0.999-1.001
OCDF		13C-OCDD	1.002	0.999-1.008

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_137S90__Form6A_SJ2313662.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6B
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 90
Instrument ID:	HR GC/MS	**Analysis Date:**	20-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	22:45:44

	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
LABELED COMPOUND				
13C-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.013	0.976-1.043
13C-1,2,3,7,8-PECDD		13C-1,2,3,4-TCDD	1.384	1.000-1.567
13C-1,2,3,4,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.987	0.977-1.000
13C-1,2,3,6,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.990	0.981-1.003
13C-1,2,3,4,6,7,8-HPCDD		13C-1,2,3,7,8,9-HXCDD	1.094	1.086-1.110
13C-OCDD		13C-1,2,3,7,8,9-HXCDD	1.177	1.032-1.311
13C-2,3,7,8-TCDF		13C-1,2,3,4-TCDD	0.966	0.923-1.103
13C-1,2,3,7,8-PECDF		13C-1,2,3,4-TCDD	1.285	1.000-1.425
13C-2,3,4,7,8-PECDF		13C-1,2,3,4-TCDD	1.352	1.011-1.526
13C-1,2,3,4,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.954	0.944-0.970
13C-1,2,3,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.958	0.949-0.975
13C-1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDD	1.005	0.977-1.047
13C-2,3,4,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.981	0.959-1.021
13C-1,2,3,4,6,7,8-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.062	1.043-1.085
13C-1,2,3,4,7,8,9-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.104	1.057-1.151
CLEANUP STANDARD				
37CL-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.001	0.989-1.052

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_137S90__Form6B_SJ2313662.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 102
Instrument ID:	HR GC/MS	**Analysis Date:**	21-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	09:53:57

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
2,3,7,8-TCDD		**M/M+2**	0.80	0.65-0.89	10.4	7.8 - 12.9
1,2,3,7,8-PECDD [5]		**M/M+2**	0.62	0.52-0.70	49.9	39 - 65
1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.23	1.05-1.43	49.0	39 - 64
1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.26	1.05-1.43	49.8	39 - 64
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.22	1.05-1.43	50.1	41 - 61
1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.06	0.88-1.20	50.4	43 - 58
OCDD		**M+2/M+4**	0.88	0.76-1.02	101	79 - 126
2,3,7,8-TCDF		**M/M+2**	0.80	0.65-0.89	10.2	8.4 - 12
1,2,3,7,8-PECDF		**M+2/M+4**	1.59	1.32-1.78	51.1	41 - 60
2,3,4,7,8-PECDF		**M+2/M+4**	1.57	1.32-1.78	50.2	41 - 61
1,2,3,4,7,8-HXCDF		**M+2/M+4**	1.26	1.05-1.43	50.3	45 - 56
1,2,3,6,7,8-HXCDF		**M+2/M+4**	1.23	1.05-1.43	50.6	44 - 57
1,2,3,7,8,9-HXCDF		**M+2/M+4**	1.24	1.05-1.43	47.0	45 - 56
2,3,4,6,7,8-HXCDF		**M+2/M+4**	1.22	1.05-1.43	51.2	44 - 57
1,2,3,4,6,7,8-HPCDF		**M+2/M+4**	1.06	0.88-1.20	52.0	45 - 55
1,2,3,4,7,8,9-HPCDF		**M+2/M+4**	1.09	0.88-1.20	51.4	43 - 58
OCDF		**M+2/M+4**	0.92	0.76-1.02	95.5	63 - 159

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_137S102__Form4A_SJ2313661.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4B
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 102
Instrument ID:	HR GC/MS	**Analysis Date:**	21-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	09:53:57

	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
LABELED COMPOUND						
13C-2,3,7,8-TCDD		**M/M+2**	0.78	0.65-0.89	100	82 - 121
13C-1,2,3,7,8-PECDD [5]		**M/M+2**	0.65	0.52-0.70	101	62 - 160
13C-1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.26	1.05-1.43	97.2	85 - 117
13C-1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.25	1.05-1.43	99.1	85 - 118
13C-1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.03	0.88-1.20	96.5	72 - 138
13C-OCDD		**M+2/M+4**	0.88	0.76-1.02	178	96 - 415
13C-2,3,7,8-TCDF		**M/M+2**	0.76	0.65-0.89	102	71 - 140
13C-1,2,3,7,8-PECDF		**M+2/M+4**	1.58	1.32-1.78	100	76 - 130
13C-2,3,4,7,8-PECDF		**M+2/M+4**	1.56	1.32-1.78	101	77 - 130
13C-1,2,3,4,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	98.0	76 - 131
13C-1,2,3,6,7,8-HXCDF		**M/M+2**	0.53	0.43-0.59	100	70 - 143
13C-1,2,3,7,8,9-HXCDF		**M/M+2**	0.50	0.43-0.59	97.3	74 - 135
13C-2,3,4,6,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	98.9	73 - 137
13C-1,2,3,4,6,7,8-HPCDF		**M/M+2**	0.46	0.37-0.51	92.2	78 - 129
13C-1,2,3,4,7,8,9-HPCDF		**M/M+2**	0.46	0.37-0.51	91.9	77 - 129
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD [6]					9.31	7.9 - 12.7

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(6) No ion abundance ratio for 37Cl4-2,3,7,8-TCDD; concentration reported.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_137S102__Form4B_SJ2313661.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 102
Instrument ID:	HR GC/MS	**Analysis Date:**	21-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	09:53:57

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
2,3,7,8-TCDD		13C-2,3,7,8-TCDD	1.001	0.999-1.002
1,2,3,7,8-PECDD [3]		13C-1,2,3,7,8-PECDD	1.001	0.999-1.002
1,2,3,4,7,8-HXCDD		13C-1,2,3,4,7,8-HXCDD	1.000	0.999-1.001
1,2,3,6,7,8-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.000	0.998-1.004
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.010	1.000-1.019
1,2,3,4,6,7,8-HPCDD		13C-1,2,3,4,6,7,8-HPCDD	1.000	0.999-1.001
OCDD		13C-OCDD	1.000	0.999-1.001
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003
1,2,3,7,8-PECDF		13C-1,2,3,7,8-PECDF	1.001	0.999-1.002
2,3,4,7,8-PECDF		13C-2,3,4,7,8-PECDF	1.000	0.999-1.002
1,2,3,4,7,8-HXCDF		13C-1,2,3,4,7,8-HXCDF	1.000	0.999-1.001
1,2,3,6,7,8-HXCDF		13C-1,2,3,6,7,8-HXCDF	1.000	0.997-1.005
1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDF	1.001	0.999-1.001
2,3,4,6,7,8-HXCDF		13C-2,3,4,6,7,8-HXCDF	1.000	0.999-1.001
1,2,3,4,6,7,8-HPCDF		13C-1,2,3,4,6,7,8-HPCDF	1.000	0.999-1.001
1,2,3,4,7,8,9-HPCDF		13C-1,2,3,4,7,8,9-HPCDF	1.000	0.999-1.001
OCDF		13C-OCDD	1.002	0.999-1.008

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_137S102__Form6A_SJ2313661.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6B
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_137 S: 102
Instrument ID:	HR GC/MS	**Analysis Date:**	21-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	09:53:57

	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
LABELED COMPOUND				
13C-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.013	0.976-1.043
13C-1,2,3,7,8-PECDD		13C-1,2,3,4-TCDD	1.383	1.000-1.567
13C-1,2,3,4,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.987	0.977-1.000
13C-1,2,3,6,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.990	0.981-1.003
13C-1,2,3,4,6,7,8-HPCDD		13C-1,2,3,7,8,9-HXCDD	1.094	1.086-1.110
13C-OCDD		13C-1,2,3,7,8,9-HXCDD	1.177	1.032-1.311
13C-2,3,7,8-TCDF		13C-1,2,3,4-TCDD	0.966	0.923-1.103
13C-1,2,3,7,8-PECDF		13C-1,2,3,4-TCDD	1.285	1.000-1.425
13C-2,3,4,7,8-PECDF		13C-1,2,3,4-TCDD	1.352	1.011-1.526
13C-1,2,3,4,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.954	0.944-0.970
13C-1,2,3,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.958	0.949-0.975
13C-1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDD	1.004	0.977-1.047
13C-2,3,4,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.980	0.959-1.021
13C-1,2,3,4,6,7,8-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.061	1.043-1.085
13C-1,2,3,4,7,8,9-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.103	1.057-1.151
CLEANUP STANDARD				
37CL-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.001	0.989-1.052

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_137S102__Form6B_SJ2313661.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5
PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		06-Nov-2017
RT Window Data Filename:	DX7M_137 S: 78	**Analysis Date:**	20-Nov-2017	**Time:** 11:35:50
DB-5 IS Data Filename:	DX7M_137 S: 78	**Analysis Date:**	20-Nov-2017	**Time:** 11:35:50
DB-225 IS Data Filename:		**Analysis Date:**		**Time:**

DB5 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	22:59	**1,3,6,8-TCDF (F)**	21:26
1,2,8,9-TCDD (L)	28:22	**1,2,8,9-TCDF (L)**	28:13
1,2,4,7,9-PECDD (F)	32:08	**1,3,4,6,8-PECDF (F)**	28:56
1,2,3,8,9-PECDD (L)	37:07	**1,2,3,8,9-PECDF (L)**	37:10
1,2,4,6,7,9-HXCDD (F)	40:06	**1,2,3,4,6,8-HXCDF (F)**	39:03
1,2,3,4,6,7-HXCDD (L)	42:43	**1,2,3,4,8,9-HXCDF (L)**	43:03
1,2,3,4,6,7,9-HPCDD (F)	45:48	**1,2,3,4,6,7,8-HPCDF (F)**	45:21
1,2,3,4,6,7,8-HPCDD (L)	46:44	**1,2,3,4,7,8,9-HPCDF (L)**	47:08

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	0	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	17
1,2,7,8-TCDD **1,4,7,8-TCDD**	0	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	N/A
1,4,7,8-TCDD **1,2,3,7-TCDD**	0	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	N/A
1,2,3,7-TCDD **1,2,3,8-TCDD**	DB-5 column; co-elute as per Figure 6 in Method		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS__DX7M_137S78_Form5_SJ2309802.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5
PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		06-Nov-2017
RT Window Data Filename:	DX7M_137 S: 90	**Analysis Date:**	20-Nov-2017	**Time:** 22:45:44
DB-5 IS Data Filename:	DX7M_137 S: 90	**Analysis Date:**	20-Nov-2017	**Time:** 22:45:44
DB-225 IS Data Filename:		**Analysis Date:**		**Time:**

DB5 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	22:58	**1,3,6,8-TCDF (F)**	21:26
1,2,8,9-TCDD (L)	28:20	**1,2,8,9-TCDF (L)**	28:11
1,2,4,7,9-PECDD (F)	32:06	**1,3,4,6,8-PECDF (F)**	28:54
1,2,3,8,9-PECDD (L)	37:06	**1,2,3,8,9-PECDF (L)**	37:09
1,2,4,6,7,9-HXCDD (F)	40:05	**1,2,3,4,6,8-HXCDF (F)**	39:03
1,2,3,4,6,7-HXCDD (L)	42:42	**1,2,3,4,8,9-HXCDF (L)**	43:02
1,2,3,4,6,7,9-HPCDD (F)	45:48	**1,2,3,4,6,7,8-HPCDF (F)**	45:21
1,2,3,4,6,7,8-HPCDD (L)	46:43	**1,2,3,4,7,8,9-HPCDF (L)**	47:08

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	0	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	19
1,2,7,8-TCDD **1,4,7,8-TCDD**	0	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	N/A
1,4,7,8-TCDD **1,2,3,7-TCDD**	0	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	N/A
1,2,3,7-TCDD **1,2,3,8-TCDD**	DB-5 column; co-elute as per Figure 6 in Method		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS__DX7M_137S90_Form5_SJ2309804.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_138D S: 1
Instrument ID:	HR GC/MS	**Analysis Date:**	22-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	08:13:49

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
2,3,7,8-TCDD		**M/M+2**	0.78	0.65-0.89	10.1	7.8 - 12.9
1,2,3,7,8-PECDD [5]		**M/M+2**	0.61	0.52-0.70	50.6	39 - 65
1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.23	1.05-1.43	49.9	39 - 64
1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.21	1.05-1.43	48.7	39 - 64
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.24	1.05-1.43	49.3	41 - 61
1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.02	0.88-1.20	51.0	43 - 58
OCDD		**M+2/M+4**	0.90	0.76-1.02	98.5	79 - 126
2,3,7,8-TCDF		**M/M+2**	0.77	0.65-0.89	10.4	8.4 - 12
1,2,3,7,8-PECDF		**M+2/M+4**	1.56	1.32-1.78	51.3	41 - 60
2,3,4,7,8-PECDF		**M+2/M+4**	1.51	1.32-1.78	50.4	41 - 61
1,2,3,4,7,8-HXCDF		**M+2/M+4**	1.25	1.05-1.43	51.2	45 - 56
1,2,3,6,7,8-HXCDF		**M+2/M+4**	1.26	1.05-1.43	50.6	44 - 57
1,2,3,7,8,9-HXCDF		**M+2/M+4**	1.25	1.05-1.43	50.8	45 - 56
2,3,4,6,7,8-HXCDF		**M+2/M+4**	1.24	1.05-1.43	50.8	44 - 57
1,2,3,4,6,7,8-HPCDF		**M+2/M+4**	1.04	0.88-1.20	50.6	45 - 55
1,2,3,4,7,8,9-HPCDF		**M+2/M+4**	1.04	0.88-1.20	51.4	43 - 58
OCDF		**M+2/M+4**	0.89	0.76-1.02	99.9	63 - 159

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_138DS1__Form4A_SJ2313666.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4B
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_138D S: 1
Instrument ID:	HR GC/MS	**Analysis Date:**	22-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	08:13:49

	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
LABELED COMPOUND						
13C-2,3,7,8-TCDD		**M/M+2**	0.78	0.65-0.89	95.7	82 - 121
13C-1,2,3,7,8-PECDD [5]		**M/M+2**	0.65	0.52-0.70	101	62 - 160
13C-1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.27	1.05-1.43	103	85 - 117
13C-1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.24	1.05-1.43	100	85 - 118
13C-1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.03	0.88-1.20	110	72 - 138
13C-OCDD		**M+2/M+4**	0.90	0.76-1.02	222	96 - 415
13C-2,3,7,8-TCDF		**M/M+2**	0.76	0.65-0.89	100	71 - 140
13C-1,2,3,7,8-PECDF		**M+2/M+4**	1.58	1.32-1.78	99.3	76 - 130
13C-2,3,4,7,8-PECDF		**M+2/M+4**	1.60	1.32-1.78	103	77 - 130
13C-1,2,3,4,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	105	76 - 131
13C-1,2,3,6,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	102	70 - 143
13C-1,2,3,7,8,9-HXCDF		**M/M+2**	0.53	0.43-0.59	99.6	74 - 135
13C-2,3,4,6,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	104	73 - 137
13C-1,2,3,4,6,7,8-HPCDF		**M/M+2**	0.44	0.37-0.51	106	78 - 129
13C-1,2,3,4,7,8,9-HPCDF		**M/M+2**	0.44	0.37-0.51	111	77 - 129
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD [6]					9.39	7.9 - 12.7

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(6) No ion abundance ratio for 37Cl4-2,3,7,8-TCDD; concentration reported.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_138DS1__Form4B_SJ2313666.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_138D S: 1
Instrument ID:	HR GC/MS	**Analysis Date:**	22-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	08:13:49

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
2,3,7,8-TCDD		13C-2,3,7,8-TCDD	1.001	0.999-1.002
1,2,3,7,8-PECDD [3]		13C-1,2,3,7,8-PECDD	1.001	0.999-1.002
1,2,3,4,7,8-HXCDD		13C-1,2,3,4,7,8-HXCDD	1.000	0.999-1.001
1,2,3,6,7,8-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.000	0.998-1.004
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.010	1.000-1.019
1,2,3,4,6,7,8-HPCDD		13C-1,2,3,4,6,7,8-HPCDD	1.000	0.999-1.001
OCDD		13C-OCDD	1.000	0.999-1.001
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003
1,2,3,7,8-PECDF		13C-1,2,3,7,8-PECDF	1.000	0.999-1.002
2,3,4,7,8-PECDF		13C-2,3,4,7,8-PECDF	1.001	0.999-1.002
1,2,3,4,7,8-HXCDF		13C-1,2,3,4,7,8-HXCDF	1.000	0.999-1.001
1,2,3,6,7,8-HXCDF		13C-1,2,3,6,7,8-HXCDF	1.001	0.997-1.005
1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDF	1.000	0.999-1.001
2,3,4,6,7,8-HXCDF		13C-2,3,4,6,7,8-HXCDF	1.000	0.999-1.001
1,2,3,4,6,7,8-HPCDF		13C-1,2,3,4,6,7,8-HPCDF	1.000	0.999-1.001
1,2,3,4,7,8,9-HPCDF		13C-1,2,3,4,7,8,9-HPCDF	1.000	0.999-1.001
OCDF		13C-OCDD	1.002	0.999-1.008

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_138DS1__Form6A_SJ2313666.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6B
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_138D S: 1
Instrument ID:	HR GC/MS	**Analysis Date:**	22-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	08:13:49

	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
LABELED COMPOUND				
13C-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.012	0.976-1.043
13C-1,2,3,7,8-PECDD		13C-1,2,3,4-TCDD	1.384	1.000-1.567
13C-1,2,3,4,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.987	0.977-1.000
13C-1,2,3,6,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.990	0.981-1.003
13C-1,2,3,4,6,7,8-HPCDD		13C-1,2,3,7,8,9-HXCDD	1.094	1.086-1.110
13C-OCDD		13C-1,2,3,7,8,9-HXCDD	1.178	1.032-1.311
13C-2,3,7,8-TCDF		13C-1,2,3,4-TCDD	0.965	0.923-1.103
13C-1,2,3,7,8-PECDF		13C-1,2,3,4-TCDD	1.285	1.000-1.425
13C-2,3,4,7,8-PECDF		13C-1,2,3,4-TCDD	1.352	1.011-1.526
13C-1,2,3,4,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.954	0.944-0.970
13C-1,2,3,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.958	0.949-0.975
13C-1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDD	1.004	0.977-1.047
13C-2,3,4,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.980	0.959-1.021
13C-1,2,3,4,6,7,8-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.062	1.043-1.085
13C-1,2,3,4,7,8,9-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.104	1.057-1.151
CLEANUP STANDARD				
37CL-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.001	0.989-1.052

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_138DS1__Form6B_SJ2313666.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_138D S: 12
Instrument ID:	HR GC/MS	**Analysis Date:**	22-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	18:25:47

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
2,3,7,8-TCDD		M/M+2	0.81	0.65-0.89	10.2	7.8 - 12.9
1,2,3,7,8-PECDD [5]		M/M+2	0.63	0.52-0.70	50.8	39 - 65
1,2,3,4,7,8-HXCDD		M+2/M+4	1.22	1.05-1.43	48.9	39 - 64
1,2,3,6,7,8-HXCDD		M+2/M+4	1.25	1.05-1.43	49.2	39 - 64
1,2,3,7,8,9-HXCDD		M+2/M+4	1.26	1.05-1.43	50.3	41 - 61
1,2,3,4,6,7,8-HPCDD		M+2/M+4	1.01	0.88-1.20	49.0	43 - 58
OCDD		M+2/M+4	0.86	0.76-1.02	99.1	79 - 126
2,3,7,8-TCDF		M/M+2	0.77	0.65-0.89	10.5	8.4 - 12
1,2,3,7,8-PECDF		M+2/M+4	1.55	1.32-1.78	52.0	41 - 60
2,3,4,7,8-PECDF		M+2/M+4	1.55	1.32-1.78	49.5	41 - 61
1,2,3,4,7,8-HXCDF		M+2/M+4	1.23	1.05-1.43	51.0	45 - 56
1,2,3,6,7,8-HXCDF		M+2/M+4	1.25	1.05-1.43	49.8	44 - 57
1,2,3,7,8,9-HXCDF		M+2/M+4	1.23	1.05-1.43	46.2	45 - 56
2,3,4,6,7,8-HXCDF		M+2/M+4	1.26	1.05-1.43	51.6	44 - 57
1,2,3,4,6,7,8-HPCDF		M+2/M+4	1.05	0.88-1.20	50.9	45 - 55
1,2,3,4,7,8,9-HPCDF		M+2/M+4	1.03	0.88-1.20	51.3	43 - 58
OCDF		M+2/M+4	0.90	0.76-1.02	97.6	63 - 159

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_138DS12__Form4A_SJ2313665.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4B
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_138D S: 12
Instrument ID:	HR GC/MS	**Analysis Date:**	22-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	18:25:47

LABELED COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
13C-2,3,7,8-TCDD		**M/M+2**	0.78	0.65-0.89	97.9	82 - 121
13C-1,2,3,7,8-PECDD [5]		**M/M+2**	0.65	0.52-0.70	108	62 - 160
13C-1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.24	1.05-1.43	94.2	85 - 117
13C-1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.27	1.05-1.43	103	85 - 118
13C-1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.07	0.88-1.20	113	72 - 138
13C-OCDD		**M+2/M+4**	0.89	0.76-1.02	232	96 - 415
13C-2,3,7,8-TCDF		**M/M+2**	0.76	0.65-0.89	103	71 - 140
13C-1,2,3,7,8-PECDF		**M+2/M+4**	1.58	1.32-1.78	109	76 - 130
13C-2,3,4,7,8-PECDF		**M+2/M+4**	1.59	1.32-1.78	113	77 - 130
13C-1,2,3,4,7,8-HXCDF		**M/M+2**	0.53	0.43-0.59	96.5	76 - 131
13C-1,2,3,6,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	97.2	70 - 143
13C-1,2,3,7,8,9-HXCDF		**M/M+2**	0.53	0.43-0.59	101	74 - 135
13C-2,3,4,6,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	99.6	73 - 137
13C-1,2,3,4,6,7,8-HPCDF		**M/M+2**	0.46	0.37-0.51	105	78 - 129
13C-1,2,3,4,7,8,9-HPCDF		**M/M+2**	0.44	0.37-0.51	111	77 - 129
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD [6]					9.38	7.9 - 12.7

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(6) No ion abundance ratio for 37Cl4-2,3,7,8-TCDD; concentration reported.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_138DS12__Form4B_SJ2313665.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_138D S: 12
Instrument ID:	HR GC/MS	**Analysis Date:**	22-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	18:25:47

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
2,3,7,8-TCDD		13C-2,3,7,8-TCDD	1.001	0.999-1.002
1,2,3,7,8-PECDD [3]		13C-1,2,3,7,8-PECDD	1.001	0.999-1.002
1,2,3,4,7,8-HXCDD		13C-1,2,3,4,7,8-HXCDD	1.000	0.999-1.001
1,2,3,6,7,8-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.000	0.998-1.004
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.010	1.000-1.019
1,2,3,4,6,7,8-HPCDD		13C-1,2,3,4,6,7,8-HPCDD	1.000	0.999-1.001
OCDD		13C-OCDD	1.000	0.999-1.001
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003
1,2,3,7,8-PECDF		13C-1,2,3,7,8-PECDF	1.000	0.999-1.002
2,3,4,7,8-PECDF		13C-2,3,4,7,8-PECDF	1.001	0.999-1.002
1,2,3,4,7,8-HXCDF		13C-1,2,3,4,7,8-HXCDF	1.000	0.999-1.001
1,2,3,6,7,8-HXCDF		13C-1,2,3,6,7,8-HXCDF	1.001	0.997-1.005
1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDF	1.000	0.999-1.001
2,3,4,6,7,8-HXCDF		13C-2,3,4,6,7,8-HXCDF	1.000	0.999-1.001
1,2,3,4,6,7,8-HPCDF		13C-1,2,3,4,6,7,8-HPCDF	1.000	0.999-1.001
1,2,3,4,7,8,9-HPCDF		13C-1,2,3,4,7,8,9-HPCDF	1.000	0.999-1.001
OCDF		13C-OCDD	1.002	0.999-1.008

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_138DS12__Form6A_SJ2313665.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6B
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_138D S: 12
Instrument ID:	HR GC/MS	**Analysis Date:**	22-Nov-2017
GC Column ID:	DB5	**Analysis Time:**	18:25:47

	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
LABELED COMPOUND				
13C-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.013	0.976-1.043
13C-1,2,3,7,8-PECDD		13C-1,2,3,4-TCDD	1.383	1.000-1.567
13C-1,2,3,4,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.987	0.977-1.000
13C-1,2,3,6,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.990	0.981-1.003
13C-1,2,3,4,6,7,8-HPCDD		13C-1,2,3,7,8,9-HXCDD	1.094	1.086-1.110
13C-OCDD		13C-1,2,3,7,8,9-HXCDD	1.178	1.032-1.311
13C-2,3,7,8-TCDF		13C-1,2,3,4-TCDD	0.966	0.923-1.103
13C-1,2,3,7,8-PECDF		13C-1,2,3,4-TCDD	1.285	1.000-1.425
13C-2,3,4,7,8-PECDF		13C-1,2,3,4-TCDD	1.352	1.011-1.526
13C-1,2,3,4,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.954	0.944-0.970
13C-1,2,3,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.958	0.949-0.975
13C-1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDD	1.005	0.977-1.047
13C-2,3,4,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.981	0.959-1.021
13C-1,2,3,4,6,7,8-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.062	1.043-1.085
13C-1,2,3,4,7,8,9-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.104	1.057-1.151
CLEANUP STANDARD				
37CL-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.001	0.989-1.052

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_138DS12__Form6B_SJ2313665.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5

PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		06-Nov-2017
RT Window Data Filename:	DX7M_138D S: 1	**Analysis Date:**	22-Nov-2017	**Time:** 08:13:49
DB-5 IS Data Filename:	DX7M_138D S: 1	**Analysis Date:**	22-Nov-2017	**Time:** 08:13:49
DB-225 IS Data Filename:		**Analysis Date:**		**Time:**

DB5 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	22:55	**1,3,6,8-TCDF (F)**	21:23
1,2,8,9-TCDD (L)	28:17	**1,2,8,9-TCDF (L)**	28:07
1,2,4,7,9-PECDD (F)	32:01	**1,3,4,6,8-PECDF (F)**	28:50
1,2,3,8,9-PECDD (L)	37:03	**1,2,3,8,9-PECDF (L)**	37:06
1,2,4,6,7,9-HXCDD (F)	40:02	**1,2,3,4,6,8-HXCDF (F)**	38:59
1,2,3,4,6,7-HXCDD (L)	42:40	**1,2,3,4,8,9-HXCDF (L)**	43:00
1,2,3,4,6,7,9-HPCDD (F)	45:46	**1,2,3,4,6,7,8-HPCDF (F)**	45:18
1,2,3,4,6,7,8-HPCDD (L)	46:41	**1,2,3,4,7,8,9-HPCDF (L)**	47:06

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	0	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	10
1,2,7,8-TCDD **1,4,7,8-TCDD**	0	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	N/A
1,4,7,8-TCDD **1,2,3,7-TCDD**	0	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	N/A
1,2,3,7-TCDD **1,2,3,8-TCDD**	DB-5 column; co-elute as per Figure 6 in Method		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Thong Do_________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS__DX7M_138DS1_Form5_SJ2305521.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 3A
PCDD/PCDF INITIAL CALIBRATION RELATIVE RESPONSES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	22-Nov-2017
Instrument ID:	HR GC/MS
GC Column ID:	DB225

CS0 Data Filename:	N/A
CS1 Data Filename:	DB73_220B S: 3
CS2 Data Filename:	DB73_220B S: 2
CS3 Data Filename:	DB73_220B S: 8
CS4 Data Filename:	DB73_220B S: 7
CS5 Data Filename:	DB73_220B S: 6
CS6 Data Filename:	N/A

		RELATIVE RESPONSE (RR)								
COMPOUND	**LAB FLAG [1]**	**CS0**	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**	**CS6**	**MEAN RR**	**CV (%RSD)[2]**
1,2,3,7,8,9-HXCDD			0.90	0.87	0.93	1.01	0.97		0.93	5.92
2,3,7,8-TCDF			0.85	0.83	0.86	0.89	0.90		0.87	3.21

(1) Where applicable, custom lab flags have been used on this report.
(2) For contract CV specifications, see Section 10.5.4, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Bjorn Arvi________

For Axys Internal Use Only [XSL Template: Form3A.xsl; Created: 05-Jan-2018 11:19:35; Application: XMLTransformer-1.16.22; Report Filename: 1613_DIOXINS_22-Nov-2017_DB73__Form3A_GS73630.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 3C
PCDD/PCDF INITIAL CALIBRATION ION ABUNDANCE RATIOS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	22-Nov-2017	**CS0 Data Filename:**	N/A
Instrument ID:	HR GC/MS	**CS1 Data Filename:**	DB73_220B S: 3
GC Column ID:	DB225	**CS2 Data Filename:**	DB73_220B S: 2
		CS3 Data Filename:	DB73_220B S: 8
		CS4 Data Filename:	DB73_220B S: 7
		CS5 Data Filename:	DB73_220B S: 6
		CS6 Data Filename:	N/A

COMPOUND	LAB FLAG [1]	M/Z's FORMING RATIO [2]	ION ABUNDANCE RATIO CS0	CS1	CS2	CS3	CS4	CS5	CS6	QC LIMITS[3]
1,2,3,7,8,9-HXCDD		**M+2/M+4**		1.18	1.27	1.25	1.24	1.23		1.05-1.43
2,3,7,8-TCDF		**M/M+2**		0.78	0.77	0.76	0.77	0.77		0.65-0.89

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits from Table 9, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Bjorn Arvi________

For Axys Internal Use Only [XSL Template: Form3C.xsl; Created: 05-Jan-2018 11:19:35; Application: XMLTransformer-1.16.22; Report Filename: 1613_DIOXINS_22-Nov-2017_DB73__Form3C_GS73630.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5
PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		22-Nov-2017	
RT Window Data Filename:		**Analysis Date:**		**Time:**	
DB-5 IS Data Filename:		**Analysis Date:**		**Time:**	
DB-225 IS Data Filename:	DB73_220B S: 1	**Analysis Date:**	22-Nov-2017	**Time:**	14:11:47

DB225 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	N/A	**1,3,6,8-TCDF (F)**	N/A
1,2,8,9-TCDD (L)	N/A	**1,2,8,9-TCDF (L)**	N/A
1,2,4,7,9-PECDD (F)	N/A	**1,3,4,6,8-PECDF (F)**	N/A
1,2,3,8,9-PECDD (L)	N/A	**1,2,3,8,9-PECDF (L)**	N/A
1,2,4,6,7,9-HXCDD (F)	N/A	**1,2,3,4,6,8-HXCDF (F)**	N/A
1,2,3,4,6,7-HXCDD (L)	N/A	**1,2,3,4,8,9-HXCDF (L)**	N/A
1,2,3,4,6,7,9-HPCDD (F)	N/A	**1,2,3,4,6,7,8-HPCDF (F)**	N/A
1,2,3,4,6,7,8-HPCDD (L)	N/A	**1,2,3,4,7,8,9-HPCDF (L)**	N/A

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	N/A	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	N/A
1,2,7,8-TCDD **1,4,7,8-TCDD**	N/A	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	10
1,4,7,8-TCDD **1,2,3,7-TCDD**	N/A	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	8.5
1,2,3,7-TCDD **1,2,3,8-TCDD**	N/A		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Angela Schlak________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 05-Jan-2018 11:19:35; Application: XMLTransformer-1.16.22; Report Filename: 1613_DIOXINS__DB73_220BS1_Form5_SJ2306446.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_231A S: 2
Instrument ID:	HR GC/MS	**Analysis Date:**	01-Dec-2017
GC Column ID:	DB225	**Analysis Time:**	21:32:00

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.24	1.05-1.43	48.0	41 - 61
2,3,7,8-TCDF		**M/M+2**	0.75	0.65-0.89	10.1	8.4 - 12

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DB73_231AS2__Form4A_SJ2318307.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_231A S: 2
Instrument ID:	HR GC/MS	**Analysis Date:**	01-Dec-2017
GC Column ID:	DB225	**Analysis Time:**	21:32:00

COMPOUND	**LAB FLAG** [1]	**RETENTION TIME REFERENCE**	**RRT**	**RRT QC LIMITS** [2]
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.061	1.052-1.075
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.002	0.999-1.003

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DB73_231AS2__Form6A_SJ2318307.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_231A S: 17
Instrument ID:	HR GC/MS	**Analysis Date:**	02-Dec-2017
GC Column ID:	DB225	**Analysis Time:**	07:56:25

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.26	1.05-1.43	46.9	41 - 61
2,3,7,8-TCDF		**M/M+2**	0.74	0.65-0.89	9.59	8.4 - 12

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DB73_231AS17__Form4A_SJ2318308.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	19-Sep-2017	**VER Data Filename:**	DB73_231A S: 17
Instrument ID:	HR GC/MS	**Analysis Date:**	02-Dec-2017
GC Column ID:	DB225	**Analysis Time:**	07:56:25

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.061	1.052-1.075
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DB73_231AS17__Form6A_SJ2318308.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5
PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		19-Sep-2017
RT Window Data Filename:		**Analysis Date:**		**Time:**
DB-5 IS Data Filename:		**Analysis Date:**		**Time:**
DB-225 IS Data Filename:	DB73_231A S: 1	**Analysis Date:**	01-Dec-2017	**Time:** 20:47:35

DB225 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	N/A	**1,3,6,8-TCDF (F)**	N/A
1,2,8,9-TCDD (L)	N/A	**1,2,8,9-TCDF (L)**	N/A
1,2,4,7,9-PECDD (F)	N/A	**1,3,4,6,8-PECDF (F)**	N/A
1,2,3,8,9-PECDD (L)	N/A	**1,2,3,8,9-PECDF (L)**	N/A
1,2,4,6,7,9-HXCDD (F)	N/A	**1,2,3,4,6,8-HXCDF (F)**	N/A
1,2,3,4,6,7-HXCDD (L)	N/A	**1,2,3,4,8,9-HXCDF (L)**	N/A
1,2,3,4,6,7,9-HPCDD (F)	N/A	**1,2,3,4,6,7,8-HPCDF (F)**	N/A
1,2,3,4,6,7,8-HPCDD (L)	N/A	**1,2,3,4,7,8,9-HPCDF (L)**	N/A

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	N/A	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	N/A
1,2,7,8-TCDD **1,4,7,8-TCDD**	N/A	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	1.5
1,4,7,8-TCDD **1,2,3,7-TCDD**	N/A	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	3.4
1,2,3,7-TCDD **1,2,3,8-TCDD**	N/A		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Angela Schlak________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:59:05; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS__DB73_231AS1_Form5_SJ2311616.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 33
Instrument ID:	HR GC/MS	**Analysis Date:**	02-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	16:52:00

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
2,3,7,8-TCDD		**M/M+2**	0.79	0.65-0.89	10.3	7.8 - 12.9
1,2,3,7,8-PECDD [5]		**M/M+2**	0.63	0.52-0.70	51.2	39 - 65
1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.24	1.05-1.43	49.5	39 - 64
1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.24	1.05-1.43	49.0	39 - 64
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.18	1.05-1.43	50.8	41 - 61
1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.03	0.88-1.20	49.5	43 - 58
OCDD		**M+2/M+4**	0.89	0.76-1.02	98.5	79 - 126
2,3,7,8-TCDF		**M/M+2**	0.79	0.65-0.89	10.3	8.4 - 12
1,2,3,7,8-PECDF		**M+2/M+4**	1.55	1.32-1.78	51.8	41 - 60
2,3,4,7,8-PECDF		**M+2/M+4**	1.54	1.32-1.78	49.5	41 - 61
1,2,3,4,7,8-HXCDF		**M+2/M+4**	1.23	1.05-1.43	49.0	45 - 56
1,2,3,6,7,8-HXCDF		**M+2/M+4**	1.22	1.05-1.43	48.7	44 - 57
1,2,3,7,8,9-HXCDF		**M+2/M+4**	1.21	1.05-1.43	47.9	45 - 56
2,3,4,6,7,8-HXCDF		**M+2/M+4**	1.23	1.05-1.43	50.3	44 - 57
1,2,3,4,6,7,8-HPCDF		**M+2/M+4**	1.03	0.88-1.20	48.7	45 - 55
1,2,3,4,7,8,9-HPCDF		**M+2/M+4**	1.06	0.88-1.20	48.2	43 - 58
OCDF		**M+2/M+4**	0.90	0.76-1.02	96.2	63 - 159

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_142S33__Form4A_SJ2313669.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4B
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 33
Instrument ID:	HR GC/MS	**Analysis Date:**	02-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	16:52:00

	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
LABELED COMPOUND						
13C-2,3,7,8-TCDD		**M/M+2**	0.79	0.65-0.89	98.6	82 - 121
13C-1,2,3,7,8-PECDD [5]		**M/M+2**	0.65	0.52-0.70	107	62 - 160
13C-1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.27	1.05-1.43	97.6	85 - 117
13C-1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.25	1.05-1.43	96.3	85 - 118
13C-1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.04	0.88-1.20	106	72 - 138
13C-OCDD		**M+2/M+4**	0.90	0.76-1.02	211	96 - 415
13C-2,3,7,8-TCDF		**M/M+2**	0.77	0.65-0.89	99.9	71 - 140
13C-1,2,3,7,8-PECDF		**M+2/M+4**	1.57	1.32-1.78	99.3	76 - 130
13C-2,3,4,7,8-PECDF		**M+2/M+4**	1.55	1.32-1.78	107	77 - 130
13C-1,2,3,4,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	95.0	76 - 131
13C-1,2,3,6,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	92.7	70 - 143
13C-1,2,3,7,8,9-HXCDF		**M/M+2**	0.52	0.43-0.59	98.4	74 - 135
13C-2,3,4,6,7,8-HXCDF		**M/M+2**	0.53	0.43-0.59	96.8	73 - 137
13C-1,2,3,4,6,7,8-HPCDF		**M/M+2**	0.46	0.37-0.51	100	78 - 129
13C-1,2,3,4,7,8,9-HPCDF		**M/M+2**	0.45	0.37-0.51	105	77 - 129
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD [6]					9.85	7.9 - 12.7

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(6) No ion abundance ratio for 37Cl4-2,3,7,8-TCDD; concentration reported.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S33__Form4B_SJ2313669.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 33
Instrument ID:	HR GC/MS	**Analysis Date:**	02-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	16:52:00

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
2,3,7,8-TCDD		13C-2,3,7,8-TCDD	1.001	0.999-1.002
1,2,3,7,8-PECDD [3]		13C-1,2,3,7,8-PECDD	1.001	0.999-1.002
1,2,3,4,7,8-HXCDD		13C-1,2,3,4,7,8-HXCDD	1.000	0.999-1.001
1,2,3,6,7,8-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.000	0.998-1.004
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.010	1.000-1.019
1,2,3,4,6,7,8-HPCDD		13C-1,2,3,4,6,7,8-HPCDD	1.000	0.999-1.001
OCDD		13C-OCDD	1.000	0.999-1.001
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003
1,2,3,7,8-PECDF		13C-1,2,3,7,8-PECDF	1.001	0.999-1.002
2,3,4,7,8-PECDF		13C-2,3,4,7,8-PECDF	1.001	0.999-1.002
1,2,3,4,7,8-HXCDF		13C-1,2,3,4,7,8-HXCDF	1.000	0.999-1.001
1,2,3,6,7,8-HXCDF		13C-1,2,3,6,7,8-HXCDF	1.000	0.997-1.005
1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDF	1.000	0.999-1.001
2,3,4,6,7,8-HXCDF		13C-2,3,4,6,7,8-HXCDF	1.000	0.999-1.001
1,2,3,4,6,7,8-HPCDF		13C-1,2,3,4,6,7,8-HPCDF	1.000	0.999-1.001
1,2,3,4,7,8,9-HPCDF		13C-1,2,3,4,7,8,9-HPCDF	1.000	0.999-1.001
OCDF		13C-OCDD	1.002	0.999-1.008

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S33__Form6A_SJ2313669.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6B
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 33
Instrument ID:	HR GC/MS	**Analysis Date:**	02-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	16:52:00

	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
LABELED COMPOUND				
13C-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.013	0.976-1.043
13C-1,2,3,7,8-PECDD		13C-1,2,3,4-TCDD	1.383	1.000-1.567
13C-1,2,3,4,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.987	0.977-1.000
13C-1,2,3,6,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.990	0.981-1.003
13C-1,2,3,4,6,7,8-HPCDD		13C-1,2,3,7,8,9-HXCDD	1.094	1.086-1.110
13C-OCDD		13C-1,2,3,7,8,9-HXCDD	1.177	1.032-1.311
13C-2,3,7,8-TCDF		13C-1,2,3,4-TCDD	0.966	0.923-1.103
13C-1,2,3,7,8-PECDF		13C-1,2,3,4-TCDD	1.285	1.000-1.425
13C-2,3,4,7,8-PECDF		13C-1,2,3,4-TCDD	1.352	1.011-1.526
13C-1,2,3,4,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.955	0.944-0.970
13C-1,2,3,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.959	0.949-0.975
13C-1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDD	1.005	0.977-1.047
13C-2,3,4,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.980	0.959-1.021
13C-1,2,3,4,6,7,8-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.062	1.043-1.085
13C-1,2,3,4,7,8,9-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.103	1.057-1.151
CLEANUP STANDARD				
37CL-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.001	0.989-1.052

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S33__Form6B_SJ2313669.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 45
Instrument ID:	HR GC/MS	**Analysis Date:**	03-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	13:20:06

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
2,3,7,8-TCDD		**M/M+2**	0.79	0.65-0.89	10.7	7.8 - 12.9
1,2,3,7,8-PECDD [5]		**M/M+2**	0.62	0.52-0.70	50.6	39 - 65
1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.24	1.05-1.43	49.5	39 - 64
1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.26	1.05-1.43	48.0	39 - 64
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.23	1.05-1.43	48.9	41 - 61
1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.04	0.88-1.20	49.8	43 - 58
OCDD		**M+2/M+4**	0.88	0.76-1.02	102	79 - 126
2,3,7,8-TCDF		**M/M+2**	0.76	0.65-0.89	10.1	8.4 - 12
1,2,3,7,8-PECDF		**M+2/M+4**	1.51	1.32-1.78	51.0	41 - 60
2,3,4,7,8-PECDF		**M+2/M+4**	1.52	1.32-1.78	49.0	41 - 61
1,2,3,4,7,8-HXCDF		**M+2/M+4**	1.22	1.05-1.43	49.2	45 - 56
1,2,3,6,7,8-HXCDF		**M+2/M+4**	1.21	1.05-1.43	48.3	44 - 57
1,2,3,7,8,9-HXCDF		**M+2/M+4**	1.21	1.05-1.43	46.7	45 - 56
2,3,4,6,7,8-HXCDF		**M+2/M+4**	1.22	1.05-1.43	50.6	44 - 57
1,2,3,4,6,7,8-HPCDF		**M+2/M+4**	1.03	0.88-1.20	48.7	45 - 55
1,2,3,4,7,8,9-HPCDF		**M+2/M+4**	1.04	0.88-1.20	48.3	43 - 58
OCDF		**M+2/M+4**	0.89	0.76-1.02	96.1	63 - 159

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S45__Form4A_SJ2313672.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4B
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 45
Instrument ID:	HR GC/MS	**Analysis Date:**	03-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	13:20:06

LABELED COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
13C-2,3,7,8-TCDD		**M/M+2**	0.79	0.65-0.89	99.5	82 - 121
13C-1,2,3,7,8-PECDD [5]		**M/M+2**	0.65	0.52-0.70	115	62 - 160
13C-1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.25	1.05-1.43	97.3	85 - 117
13C-1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.23	1.05-1.43	101	85 - 118
13C-1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.04	0.88-1.20	103	72 - 138
13C-OCDD		**M+2/M+4**	0.91	0.76-1.02	192	96 - 415
13C-2,3,7,8-TCDF		**M/M+2**	0.76	0.65-0.89	106	71 - 140
13C-1,2,3,7,8-PECDF		**M+2/M+4**	1.60	1.32-1.78	108	76 - 130
13C-2,3,4,7,8-PECDF		**M+2/M+4**	1.56	1.32-1.78	114	77 - 130
13C-1,2,3,4,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	96.7	76 - 131
13C-1,2,3,6,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	95.9	70 - 143
13C-1,2,3,7,8,9-HXCDF		**M/M+2**	0.53	0.43-0.59	98.5	74 - 135
13C-2,3,4,6,7,8-HXCDF		**M/M+2**	0.53	0.43-0.59	95.9	73 - 137
13C-1,2,3,4,6,7,8-HPCDF		**M/M+2**	0.45	0.37-0.51	98.6	78 - 129
13C-1,2,3,4,7,8,9-HPCDF		**M/M+2**	0.44	0.37-0.51	102	77 - 129
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD [6]					9.62	7.9 - 12.7

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(6) No ion abundance ratio for 37Cl4-2,3,7,8-TCDD; concentration reported.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S45__Form4B_SJ2313672.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 45
Instrument ID:	HR GC/MS	**Analysis Date:**	03-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	13:20:06

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
2,3,7,8-TCDD		13C-2,3,7,8-TCDD	1.001	0.999-1.002
1,2,3,7,8-PECDD [3]		13C-1,2,3,7,8-PECDD	1.000	0.999-1.002
1,2,3,4,7,8-HXCDD		13C-1,2,3,4,7,8-HXCDD	1.000	0.999-1.001
1,2,3,6,7,8-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.000	0.998-1.004
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.010	1.000-1.019
1,2,3,4,6,7,8-HPCDD		13C-1,2,3,4,6,7,8-HPCDD	1.000	0.999-1.001
OCDD		13C-OCDD	1.000	0.999-1.001
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003
1,2,3,7,8-PECDF		13C-1,2,3,7,8-PECDF	1.001	0.999-1.002
2,3,4,7,8-PECDF		13C-2,3,4,7,8-PECDF	1.000	0.999-1.002
1,2,3,4,7,8-HXCDF		13C-1,2,3,4,7,8-HXCDF	1.000	0.999-1.001
1,2,3,6,7,8-HXCDF		13C-1,2,3,6,7,8-HXCDF	1.001	0.997-1.005
1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDF	1.000	0.999-1.001
2,3,4,6,7,8-HXCDF		13C-2,3,4,6,7,8-HXCDF	1.001	0.999-1.001
1,2,3,4,6,7,8-HPCDF		13C-1,2,3,4,6,7,8-HPCDF	1.000	0.999-1.001
1,2,3,4,7,8,9-HPCDF		13C-1,2,3,4,7,8,9-HPCDF	1.000	0.999-1.001
OCDF		13C-OCDD	1.002	0.999-1.008

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S45__Form6A_SJ2313672.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6B
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 45
Instrument ID:	HR GC/MS	**Analysis Date:**	03-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	13:20:06

	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
LABELED COMPOUND				
13C-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.013	0.976-1.043
13C-1,2,3,7,8-PECDD		13C-1,2,3,4-TCDD	1.383	1.000-1.567
13C-1,2,3,4,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.987	0.977-1.000
13C-1,2,3,6,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.990	0.981-1.003
13C-1,2,3,4,6,7,8-HPCDD		13C-1,2,3,7,8,9-HXCDD	1.094	1.086-1.110
13C-OCDD		13C-1,2,3,7,8,9-HXCDD	1.177	1.032-1.311
13C-2,3,7,8-TCDF		13C-1,2,3,4-TCDD	0.966	0.923-1.103
13C-1,2,3,7,8-PECDF		13C-1,2,3,4-TCDD	1.285	1.000-1.425
13C-2,3,4,7,8-PECDF		13C-1,2,3,4-TCDD	1.352	1.011-1.526
13C-1,2,3,4,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.954	0.944-0.970
13C-1,2,3,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.958	0.949-0.975
13C-1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDD	1.005	0.977-1.047
13C-2,3,4,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.980	0.959-1.021
13C-1,2,3,4,6,7,8-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.062	1.043-1.085
13C-1,2,3,4,7,8,9-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.103	1.057-1.151
CLEANUP STANDARD				
37CL-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.001	0.989-1.052

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_142S45__Form6B_SJ2313672.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 57
Instrument ID:	HR GC/MS	**Analysis Date:**	04-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	00:28:50

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
2,3,7,8-TCDD		**M/M+2**	0.82	0.65-0.89	10.6	7.8 - 12.9
1,2,3,7,8-PECDD [5]		**M/M+2**	0.62	0.52-0.70	50.5	39 - 65
1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.24	1.05-1.43	50.0	39 - 64
1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.20	1.05-1.43	49.3	39 - 64
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.22	1.05-1.43	51.4	41 - 61
1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.05	0.88-1.20	49.3	43 - 58
OCDD		**M+2/M+4**	0.90	0.76-1.02	99.5	79 - 126
2,3,7,8-TCDF		**M/M+2**	0.75	0.65-0.89	10.4	8.4 - 12
1,2,3,7,8-PECDF		**M+2/M+4**	1.52	1.32-1.78	50.6	41 - 60
2,3,4,7,8-PECDF		**M+2/M+4**	1.51	1.32-1.78	49.7	41 - 61
1,2,3,4,7,8-HXCDF		**M+2/M+4**	1.22	1.05-1.43	49.4	45 - 56
1,2,3,6,7,8-HXCDF		**M+2/M+4**	1.21	1.05-1.43	49.8	44 - 57
1,2,3,7,8,9-HXCDF		**M+2/M+4**	1.21	1.05-1.43	48.2	45 - 56
2,3,4,6,7,8-HXCDF		**M+2/M+4**	1.20	1.05-1.43	49.5	44 - 57
1,2,3,4,6,7,8-HPCDF		**M+2/M+4**	1.03	0.88-1.20	49.0	45 - 55
1,2,3,4,7,8,9-HPCDF		**M+2/M+4**	1.02	0.88-1.20	49.0	43 - 58
OCDF		**M+2/M+4**	0.88	0.76-1.02	95.8	63 - 159

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S57__Form4A_SJ2313673.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4B
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 57
Instrument ID:	HR GC/MS	**Analysis Date:**	04-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	00:28:50

	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
LABELED COMPOUND						
13C-2,3,7,8-TCDD		**M/M+2**	0.75	0.65-0.89	98.5	82 - 121
13C-1,2,3,7,8-PECDD [5]		**M/M+2**	0.65	0.52-0.70	124	62 - 160
13C-1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.25	1.05-1.43	97.5	85 - 117
13C-1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.26	1.05-1.43	98.6	85 - 118
13C-1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.07	0.88-1.20	113	72 - 138
13C-OCDD		**M+2/M+4**	0.88	0.76-1.02	228	96 - 415
13C-2,3,7,8-TCDF		**M/M+2**	0.77	0.65-0.89	102	71 - 140
13C-1,2,3,7,8-PECDF		**M+2/M+4**	1.55	1.32-1.78	114	76 - 130
13C-2,3,4,7,8-PECDF		**M+2/M+4**	1.52	1.32-1.78	121	77 - 130
13C-1,2,3,4,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	94.1	76 - 131
13C-1,2,3,6,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	94.0	70 - 143
13C-1,2,3,7,8,9-HXCDF		**M/M+2**	0.52	0.43-0.59	99.7	74 - 135
13C-2,3,4,6,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	98.1	73 - 137
13C-1,2,3,4,6,7,8-HPCDF		**M/M+2**	0.44	0.37-0.51	107	78 - 129
13C-1,2,3,4,7,8,9-HPCDF		**M/M+2**	0.45	0.37-0.51	113	77 - 129
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD [6]					10.1	7.9 - 12.7

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(6) No ion abundance ratio for 37Cl4-2,3,7,8-TCDD; concentration reported.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_142S57__Form4B_SJ2313673.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 57
Instrument ID:	HR GC/MS	**Analysis Date:**	04-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	00:28:50

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
2,3,7,8-TCDD		13C-2,3,7,8-TCDD	1.001	0.999-1.002
1,2,3,7,8-PECDD [3]		13C-1,2,3,7,8-PECDD	1.001	0.999-1.002
1,2,3,4,7,8-HXCDD		13C-1,2,3,4,7,8-HXCDD	1.000	0.999-1.001
1,2,3,6,7,8-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.000	0.998-1.004
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.010	1.000-1.019
1,2,3,4,6,7,8-HPCDD		13C-1,2,3,4,6,7,8-HPCDD	1.000	0.999-1.001
OCDD		13C-OCDD	1.000	0.999-1.001
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003
1,2,3,7,8-PECDF		13C-1,2,3,7,8-PECDF	1.000	0.999-1.002
2,3,4,7,8-PECDF		13C-2,3,4,7,8-PECDF	1.000	0.999-1.002
1,2,3,4,7,8-HXCDF		13C-1,2,3,4,7,8-HXCDF	1.000	0.999-1.001
1,2,3,6,7,8-HXCDF		13C-1,2,3,6,7,8-HXCDF	1.000	0.997-1.005
1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDF	1.001	0.999-1.001
2,3,4,6,7,8-HXCDF		13C-2,3,4,6,7,8-HXCDF	1.000	0.999-1.001
1,2,3,4,6,7,8-HPCDF		13C-1,2,3,4,6,7,8-HPCDF	1.000	0.999-1.001
1,2,3,4,7,8,9-HPCDF		13C-1,2,3,4,7,8,9-HPCDF	1.000	0.999-1.001
OCDF		13C-OCDD	1.002	0.999-1.008

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S57__Form6A_SJ2313673.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6B
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 57
Instrument ID:	HR GC/MS	**Analysis Date:**	04-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	00:28:50

	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
LABELED COMPOUND				
13C-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.013	0.976-1.043
13C-1,2,3,7,8-PECDD		13C-1,2,3,4-TCDD	1.383	1.000-1.567
13C-1,2,3,4,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.987	0.977-1.000
13C-1,2,3,6,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.990	0.981-1.003
13C-1,2,3,4,6,7,8-HPCDD		13C-1,2,3,7,8,9-HXCDD	1.094	1.086-1.110
13C-OCDD		13C-1,2,3,7,8,9-HXCDD	1.177	1.032-1.311
13C-2,3,7,8-TCDF		13C-1,2,3,4-TCDD	0.966	0.923-1.103
13C-1,2,3,7,8-PECDF		13C-1,2,3,4-TCDD	1.285	1.000-1.425
13C-2,3,4,7,8-PECDF		13C-1,2,3,4-TCDD	1.352	1.011-1.526
13C-1,2,3,4,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.954	0.944-0.970
13C-1,2,3,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.958	0.949-0.975
13C-1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDD	1.004	0.977-1.047
13C-2,3,4,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.980	0.959-1.021
13C-1,2,3,4,6,7,8-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.061	1.043-1.085
13C-1,2,3,4,7,8,9-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.103	1.057-1.151
CLEANUP STANDARD				
37CL-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.001	0.989-1.052

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S57__Form6B_SJ2313673.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4A
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 69
Instrument ID:	HR GC/MS	**Analysis Date:**	04-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	11:37:10

COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
2,3,7,8-TCDD		**M/M+2**	0.78	0.65-0.89	10.7	7.8 - 12.9
1,2,3,7,8-PECDD [5]		**M/M+2**	0.62	0.52-0.70	51.5	39 - 65
1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.23	1.05-1.43	51.3	39 - 64
1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.22	1.05-1.43	48.6	39 - 64
1,2,3,7,8,9-HXCDD		**M+2/M+4**	1.21	1.05-1.43	50.1	41 - 61
1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.05	0.88-1.20	50.0	43 - 58
OCDD		**M+2/M+4**	0.88	0.76-1.02	102	79 - 126
2,3,7,8-TCDF		**M/M+2**	0.76	0.65-0.89	10.1	8.4 - 12
1,2,3,7,8-PECDF		**M+2/M+4**	1.52	1.32-1.78	50.7	41 - 60
2,3,4,7,8-PECDF		**M+2/M+4**	1.55	1.32-1.78	49.9	41 - 61
1,2,3,4,7,8-HXCDF		**M+2/M+4**	1.22	1.05-1.43	49.7	45 - 56
1,2,3,6,7,8-HXCDF		**M+2/M+4**	1.23	1.05-1.43	49.9	44 - 57
1,2,3,7,8,9-HXCDF		**M+2/M+4**	1.26	1.05-1.43	46.0	45 - 56
2,3,4,6,7,8-HXCDF		**M+2/M+4**	1.20	1.05-1.43	49.6	44 - 57
1,2,3,4,6,7,8-HPCDF		**M+2/M+4**	1.03	0.88-1.20	49.9	45 - 55
1,2,3,4,7,8,9-HPCDF		**M+2/M+4**	1.02	0.88-1.20	48.0	43 - 58
OCDF		**M+2/M+4**	0.88	0.76-1.02	97.2	63 - 159

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S69__Form4A_SJ2313676.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 4B
PCDD/PCDF CALIBRATION VERIFICATION

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 69
Instrument ID:	HR GC/MS	**Analysis Date:**	04-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	11:37:10

LABELED COMPOUND	LAB FLAG [1]	MZ's FORMING RATIO [2]	ION ABUND. RATIO	QC LIMITS [3]	CONC. FOUND (ng/mL)	CONC. RANGE (ng/mL) [4]
13C-2,3,7,8-TCDD		**M/M+2**	0.78	0.65-0.89	98.3	82 - 121
13C-1,2,3,7,8-PECDD [5]		**M/M+2**	0.66	0.52-0.70	109	62 - 160
13C-1,2,3,4,7,8-HXCDD		**M+2/M+4**	1.30	1.05-1.43	95.4	85 - 117
13C-1,2,3,6,7,8-HXCDD		**M+2/M+4**	1.24	1.05-1.43	100	85 - 118
13C-1,2,3,4,6,7,8-HPCDD		**M+2/M+4**	1.04	0.88-1.20	101	72 - 138
13C-OCDD		**M+2/M+4**	0.88	0.76-1.02	180	96 - 415
13C-2,3,7,8-TCDF		**M/M+2**	0.78	0.65-0.89	105	71 - 140
13C-1,2,3,7,8-PECDF		**M+2/M+4**	1.52	1.32-1.78	106	76 - 130
13C-2,3,4,7,8-PECDF		**M+2/M+4**	1.56	1.32-1.78	109	77 - 130
13C-1,2,3,4,7,8-HXCDF		**M/M+2**	0.51	0.43-0.59	98.3	76 - 131
13C-1,2,3,6,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	96.2	70 - 143
13C-1,2,3,7,8,9-HXCDF		**M/M+2**	0.52	0.43-0.59	99.0	74 - 135
13C-2,3,4,6,7,8-HXCDF		**M/M+2**	0.52	0.43-0.59	100	73 - 137
13C-1,2,3,4,6,7,8-HPCDF		**M/M+2**	0.45	0.37-0.51	99.2	78 - 129
13C-1,2,3,4,7,8,9-HPCDF		**M/M+2**	0.45	0.37-0.51	97.0	77 - 129
CLEANUP STANDARD						
37CL-2,3,7,8-TCDD [6]					9.51	7.9 - 12.7

(1) Where applicable, custom lab flags have been used on this report.
(2) See Table 8, Method 1613, for m/z specifications.
(3) Ion Abundance Ratio Control Limits as specified in Table 9, Method 1613.
(4) Contract-required concentration range as determined from the percent of the test concentration in Table 6, Method 1613, under VER.
(5) Alternate confirmation and quantitation ions used for native and labeled PECDD.
(6) No ion abundance ratio for 37Cl4-2,3,7,8-TCDD; concentration reported.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form4B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21; Report Filename: 1613_DIOXINS_DX7M_142S69__Form4B_SJ2313676.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6A
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 69
Instrument ID:	HR GC/MS	**Analysis Date:**	04-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	11:37:10

COMPOUND	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
2,3,7,8-TCDD		13C-2,3,7,8-TCDD	1.001	0.999-1.002
1,2,3,7,8-PECDD [3]		13C-1,2,3,7,8-PECDD	1.001	0.999-1.002
1,2,3,4,7,8-HXCDD		13C-1,2,3,4,7,8-HXCDD	1.001	0.999-1.001
1,2,3,6,7,8-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.000	0.998-1.004
1,2,3,7,8,9-HXCDD		13C-1,2,3,6,7,8-HXCDD	1.010	1.000-1.019
1,2,3,4,6,7,8-HPCDD		13C-1,2,3,4,6,7,8-HPCDD	1.000	0.999-1.001
OCDD		13C-OCDD	1.000	0.999-1.001
2,3,7,8-TCDF		13C-2,3,7,8-TCDF	1.001	0.999-1.003
1,2,3,7,8-PECDF		13C-1,2,3,7,8-PECDF	1.001	0.999-1.002
2,3,4,7,8-PECDF		13C-2,3,4,7,8-PECDF	1.000	0.999-1.002
1,2,3,4,7,8-HXCDF		13C-1,2,3,4,7,8-HXCDF	1.001	0.999-1.001
1,2,3,6,7,8-HXCDF		13C-1,2,3,6,7,8-HXCDF	1.000	0.997-1.005
1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDF	1.000	0.999-1.001
2,3,4,6,7,8-HXCDF		13C-2,3,4,6,7,8-HXCDF	1.000	0.999-1.001
1,2,3,4,6,7,8-HPCDF		13C-1,2,3,4,6,7,8-HPCDF	1.000	0.999-1.001
1,2,3,4,7,8,9-HPCDF		13C-1,2,3,4,7,8,9-HPCDF	1.000	0.999-1.001
OCDF		13C-OCDD	1.002	0.999-1.008

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.
(3) Alternate confirmation and quantitation ions used for native and labeled PECDD.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6A.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S69__Form6A_SJ2313676.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 6B
PCDD/PCDF RELATIVE RETENTION TIMES

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date:	06-Nov-2017	**VER Data Filename:**	DX7M_142 S: 69
Instrument ID:	HR GC/MS	**Analysis Date:**	04-Dec-2017
GC Column ID:	DB5	**Analysis Time:**	11:37:10

	LAB FLAG [1]	RETENTION TIME REFERENCE	RRT	RRT QC LIMITS [2]
LABELED COMPOUND				
13C-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.013	0.976-1.043
13C-1,2,3,7,8-PECDD		13C-1,2,3,4-TCDD	1.384	1.000-1.567
13C-1,2,3,4,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.987	0.977-1.000
13C-1,2,3,6,7,8-HXCDD		13C-1,2,3,7,8,9-HXCDD	0.990	0.981-1.003
13C-1,2,3,4,6,7,8-HPCDD		13C-1,2,3,7,8,9-HXCDD	1.094	1.086-1.110
13C-OCDD		13C-1,2,3,7,8,9-HXCDD	1.177	1.032-1.311
13C-2,3,7,8-TCDF		13C-1,2,3,4-TCDD	0.966	0.923-1.103
13C-1,2,3,7,8-PECDF		13C-1,2,3,4-TCDD	1.285	1.000-1.425
13C-2,3,4,7,8-PECDF		13C-1,2,3,4-TCDD	1.353	1.011-1.526
13C-1,2,3,4,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.954	0.944-0.970
13C-1,2,3,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.959	0.949-0.975
13C-1,2,3,7,8,9-HXCDF		13C-1,2,3,7,8,9-HXCDD	1.005	0.977-1.047
13C-2,3,4,6,7,8-HXCDF		13C-1,2,3,7,8,9-HXCDD	0.980	0.959-1.021
13C-1,2,3,4,6,7,8-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.062	1.043-1.085
13C-1,2,3,4,7,8,9-HPCDF		13C-1,2,3,7,8,9-HXCDD	1.104	1.057-1.151
CLEANUP STANDARD				
37CL-2,3,7,8-TCDD		13C-1,2,3,4-TCDD	1.001	0.989-1.052

(1) Where applicable, custom lab flags have been used on this report.
(2) Contract-required limits for Relative Retention Times (RRT) as specified in Table 2, Method 1613.

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: Form6B.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS_DX7M_142S69__Form6B_SJ2313676.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5
PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		06-Nov-2017
RT Window Data Filename:	DX7M_142 S: 33	**Analysis Date:**	02-Dec-2017	**Time:** 16:52:00
DB-5 IS Data Filename:	DX7M_142 S: 33	**Analysis Date:**	02-Dec-2017	**Time:** 16:52:00
DB-225 IS Data Filename:		**Analysis Date:**		**Time:**

DB5 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	22:56	**1,3,6,8-TCDF (F)**	21:24
1,2,8,9-TCDD (L)	28:19	**1,2,8,9-TCDF (L)**	28:09
1,2,4,7,9-PECDD (F)	32:04	**1,3,4,6,8-PECDF (F)**	28:52
1,2,3,8,9-PECDD (L)	37:03	**1,2,3,8,9-PECDF (L)**	37:07
1,2,4,6,7,9-HXCDD (F)	40:02	**1,2,3,4,6,8-HXCDF (F)**	38:59
1,2,3,4,6,7-HXCDD (L)	42:38	**1,2,3,4,8,9-HXCDF (L)**	42:58
1,2,3,4,6,7,9-HPCDD (F)	45:44	**1,2,3,4,6,7,8-HPCDF (F)**	45:16
1,2,3,4,6,7,8-HPCDD (L)	46:38	**1,2,3,4,7,8,9-HPCDF (L)**	47:03

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	0	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	10
1,2,7,8-TCDD **1,4,7,8-TCDD**	0	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	N/A
1,4,7,8-TCDD **1,2,3,7-TCDD**	0	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	N/A
1,2,3,7-TCDD **1,2,3,8-TCDD**	DB-5 column; co-elute as per Figure 6 in Method		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _________Robert Tones________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS__DX7M_142S33_Form5_SJ2313731.html; Workgroup: WG61707; Design ID: 3006]

AXYS METHOD MLA-017 Rev 20

Form 5
PCDD/PCDF RT WINDOW AND ISOMER SPECIFICITY STANDARDS

SGS AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Instrument ID:	HR GC/MS	**Initial Calibration Date:**		06-Nov-2017
RT Window Data Filename:	DX7M_142 S: 57	**Analysis Date:**	04-Dec-2017	**Time:** 00:28:50
DB-5 IS Data Filename:	DX7M_142 S: 57	**Analysis Date:**	04-Dec-2017	**Time:** 00:28:50
DB-225 IS Data Filename:		**Analysis Date:**		**Time:**

DB5 RT WINDOW DEFINING STANDARDS RESULT

ISOMERS	ABSOLUTE RT	ISOMERS	ABSOLUTE RT
1,3,6,8-TCDD (F)	22:56	**1,3,6,8-TCDF (F)**	21:24
1,2,8,9-TCDD (L)	28:17	**1,2,8,9-TCDF (L)**	28:08
1,2,4,7,9-PECDD (F)	32:01	**1,3,4,6,8-PECDF (F)**	28:50
1,2,3,8,9-PECDD (L)	37:02	**1,2,3,8,9-PECDF (L)**	37:05
1,2,4,6,7,9-HXCDD (F)	40:00	**1,2,3,4,6,8-HXCDF (F)**	38:58
1,2,3,4,6,7-HXCDD (L)	42:37	**1,2,3,4,8,9-HXCDF (L)**	42:57
1,2,3,4,6,7,9-HPCDD (F)	45:42	**1,2,3,4,6,7,8-HPCDF (F)**	45:14
1,2,3,4,6,7,8-HPCDD (L)	46:36	**1,2,3,4,7,8,9-HPCDF (L)**	47:02

(F) = First eluting isomer (DB-5); (L) = Last eluting isomer (DB-5)

ISOMER SPECIFICITY (IS) TEST STANDARDS RESULT

Isomers	% Valley Height Between Compared Peaks	Isomers	% Valley Height Between Compared Peaks
1,2,3,4-TCDD **1,2,7,8-TCDD**	0	**1,2,3,8-TCDD** **2,3,7,8-TCDD**	18
1,2,7,8-TCDD **1,4,7,8-TCDD**	0	**2,3,4,7-TCDF** **2,3,7,8-TCDF**	N/A
1,4,7,8-TCDD **1,2,3,7-TCDD**	0	**2,3,7,8-TCDF** **1,2,3,9-TCDF**	N/A
1,2,3,7-TCDD **1,2,3,8-TCDD**	DB-5 column; co-elute as per Figure 6 in Method		

These data are validated and reported as accurate and in accord with SGS AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: ________Robert Tones________

For Axys Internal Use Only [XSL Template: DXForm5.xsl; Created: 15-Dec-2017 14:57:37; Application: XMLTransformer-1.16.21;
Report Filename: 1613_DIOXINS__DX7M_142S57_Form5_SJ2313732.html; Workgroup: WG61707; Design ID: 3006]

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
BFR	BTBPE	SGS AXYS MLA-033	MLA-033			Y											Y								Y											
	DBDPE	SGS AXYS MLA-033	MLA-033			Y											Y								Y											
	HBB	SGS AXYS MLA-033	MLA-033			Y											Y								Y											
	PBEB	SGS AXYS MLA-033	MLA-033			Y											Y								Y											
BPA and MPE	4,4'-dihydroxy-2,2-diphenylpropane (Bisphenol A) (BPA)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-(3-carboxypropyl) phthalate (MCPP)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-2-ethylhexyl phthalate (MEHP)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-benzyl phthalate (MBzP)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-butyl phthalate (MBP) (n + iso)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-cyclohexyl phthalate (MCHP)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-ethyl phthalate (MEP)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-iso-nonyl phthalate (MiNP)	SGS AXYS MLA-059	MLA-059																					Y												
	Mono-methyl phthalate (MMP)	SGS AXYS MLA-059	MLA-059																					Y												
HBCDD	alpha-hexabromocyclododecane (a-HBCDD)	SGS AXYS MLA-070	MLA-070		Y																															
	beta-hexabromocyclododecane (b-HBCDD)	SGS AXYS MLA-070	MLA-070		Y																															
	gamma-hexabromocyclododecane (g-HBCDD)	SGS AXYS MLA-070	MLA-070		Y																															
OC Pesticides	2,4'-DDD	EPA 625	MLA-007																								Y									
		EPA 8270	MLA-007					Y					Y																							
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y									Y								Y		Y									
	2,4'-DDE	EPA 625	MLA-007																								Y									
		EPA 8270	MLA-007					Y					Y																							
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y									Y								Y		Y									
	2,4'-DDT	EPA 625	MLA-007																								Y									
		EPA 8270	MLA-007					Y					Y																							
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y									Y								Y		Y									
	4,4'-DDD	EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	4,4'-DDE	EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	4,4'-DDT	EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Aldrin	EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y	Y	Y																					

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
				CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Alpha-HCH	EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Beta-HCH	EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Chlordane, technical	EPA 625	MLA-007																							Y							Y			
		EPA 8270	MLA-007				Y	Y			Y	Y		Y	Y												Y			Y	Y		Y	Y		
		SGS AXYS MLA-007	MLA-007					Y							Y												Y							Y		
	cis-Chlordane (alpha-Chlordane)	EPA 8270	MLA-007					Y			Y		Y	Y	Y												Y			Y			Y	Y		
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	cis-Nonachlor	EPA 8270	MLA-007					Y					Y														Y									
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y									Y								Y		Y									
	Delta-HCH	EPA 608	MLA-007																								Y			Y	Y		Y	Y		
		EPA 8081	MLA-007					Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Dieldrin	EPA 608	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8081	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Endosulphan I	EPA 608	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8081	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Endosulphan II	EPA 608	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8081	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Endosulphan sulphate	EPA 608	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8081	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Endrin	EPA 608	MLA-007																							Y	Y			Y	Y		Y	Y		

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		EPA 8081	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Endrin aldehyde	EPA 608	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8081	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007			Y		Y							Y										Y		Y							Y		
	Endrin ketone	EPA 8081	MLA-007					Y			Y		Y		Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y				
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Gamma-HCH (Lindane)	EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Heptachlor	EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Heptachlor epoxide	EPA 608	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8081	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Hexachlorobenzene	EPA 1625	MLA-007																							Y	Y			Y				Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Methoxychlor	EPA 608	MLA-007																								Y			Y	Y			Y		
		EPA 8081	MLA-007				Y	Y			Y	Y	Y	Y	Y																					
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Mirex	EPA 8270	MLA-007					Y			Y		Y		Y												Y			Y	Y		Y	Y		
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	Oxychlordane	EPA 8270	MLA-007					Y					Y														Y									
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y									Y								Y		Y									
	Toxaphene	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	trans-Chlordane (gamma-Chlordane)	EPA 8270	MLA-007					Y			Y		Y	Y	Y												Y			Y			Y	Y		
		EPA 1699	MLA-028					Y							Y												Y							Y		

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y							Y		Y								Y		Y							Y		
	trans-Nonachlor	EPA 8270	MLA-007					Y					Y														Y									
		EPA 1699	MLA-028					Y							Y												Y							Y		
		SGS AXYS MLA-028	MLA-028		Y	Y		Y					Y		Y		Y								Y		Y					Y		Y		
		SGS AXYS MLA-007	MLA-007		Y	Y		Y									Y										Y									
PAH	1,2,6-Trimethylphenanthrene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	1,2-Dimethylnaphthalene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	1,4,6,7-Tetramethylnaphthalene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	1,7-Dimethylfluorene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	1,7-Dimethylphenanthrene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	1,8-Dimethylphenanthrene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	1-Methylchrysene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	1-Methylnaphthalene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	1-Methylphenanthrene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	2,3,5-Trimethylnaphthalene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	2,3,6-Trimethylnaphthalene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	2,4-Dimethyldibenzothiophene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	2,6-Dimethylnaphthalene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	2,6-Dimethylphenanthrene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	2/3-Methyldibenzothiophenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	2-Methylanthracene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	2-Methylfluorene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	2-methylnaphthalene	EPA 1625	MLA-021																															Y		
		EPA 8270	MLA-021					Y			Y				Y												Y									
		SGS AXYS MLA-021	MLA-021			Y		Y							Y										Y									Y		
	2-Methylphenanthrene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	3,6-Dimethylphenanthrene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	3-Methylfluoranthene/ Benzo(a)fluorene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	3-Methylphenanthrene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	5,9-Dimethylchrysene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	5/6-Methylchrysenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	7-Methylbenzo(a)pyrene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	9/4-Methylphenanthrenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	Acenaphthene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Acenaphthylene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Anthracene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Benz[a]anthracene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Benzo[a]pyrene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Benzo[b]fluoranthene	EPA 1625	MLA-021																							Y	Y			Y	Y		Y	Y		

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Metho	Pulp CALA	Serum CALA	Solids CALA	Solids California DPH	Solids Florida DOH	Solids Minnesota DOH	Solids New Jersey DEP	Solids New York DOH	Solids Virginia DGS	Solids Washington DE	Solids Maine DOH	Solids ANAB	Solids DoD	Tissue CALA	Tissue Florida DOH	Tissue Minnesota DOH	Tissue New Jersey DEP	Tissue Virginia DGS	Tissue ANAB	Tissue DoD	Urine CALA	Water CALA	Water, Non-Potable California DPH	Water, Non-Potable Florida DOH	Water, Non-Potable Minnesota DOH	Water, Non-Potable New Jersey DEP	Water, Non-Potable New York DOH	Water, Non-Potable Virginia DGS	Water, Non-Potable Washington DE *	Water, Non-Potable Maine DOH	Water, Non-Potable ANAB	Water, Non-Potable Pennsylvania DEP	Water, Non-Potable DoD
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Benzo[e]pyrene	SGS AXYS MLA-021	MLA-021			Y											Y								Y											
	Benzo[ghi]perylene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Benzo[j/k]fluoranthenes	SGS AXYS MLA-021	MLA-021																						Y											
	Benzo[k]fluoranthene	EPA 1625	MLA-021																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-021					Y			Y			Y	Y																					
		SGS AXYS MLA-021	MLA-021					Y							Y		Y								Y		Y							Y		
	Biphenyl	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C1-Acenaphthenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C1-Benz(a)anthracenes/chrysenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C1-Benzofluoranthenes/ Benzopyrenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C1-Biphenyls	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C1-Dibenzothiophene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C1-Fluoranthenes/Pyrenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C1-Fluorenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C1-Naphthalenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C1-Phenanthrenes/Anthracenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C2-Benz(a)anthracenes/Chrysenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C2-Benzofluoranthenes/ Benzopyrenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C2-Biphenyls	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C2-Dibenzothiophene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C2-Fluoranthenes/Pyrenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C2-Fluorenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C2-Naphthalenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C2-Phenanthrenes/Anthracenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C3-Benz(a)anthracenes/Chrysenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C3-Dibenzothiophene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C3-Fluoranthenes/Pyrenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C3-Fluorenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C3-Naphthalenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C3-Phenanthrenes/Anthracenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C4-Benz(a)anthracenes/Chrysenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C4-Dibenzothiophene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C4-Fluoranthenes/Pyrenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C4-Naphthalenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	C4-Phenanthrenes/Anthracenes	SGS AXYS MLA-021	MLA-021			Y																			Y											
	Chrysene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Dibenz[ah]anthracene	SGS AXYS MLA-021	MLA-021			Y											Y								Y											
	Dibenzo[ah]anthracene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021					Y							Y												Y							Y		
	Dibenzothiophene	SGS AXYS MLA-021	MLA-021			Y																			Y											
	Fluoranthene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
				CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	Fluorene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Indeno[1,2,3-cd]pyrene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Naphthalene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Perylene	SGS AXYS MLA-021	MLA-021			Y											Y								Y											
	Phenanthrene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Pyrene	EPA 1625	MLA-021																							Y	Y			Y	Y			Y		
		EPA 8270	MLA-021				Y	Y			Y	Y		Y	Y																					
		SGS AXYS MLA-021	MLA-021			Y		Y							Y		Y								Y		Y							Y		
	Retene	SGS AXYS MLA-021	MLA-021			Y																			Y											
PBDPE	BDE 10 2,6-dibromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 100 2,2’,4,4’,6-pentabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 105 2,3,3’,4,4’-pentabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 11 3,3’-dibromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 116 2,3,4,5,6-pentabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 119 2,3’,4,4’,6-pentabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 12 3,4-dibromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 126 3,3’,4,4’,5-pentabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 13 3,4’-dibromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 140 2,2’,3,4,4’,6’-hexabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 15 4,4’-dibromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 153 2,2’,4,4’,5,5’-hexabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 154 2,2’,4,4’,5’,6-hexabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 155 2,2’,4,4’,6,6’-hexabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 166 2,3,4,4’,5,6-hexabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 17 2,2’,4-tribromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 181 2,2’,3,4,4’,5,6-heptabromodiphenylether	EPA 1614	MLA-033										Y																			Y				

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 190 2,3,3',4,4',5,6-heptabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 206 2,2',3,3',4,4',5,5',6-nonabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 207 2,2',3,3',4,4',5,6,6'-nonabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 208 2,2',3,3',4,5,5',6,6'-nonabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 209 Decabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 25 2,3',4-tribromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 28 2,4,4'-tribromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 30 2,4,6-tribromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 35 3,3',4-tribromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 37 3,4,4'-tribromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 47 2,2',4,4'-tetrabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 49 2,2',4,5'-tetrabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 66 2,3',4,4'-tetrabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 7 2,4-dibromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 75 2,4,4',6-tetrabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 77 3,3',4,4'-tetrabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 8 2,4'-dibromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 85 2,2',3,4,4'-pentabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE 99 2,2',4,4',5-pentabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE-183 2,2',3,4,4',5',6-heptabromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
	BDE-33 2',3,4-tribromodiphenylether	EPA 1614	MLA-033										Y																			Y				
		SGS AXYS MLA-033	MLA-033		Y	Y											Y								Y											
PCB Aroclors	PCB Aroclor 1016	EPA 1668	MLA-010					Y						Y	Y												Y						Y	Y		
		EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y			Y																					
		SGS AXYS MLA-010	MLA-010					Y							Y												Y							Y		
		SGS AXYS MLA-007	MLA-007			Y		Y							Y		Y								Y		Y							Y		
	PCB Aroclor 1016/1242	EPA 8270	MLA-007										Y																							
	PCB Aroclor 1221	EPA 1668	MLA-010					Y						Y	Y												Y						Y	Y		

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y		Y																					
		SGS AXYS MLA-010	MLA-010					Y							Y												Y							Y		
		SGS AXYS MLA-007	MLA-007			Y		Y							Y		Y								Y		Y							Y		
	PCB Aroclor 1232	EPA 1668	MLA-010					Y						Y	Y												Y						Y	Y		
		EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y		Y																					
		SGS AXYS MLA-010	MLA-010					Y							Y												Y							Y		
		SGS AXYS MLA-007	MLA-007			Y		Y							Y		Y								Y		Y							Y		
	PCB Aroclor 1242	EPA 1668	MLA-010					Y						Y	Y												Y						Y	Y		
		EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y			Y																					
		SGS AXYS MLA-010	MLA-010					Y							Y												Y							Y		
		SGS AXYS MLA-007	MLA-007			Y		Y							Y		Y								Y		Y							Y		
	PCB Aroclor 1248	EPA 1668	MLA-010					Y						Y	Y												Y						Y	Y		
		EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y		Y																					
		SGS AXYS MLA-010	MLA-010					Y							Y												Y							Y		
		SGS AXYS MLA-007	MLA-007			Y		Y							Y		Y								Y		Y							Y		
	PCB Aroclor 1254	EPA 1668	MLA-010					Y						Y	Y												Y						Y	Y		
		EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y		Y																					
		SGS AXYS MLA-010	MLA-010					Y							Y												Y							Y		
		SGS AXYS MLA-007	MLA-007			Y		Y							Y		Y								Y		Y							Y		
	PCB Aroclor 1260	EPA 1668	MLA-010					Y						Y	Y												Y						Y	Y		
		EPA 625	MLA-007																							Y	Y			Y	Y		Y	Y		
		EPA 8270	MLA-007				Y	Y			Y	Y	Y		Y																					
		SGS AXYS MLA-010	MLA-010					Y							Y												Y							Y		
		SGS AXYS MLA-007	MLA-007			Y		Y							Y		Y								Y		Y							Y		
	PCB Aroclor 1268	SGS AXYS MLA-007	MLA-007			Y											Y								Y											
PCB congeners	PCB 1 2-Chlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 10 2,6-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 100 2,2',4,4',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 101 2,2',4,5,5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 101/90/89	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 102 2,2',4,5,6'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 103 2,2',4,5',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 104 2,2',4,6,6'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y

Accreditation Scope
SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp CALA	Serum CALA	Solids CALA	Solids California DPH	Solids Florida DOH	Solids Minnesota DOH	Solids New Jersey DEP	Solids New York DOH	Solids Virginia DGS	Solids Washington DE	Solids Maine DOH	Solids ANAB	Solids DoD	Tissue CALA	Tissue Florida DOH	Tissue Minnesota DOH	Tissue New Jersey DEP	Tissue Virginia DGS	Tissue ANAB	Tissue DoD	Urine CALA	Water CALA	Water, Non-Potable California DPH	Water, Non-Potable Florida DOH	Water, Non-Potable Minnesota DOH	Water, Non-Potable New Jersey DEP	Water, Non-Potable New York DOH	Water, Non-Potable Virginia DGS	Water, Non-Potable Washington DE *	Water, Non-Potable Maine DOH	Water, Non-Potable ANAB	Water, Non-Potable Pennsylvania DEP	Water, Non-Potable DoD
	PCB 105 2,3,3',4,4'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 105/127	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 106 2,3,3',4,5-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 107 2,3,3',4',5-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 107/109	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 108 2,3,3',4,5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 109 2,3,3',4,6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 11 3,3'-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 110 2,3,3',4',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 111 2,3,3',5,5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 111/117	EPA 8270	MLA-007										Y																							
	PCB 112 2,3,3',5,6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 113 2,3,3',5',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 114 2,3,4,4',5-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 115 2,3,4,4',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 116 2,3,4,5,6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 117 2,3,4',5,6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 118 2,3',4,4',5-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 118/106	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 119 2,3',4,4',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 12 3,4-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 12/13	EPA 8270	MLA-007										Y																							

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp: CALA	Serum: CALA	Solids: CALA	Solids: California DPH	Solids: Florida DOH	Solids: Minnesota DOH	Solids: New Jersey DEP	Solids: New York DOH	Solids: Virginia DGS	Solids: Washington DE	Solids: Maine DOH	Solids: ANAB	Solids: DoD	Tissue: CALA	Tissue: Florida DOH	Tissue: Minnesota DOH	Tissue: New Jersey DEP	Tissue: Virginia DGS	Tissue: ANAB	Tissue: DoD	Urine: CALA	Water: CALA	Water, Non-Potable: California DPH	Water, Non-Potable: Florida DOH	Water, Non-Potable: Minnesota DOH	Water, Non-Potable: New Jersey DEP	Water, Non-Potable: New York DOH	Water, Non-Potable: Virginia DGS	Water, Non-Potable: Washington DE *	Water, Non-Potable: Maine DOH	Water, Non-Potable: ANAB	Water, Non-Potable: Pennsylvania DEP	Water, Non-Potable: DoD
	PCB 120 2,3',4,5,5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 121 2,3',4,5',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 122 2,3,3',4',5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 123 2,3',4,4',5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 124 2,3',4',5,5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 125 2,3',4',5',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 126 3,3',4,4',5-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 127 3,3',4,5,5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 128 2,2',3,3',4,4'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 129 2,2',3,3',4,5-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 13 3,4'-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 130 2,2',3,3',4,5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 131 2,2',3,3',4,6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 131/142	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 132 2,2',3,3',4,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 132/168	EPA 8270	MLA-007										Y																							
	PCB 133 2,2',3,3',5,5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 134 2,2',3,3',5,6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 134/143	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
				CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	PCB 135 2,2',3,3',5,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 136 2,2',3,3',6,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 137 2,2',3,4,4',5-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 138 2,2',3,4,4',5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 138/163/164	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 139 2,2',3,4,4',6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 14 3,5-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 140 2,2',3,4,4',6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 141 2,2',3,4,5,5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 142 2,2',3,4,5,6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 143 2,2',3,4,5,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 144 2,2',3,4,5',6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 144/135	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 145 2,2',3,4,6,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 146 2,2',3,4',5,5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 147 2,2',3,4',5,6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 148 2,2',3,4',5,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 149 2,2',3,4',5',6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	PCB 149/139	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 15 4,4'-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 150 2,2',3,4',6,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 151 2,2',3,5,5',6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 152 2,2',3,5,6,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 153 2,2',4,4',5,5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 154 2,2',4,4',5,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 155 2,2',4,4',6,6'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 156 2,3,3',4,4',5-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 157 2,3,3',4,4',5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 158 2,3,3',4,4',6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 158/160	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 159 2,3,3',4,5,5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 16 2,2',3-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 16/32	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 160 2,3,3',4,5,6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Metho	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 161 2,3,3',4,5',6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 162 2,3,3',4',5,5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 163 2,3,3',4',5,6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 164 2,3,3',4',5',6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 165 2,3,3',5,5',6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 166 2,3,4,4',5,6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 167 2,3',4,4',5,5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 168 2,3',4,4',5',6-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 169 3,3',4,4',5,5'-Hexachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 17 2,2',4-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 170 2,2',3,3',4,4',5-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 170/190	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 171 2,2',3,3',4,4',6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 172 2,2',3,3',4,5,5'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 172/192	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 173 2,2',3,3',4,5,6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 174 2,2',3,3',4,5,6'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 174/181	EPA 8270	MLA-007										Y																							

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp CALA	Serum CALA	Solids CALA	Solids California DPH	Solids Florida DOH	Solids Minnesota DOH	Solids New Jersey DEP	Solids New York DOH	Solids Virginia DGS	Solids Washington DE	Solids Maine DOH	Solids ANAB	Solids DoD	Tissue CALA	Tissue Florida DOH	Tissue Minnesota DOH	Tissue New Jersey DEP	Tissue Virginia DGS	Tissue ANAB	Tissue DoD	Urine CALA	Water CALA	Water, Non-Potable California DPH	Water, Non-Potable Florida DOH	Water, Non-Potable Minnesota DOH	Water, Non-Potable New Jersey DEP	Water, Non-Potable New York DOH	Water, Non-Potable Virginia DGS	Water, Non-Potable Washington DE *	Water, Non-Potable Maine DOH	Water, Non-Potable ANAB	Water, Non-Potable Pennsylvania DEP	Water, Non-Potable DoD
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 175 2,2',3,3',4,5',6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 176 2,2',3,3',4,6,6'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 177 2,2',3,3',4,5',6'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 178 2,2',3,3',5,5',6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 179 2,2',3,3',5,6,6'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 18 2,2',5-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 180 2,2',3,4,4',5,5'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 181 2,2',3,4,4',5,6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 182 2,2',3,4,4',5,6'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 183 2,2',3,4,4',5',6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 184 2,2',3,4,4',6,6'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 185 2,2',3,4,5,5',6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 186 2,2',3,4,5,6,6'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 187 2,2',3,4',5,5',6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y

Accreditation Scope
SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp: CALA	Serum: CALA	Solids: CALA	Solids: California DPH	Solids: Florida DOH	Solids: Minnesota DOH	Solids: New Jersey DEP	Solids: New York DOH	Solids: Virginia DGS	Solids: Washington DE	Solids: Maine DOH	Solids: ANAB	Solids: DoD	Tissue: CALA	Tissue: Florida DOH	Tissue: Minnesota DOH	Tissue: New Jersey DEP	Tissue: Virginia DGS	Tissue: ANAB	Tissue: DoD	Urine: CALA	Water: CALA	Water, Non-Potable: California DPH	Water, Non-Potable: Florida DOH	Water, Non-Potable: Minnesota DOH	Water, Non-Potable: New Jersey DEP	Water, Non-Potable: New York DOH	Water, Non-Potable: Virginia DGS	Water, Non-Potable: Washington DE *	Water, Non-Potable: Maine DOH	Water, Non-Potable: ANAB	Water, Non-Potable: Pennsylvania DEP	Water, Non-Potable: DoD
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 187/182	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 188 2,2',3,4',5,6,6'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 189 2,3,3',4,4',5,5'-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 19 2,2',6-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 190 2,3,3',4,4',5,6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 191 2,3,3',4,4',5',6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 192 2,3,3',4,5,5',6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 193 2,3,3',4',5,5',6-Heptachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 194 2,2',3,3',4,4',5,5'-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 195 2,2',3,3',4,4',5,6-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 196 2,2',3,3',4,4',5,6'-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 196/203	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 197 2,2',3,3',4,4',6,6'-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 198 2,2',3,3',4,5,5',6-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 199 2,2',3,3',4,5,5',6'-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y

Accreditation Scope
SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Metho	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 2 3-Chlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 20 2,3,3'-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 200 2,2',3,3',4,5,6,6'-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 201 2,2',3,3',4,5',6,6'-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 202 2,2',3,3',5,5',6,6'-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 203 2,2',3,4,4',5,5',6-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 204 2,2',3,4,4',5,6,6'-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 205 2,3,3',4,4',5,5',6-Octachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 206 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 207 2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 208 2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 209 Decachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 21 2,3,4-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 22 2,3,4'-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 23 2,3,5-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 23/34	EPA 8270	MLA-007										Y																							

Accreditation Scope
SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp CALA	Serum CALA	Solids CALA	Solids California DPH	Solids Florida DOH	Solids Minnesota DOH	Solids New Jersey DEP	Solids New York DOH	Solids Virginia DGS	Solids Washington DE	Solids Maine DOH	Solids ANAB	Solids DoD	Tissue CALA	Tissue Florida DOH	Tissue Minnesota DOH	Tissue New Jersey DEP	Tissue Virginia DGS	Tissue ANAB	Tissue DoD	Urine CALA	Water CALA	Water, Non-Potable California DPH	Water, Non-Potable Florida DOH	Water, Non-Potable Minnesota DOH	Water, Non-Potable New Jersey DEP	Water, Non-Potable New York DOH	Water, Non-Potable Virginia DGS	Water, Non-Potable Washington DE *	Water, Non-Potable Maine DOH	Water, Non-Potable ANAB	Water, Non-Potable Pennsylvania DEP	Water, Non-Potable DoD
	PCB 24 2,3,6-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 24/27	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 25 2,3',4-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 26 2,3',5-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 27 2,3',6-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 28 2,4,4'-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 29 2,4,5-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 3 4-Chlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 30 2,4,6-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 31 2,4',5-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 32 2,4',6-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 33 2,3',4'-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 33/20/21	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 34 2,3',5'-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 35 3,3',4-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 36 3,3',5-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 37 3,4,4'-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 38 3,4,5-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp CALA	Serum CALA	Solids CALA	Solids California DPH	Solids Florida DOH	Solids Minnesota DOH	Solids New Jersey DEP	Solids New York DOH	Solids Virginia DGS	Solids Washington DE	Solids Maine DOH	Solids ANAB	Solids DoD	Tissue CALA	Tissue Florida DOH	Tissue Minnesota DOH	Tissue New Jersey DEP	Tissue Virginia DGS	Tissue ANAB	Tissue DoD	Urine CALA	Water CALA	Water, Non-Potable California DPH	Water, Non-Potable Florida DOH	Water, Non-Potable Minnesota DOH	Water, Non-Potable New Jersey DEP	Water, Non-Potable New York DOH	Water, Non-Potable Virginia DGS	Water, Non-Potable Washington DE *	Water, Non-Potable Maine DOH	Water, Non-Potable ANAB	Water, Non-Potable Pennsylvania DEP	Water, Non-Potable DoD
	PCB 39 3,4',5-Trichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 4 2,2'-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 4/10	EPA 8270	MLA-007										Y																							
	PCB 40 2,2',3,3'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 41 2,2',3,4-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 41/71/64/68	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 42 2,2',3,4'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 42/59	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 43 2,2',3,5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 44 2,2',3,5'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 45 2,2',3,6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 46 2,2',3,6'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 47 2,2',4,4'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 47/48/75	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 48 2,2',4,5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 49 2,2',4,5'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 49/43	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 5 2,3-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 50 2,2',4,6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 51 2,2',4,6'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							

Accreditation Scope
SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp CALA	Serum CALA	Solids CALA	Solids California DPH	Solids Florida DOH	Solids Minnesota DOH	Solids New Jersey DEP	Solids New York DOH	Solids Virginia DGS	Solids Washington DE	Solids Maine DOH	Solids ANAB	Solids DoD	Tissue CALA	Tissue Florida DOH	Tissue Minnesota DOH	Tissue New Jersey DEP	Tissue Virginia DGS	Tissue ANAB	Tissue DoD	Urine CALA	Water CALA	Water, Non-Potable California DPH	Water, Non-Potable Florida DOH	Water, Non-Potable Minnesota DOH	Water, Non-Potable New Jersey DEP	Water, Non-Potable New York DOH	Water, Non-Potable Virginia DGS	Water, Non-Potable Washington DE *	Water, Non-Potable Maine DOH	Water, Non-Potable ANAB	Water, Non-Potable Pennsylvania DEP	Water, Non-Potable DoD
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 52 2,2',5,5'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 52/73	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 53 2,2',5,6'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 54 2,2',6,6'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 55 2,3,3',4-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 56 2,3,3',4'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 56/60	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 57 2,3,3',5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 58 2,3,3',5'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 59 2,3,3',6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 6 2,3'-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 60 2,3,4,4'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 61 2,3,4,5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 62 2,3,4,6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 62/65	EPA 8270	MLA-007										Y																							
	PCB 63 2,3,4',5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 64 2,3,4',6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 65 2,3,5,6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 66 2,3',4,4'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 66/80	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 67 2,3',4,5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	PCB 68 2,3',4,5'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 69 2,3',4,6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 7 2,4-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 7/9	EPA 8270	MLA-007										Y																							
	PCB 70 2,3',4',5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 70/76	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 71 2,3',4',6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 72 2,3',5,5'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 73 2,3',5',6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 74 2,4,4',5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB 74/61	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 75 2,4,4',6-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 76 2,3',4',5'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 77 3,3',4,4'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 78 3,3',4,5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 79 3,3',4,5'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 8 2,4'-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 8/5	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 80 3,3',5,5'-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 81 3,4,4',5-Tetrachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 82 2,2',3,3',4-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	PCB 83 2,2',3,3',5-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 83/108	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 84 2,2',3,3',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y		Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 85 2,2',3,4,4'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 85/120	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 86 2,2',3,4,5-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 87 2,2',3,4,5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 87/115/116	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 88 2,2',3,4,6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 88/121	EPA 8270	MLA-007										Y																							
	PCB 89 2,2',3,4,6'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 9 2,5-Dichlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y			Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 90 2,2',3,4',5-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 91 2,2',3,4',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 92 2,2',3,5,5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 93 2,2',3,5,6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 94 2,2',3,5,6'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 95 2,2',3,5',6-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 95/93	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	PCB 96 2,2',3,6,6'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 97 2,2',3,4',5'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 97/86	EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	PCB 98 2,2',3,4',6'-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
	PCB 98/102	EPA 8270	MLA-007										Y																							
	PCB 99 2,2',4,4',5-Pentachlorobiphenyl	EPA 1668	MLA-010					Y		Y	Y	Y	Y	Y	Y	Y						Y	Y				Y		Y	Y	Y	Y		Y	Y	Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y		Y							Y	Y	Y					Y	Y		Y		Y							Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
		SGS AXYS MLA-901	MLA-901		Y																															
	PCB congeners, total	EPA 1668	MLA-010								Y																			Y						
	Sum - Dichlorobiphenyls (BZ-12-+ BZ-13)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Heptachlorobiphenyls (BZ-171 + BZ-173)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Heptachlorobiphenyls (BZ-180 + BZ-193)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Heptachlorobiphenyls (BZ-183 + BZ-185)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Hexachlorobiphenyls (BZ-128 + BZ-166)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Hexachlorobiphenyls (BZ-129 + BZ-138 + BZ-160 + BZ-163)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Hexachlorobiphenyls (BZ-134 + BZ-143)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Hexachlorobiphenyls (BZ-135 + BZ-151 + BZ-154)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Hexachlorobiphenyls (BZ-139 + BZ-140)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Hexachlorobiphenyls (BZ-147 + BZ-149)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Hexachlorobiphenyls (BZ-153 + BZ-168)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Hexachlorobiphenyls (BZ-156 + BZ-157)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-107 + BZ-124)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-108 + BZ-124)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-110 + BZ-115)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-83 + BZ-99)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-85 + BZ-116 + BZ-117)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-86 + BZ-87 + BZ 97 + BZ-109 + BZ-119 + BZ-125)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-86 + BZ-87 + BZ-97 + BZ-108 + BZ-119 +BZ-125)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-88 + BZ-91)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-90 + BZ-101 + BZ-113)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Pentachlorobiphenyls (BZ-93 + BZ-95 + BZ-98 + BZ-100 + BZ-102)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Tetrachlorobiphenyls (BZ-40 + BZ-41 + BZ-71)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Tetrachlorobiphenyls (BZ-44 + BZ-47 + BZ-65)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Tetrachlorobiphenyls (BZ-45 + BZ-51)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Tetrachlorobiphenyls (BZ-49 + BZ-69)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Tetrachlorobiphenyls (BZ-50 + BZ-53)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Tetrachlorobiphenyls (BZ-59 + BZ-62 + BZ-75)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Tetrachlorobiphenyls (BZ-61 + BZ-70 + BZ-74 + BZ-76)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Trichlorobiphenyls (BZ-18 + BZ-30)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Trichlorobiphenyls (BZ-20 + BZ-28)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Trichlorobiphenyls (BZ-21 + BZ-33)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Sum - Trichlorobiphenyls (BZ-26 + BZ-29)	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Total Dichlorobiphenyls	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y									Y	Y	Y					Y	Y		Y									Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	Total Heptachlorobiphenyls	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y									Y	Y	Y					Y	Y		Y									Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	Total Hexachlorobiphenyls	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y									Y	Y	Y					Y	Y		Y									Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	Total Monochlorobiphenyls	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010		Y	Y									Y	Y	Y					Y	Y		Y									Y		Y
	Total Nonachlorobiphenyls	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y									Y	Y	Y					Y	Y		Y									Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	Total Octachlorobiphenyls	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y									Y	Y	Y					Y	Y		Y									Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	Total PCBs	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-010	MLA-010												Y	Y						Y	Y											Y		Y
	Total Pentachlorobiphenyls	EPA 1668	MLA-010												Y	Y						Y	Y											Y		Y

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y									Y	Y	Y					Y	Y		Y									Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	Total Polychlorinated biphenyls	SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	Total Tetrachlorobiphenyls	EPA 1668	MLA-010												Y	Y						Y	Y												Y		Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y									Y	Y	Y					Y	Y		Y									Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
	Total Trichlorobiphenyls	EPA 1668	MLA-010												Y	Y						Y	Y												Y		Y
		EPA 8270	MLA-007										Y																							
		SGS AXYS MLA-010	MLA-010		Y	Y									Y	Y	Y					Y	Y		Y									Y		Y
		SGS AXYS MLA-007	MLA-007			Y											Y								Y											
PCDDF	1,2,3,4,6,7,8-HpCDD	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,4,6,7,8-HpCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,4,7,8,9-HpCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,4,7,8-HxCDD	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,4,7,8-HxCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,6,7,8-HxCDD	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,6,7,8-HxCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,7,8,9-HxCDD	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,7,8,9-HxCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,7,8-PeCDD	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	1,2,3,7,8-PeCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	2,3,4,6,7,8-HxCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	2,3,4,7,8-PeCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp CALA	Serum CALA	Solids CALA	Solids California DPH	Solids Florida DOH	Solids Minnesota DOH	Solids New Jersey DEP	Solids New York DOH	Solids Virginia DGS	Solids Washington DE	Solids Maine DOH	Solids ANAB	Solids DoD	Tissue CALA	Tissue Florida DOH	Tissue Minnesota DOH	Tissue New Jersey DEP	Tissue Virginia DGS	Tissue ANAB	Tissue DoD	Urine CALA	Water CALA	Water, Non-Potable California DPH	Water, Non-Potable Florida DOH	Water, Non-Potable Minnesota DOH	Water, Non-Potable New Jersey DEP	Water, Non-Potable New York DOH	Water, Non-Potable Virginia DGS	Water, Non-Potable Washington DE *	Water, Non-Potable Maine DOH	Water, Non-Potable ANAB	Water, Non-Potable Pennsylvania DEP	Water, Non-Potable DoD
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	2,3,7,8-TCDD	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	2,3,7,8-TCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	OCDD	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	OCDF	EPA 1613	MLA-017										Y		Y	Y						Y	Y			Y	Y		Y	Y	Y	Y	Y	Y		Y
		EPA 8290	MLA-017				Y	Y		Y	Y	Y		Y	Y	Y		Y		Y	Y	Y	Y				Y			Y	Y			Y		Y
		SGS AXYS MLA-017	MLA-017	Y	Y	Y		Y							Y	Y	Y	Y				Y	Y		Y		Y							Y		Y
	Total HpCDD	EPA 1613	MLA-017												Y	Y						Y	Y			Y	Y						Y	Y		Y
		EPA 8290	MLA-017					Y		Y		Y		Y	Y	Y		Y		Y	Y	Y	Y				Y				Y			Y		Y
		SGS AXYS MLA-017	MLA-017					Y							Y	Y		Y				Y	Y				Y							Y		Y
	Total HpCDF	EPA 1613	MLA-017												Y	Y						Y	Y			Y	Y						Y	Y		Y
		EPA 8290	MLA-017					Y		Y		Y		Y	Y	Y		Y		Y	Y	Y	Y				Y				Y			Y		Y
		SGS AXYS MLA-017	MLA-017					Y							Y	Y		Y				Y	Y				Y							Y		Y
	Total HxCDD	EPA 1613	MLA-017												Y	Y						Y	Y			Y	Y						Y	Y		Y
		EPA 8290	MLA-017					Y		Y		Y		Y	Y	Y		Y		Y	Y	Y	Y				Y				Y			Y		Y
		SGS AXYS MLA-017	MLA-017					Y							Y	Y		Y				Y	Y				Y							Y		Y
	Total HxCDF	EPA 1613	MLA-017												Y	Y						Y	Y			Y	Y						Y	Y		Y
		EPA 8290	MLA-017					Y		Y		Y		Y	Y	Y		Y		Y	Y	Y	Y				Y				Y			Y		Y
		SGS AXYS MLA-017	MLA-017					Y							Y	Y		Y				Y	Y				Y							Y		Y
	Total PCDD	EPA 1613	MLA-017												Y	Y						Y	Y											Y		Y
		EPA 8290	MLA-017												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-017	MLA-017												Y	Y						Y	Y											Y		Y
	Total PCDD+PCDF	EPA 1613	MLA-017												Y	Y						Y	Y											Y		Y
		EPA 8290	MLA-017												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-017	MLA-017												Y	Y						Y	Y											Y		Y
	Total PCDF	EPA 1613	MLA-017												Y	Y						Y	Y											Y		Y
		EPA 8290	MLA-017												Y	Y						Y	Y											Y		Y
		SGS AXYS MLA-017	MLA-017												Y	Y						Y	Y											Y		Y
	Total PeCDD	EPA 1613	MLA-017												Y	Y						Y	Y			Y	Y						Y	Y		Y
		EPA 8290	MLA-017					Y		Y		Y		Y	Y	Y		Y		Y	Y	Y	Y				Y				Y			Y		Y
		SGS AXYS MLA-017	MLA-017					Y							Y	Y		Y				Y	Y				Y							Y		Y
	Total PeCDF	EPA 1613	MLA-017												Y	Y						Y	Y			Y	Y						Y	Y		Y
		EPA 8290	MLA-017					Y		Y		Y		Y	Y	Y		Y		Y	Y	Y	Y				Y				Y			Y		Y
		SGS AXYS MLA-017	MLA-017					Y							Y	Y		Y				Y	Y				Y							Y		Y
	Total TCDD	EPA 1613	MLA-017												Y	Y						Y	Y			Y	Y						Y	Y		Y
		EPA 8290	MLA-017					Y		Y		Y		Y	Y	Y		Y		Y	Y	Y	Y				Y				Y			Y		Y
		SGS AXYS MLA-017	MLA-017					Y							Y	Y		Y				Y	Y				Y							Y		Y
	Total TCDF	EPA 1613	MLA-017												Y	Y						Y	Y			Y	Y						Y	Y		Y
		EPA 8290	MLA-017					Y		Y		Y		Y	Y	Y		Y		Y	Y	Y	Y				Y				Y			Y		Y
		SGS AXYS MLA-017	MLA-017					Y							Y	Y		Y				Y	Y				Y							Y		Y
PFAS	4:2 fluorotelomer sulfonate (4:2 PFAS)	SGS AXYS MLA-081	MLA-081																															Y		Y
		SGS AXYS MLA-089	MLA-089												Y	Y																				
	4:2 Fluorotelomersulfonate (4:2 FTS)	SGS AXYS MLA-110	MLA-110					Y																			Y									
	4:2 fluorotelomersulfonate (4:2 PFAS)	SGS AXYS MLA-110	MLA-110			Y																			Y											

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	6:2 fluorotelomer sulfonate (6:2 PFAS)	SGS AXYS MLA-081	MLA-081																															Y		Y
		SGS AXYS MLA-089	MLA-089												Y	Y																				
	6:2 Fluorotelomersulfonate (6:2 FTS)	SGS AXYS MLA-110	MLA-110					Y																			Y									
	6:2 fluorotelomersulfonate (6:2 PFAS)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	8:2 fluorotelomer sulfonate (8:2 PFAS)	SGS AXYS MLA-081	MLA-081																															Y		Y
		SGS AXYS MLA-089	MLA-089												Y	Y																				
	8:2 Fluorotelomersulfonate (8:2 FTS)	SGS AXYS MLA-110	MLA-110					Y																			Y									
	8:2 fluorotelomersulfonate (8:2 PFAS)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	N-Ethylperfluorooctanesulfonamide (N-EtFOSA)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	N-Ethylperfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	N-Ethylperfluorooctanesulfonamidoethanol (N-EtFOSE)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	N-Methylperfluorooctanesulfonamide (N-MeFOSA)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	N-Methylperfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	N-Methylperfluorooctanesulfonamidoethanol (N-MeFOSE)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	Perfluorobutanesulfonate (PFBS)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluorobutanoate (PFBA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluorodecanesulfonate (PFDS)	SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluorodecanoate (PFDA)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	Perfluorodecanoate (PFDA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110					Y																			Y									
	Perfluorododecanesulfonate (PFDoS)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	Perfluorododecanoate (PFDoA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluoroheptanesulfonate (PFHpS)	SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Metho	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	Perfluoroheptanoate (PFHpA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluorohexanesulfonate (PFHxS)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluorohexanoate (PFHxA)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	Perfluorohexanoate (PFHxA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110					Y																			Y									
	Perfluorononanesulfonate (PFNS)	SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluorononanoate (PFNA)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	Perfluorononanoate (PFNA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110					Y																			Y									
	Perfluorooctane sulfonamide (PFOSA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110					Y																			Y									
	Perfluorooctanesulfonamide (PFOSA), a.k.a FOSA	SGS AXYS MLA-110	MLA-110			Y																			Y											
	Perfluorooctanesulfonate (PFOS)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Method	Pulp CALA	Serum CALA	Solids CALA	Solids California DPH	Solids Florida DOH	Solids Minnesota DOH	Solids New Jersey DEP	Solids New York DOH	Solids Virginia DGS	Solids Washington DE	Solids Maine DOH	Solids ANAB	Solids DoD	Tissue CALA	Tissue Florida DOH	Tissue Minnesota DOH	Tissue New Jersey DEP	Tissue Virginia DGS	Tissue ANAB	Tissue DoD	Urine CALA	Water CALA	Water, Non-Potable California DPH	Water, Non-Potable Florida DOH	Water, Non-Potable Minnesota DOH	Water, Non-Potable New Jersey DEP	Water, Non-Potable New York DOH	Water, Non-Potable Virginia DGS	Water, Non-Potable Washington DE *	Water, Non-Potable Maine DOH	Water, Non-Potable ANAB	Water, Non-Potable Pennsylvania DEP	Water, Non-Potable DoD
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluorooctanoate (PFOA)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	Perfluorooctanoate (PFOA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110					Y																			Y									
	Perfluoropentanesulfonate (PFPeS)	SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluoropentanoate (PFPeA)	SGS AXYS MLA-110	MLA-110			Y																			Y											
	Perfluoropentanoate (PFPeA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110					Y																			Y									
	Perfluorotetradecanoate (PFTeDA)	SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluorotridecanoate (PFTrDA)	SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
	Perfluoroundecanoate (PFUnA)	EPA 537 modified	MLA-041												Y	Y																				
			MLA-043																			Y	Y													
			MLA-060																															Y		Y
		SGS AXYS MLA-060	MLA-060																						Y		Y	Y	Y					Y		Y
		SGS AXYS MLA-041	MLA-041			Y		Y	Y	Y					Y	Y																				
		SGS AXYS MLA-043	MLA-043														Y	Y	Y	Y		Y	Y													
		SGS AXYS MLA-042	MLA-042		Y																															
		SGS AXYS MLA-110	MLA-110			Y		Y																	Y		Y									
PPCP	1,7-Dimethylxanthine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	10-hydroxy-amitriptyline	SGS AXYS MLA-075	MLA-075			Y																			Y											
	2-hydroxy-ibuprofen	SGS AXYS MLA-075	MLA-075			Y																			Y											
	4-Epianhydrochlortetracycline (EACTC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	4-Epianhydrotetracycline (EATC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	4-Epichlortetracycline (ECTC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	4-Epioxytetracycline (EOTC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	4-Epitetracycline (ETC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Acetaminophen	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Albuterol	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Alprazolam	SGS AXYS MLA-075	MLA-075			Y																			Y											

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Metho	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	Amitriptyline	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Amlodipine	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Amphetamine	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Anhydrochlortetracycline (ACTC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Anhydrotetracycline (ATC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Atenolol	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Atorvastatin	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Azithromycin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Benzoylecgonine	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Benztropine	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Betamethasone	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Bisphenol A	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Caffeine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Carbadox	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Carbamazepine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Cefotaxime	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Chlortetracycline (CTC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Cimetidine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Ciprofloxacin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Clarithromycin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Clinafloxacin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Clonidine	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Cloxacillin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Cocaine	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Codeine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Cotinine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	DEET (N,N-diethyl-m-toluamide)	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Dehydronifedipine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Demeclocycline	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Desmethyldiltiazem	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Diazepam	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Digoxigenin	EPA 1694	MLA-075											Y																			Y			

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

Compound Class	Compound	Accredited Method ID	SGS AXYS Metho	Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
				CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Digoxin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Diltiazem	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Diphenhydramine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Doxycycline	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Enalapril	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Enrofloxacin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Erythromycin	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Erythromycin anydrate	EPA 1694	MLA-075											Y																			Y			
	Flumequine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Fluocinonide	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Fluoxetine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Fluticasone propionate	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Furosemide	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Gemfibrozil	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Glipizide	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Glyburide	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Hydrochlorothiazide	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Hydrocodone	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Hydrocortisone	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Ibuprofen	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Isochlortetracycline (ICTC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Lincomycin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Lomefloxacin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Meprobamate	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Metformin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Methylprednisolone	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Metoprolol	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Miconazole	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Minocycline	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Naproxen	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Norfloxacin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Norfluoxetine	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Norgestimate	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Norverapamil	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Ofloxacin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Ormetoprim	EPA 1694	MLA-075											Y																			Y			

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Metho	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Oxacillin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Oxolinic acid	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Oxycodone	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Oxytetracycline (OTC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Paroxetine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Penicillin G	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Penicillin V	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Prednisolone	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Prednisone	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Promethazine	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Propoxyphene	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Propranolol	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Ranitidine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Roxithromycin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sarafloxacin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sertraline	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Simvastatin	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sulfachloropyridazine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sulfadiazine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sulfadimethoxine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sulfamerazine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sulfamethazine	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sulfamethizole	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sulfamethoxazole	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sulfanilamide	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Sulfathiazole	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Tetracycline (TC)	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Theophylline	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Thiabendazole	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Trenbolone	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Trenbolone acetate	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Triamterene	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Triclocarban	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Triclosan	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	Trimethoprim	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Tylosin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Valsartan	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Verapamil	SGS AXYS MLA-075	MLA-075			Y																			Y											
	Virginiamycin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
	Warfarin	EPA 1694	MLA-075											Y																			Y			
		SGS AXYS MLA-075	MLA-075			Y																			Y											
Targeted Metabolites	11, 14, 17-eicosatrienoic acid (eicosatrienoic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	11, 14-eicosadienoic acid	SGS AXYS MLM-001	MLM-001														Y																			
	3-hydroxytyrosine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Acetylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Acetylornithine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Alanine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	alpha-Aminoadipic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Arginine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Asparagine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Aspartate	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Asymmetric dimethylarginine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Butenylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Butyrylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	C22:5 ISOMER 1 (tentatively all-cis-4, 8, 12, 15, 19-docosapentaenoic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	C22:5 ISOMER 2 (all-cis-7,10,13,16,19-docosapentaenoic acid (DPA)	SGS AXYS MLM-001	MLM-001														Y																			
	C22:5 ISOMER 3 (tentatively all-cis-4, 7, 10, 13, 16-docosapentaenoic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	Carnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Carnosine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	chenodeoxycholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	cholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Citrulline	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Creatinine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Decadienylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	decanoic acid (capric acid)	SGS AXYS MLM-001	MLM-001														Y																			
	Decanoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Decenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	deoxycholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	docosahexaenoic acid (DHA)	SGS AXYS MLM-001	MLM-001														Y																			
	docosatetraenoic acid (adrenic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	Dodecanedioylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Dodecanoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Dodecenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Dopamine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	eicosapentaenoic acid (EPA)	SGS AXYS MLM-001	MLM-001														Y																			
	Eicosatetraenoic acid (arachidonic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	eicosatrienoic acid (dihomo-γ-linolenic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	Glutaconylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Glutamate	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Glutamine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Glutarylcarnitine (Hydroxyhexanoylcarnitine)	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Glycine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	glycochenodeoxycholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	glycocholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	glycodeoxycholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hexadecadienylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	hexadecanoic acid (palmitic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	Hexadecanoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	hexadecenoic acid (palmitoleic acid)	SGS AXYS MLM-001	MLM-001														Y																			

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue								Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Metho	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	Hexadecenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hexanoylcarnitine (Fumarylcarnitine)	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hexenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hexose (sum isomers)	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Histamine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Histidine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxyhexadecadienylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxyhexadecanoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxyhexadecenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxylbutyrylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxyoctadecenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxyproline	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxypropionylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxysphingomyeline C14:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxysphingomyeline C16:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxysphingomyeline C22:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxysphingomyeline C22:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxysphingomyeline C24:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxytetradecadienylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxytetradecenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Hydroxyvalerylcarnitine (Methylmalonylcarnitine)	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Isoleucine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Kynurenine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Leucine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lithocholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Lysine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C14:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C16:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C16:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C17:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C18:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C18:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C18:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C20:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C20:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C24:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C26:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C28:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	lysoPhosphatidylcholine acyl C28:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Methionine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Methioninesulfoxide	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Methylglutarylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Nitrotyrosine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Nonaylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	octadecadienoic acid (linoleic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	Octadecadienylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	octadecanoic acid (stearic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	Octadecanoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	octadecatrienoic acid (γ-linolenic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	Octadecenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Octanoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Ornithine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phenylalanine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phenylethylamine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C30:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C30:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C30:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C32:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												

Accreditation Scope

SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	Phosphatidylcholine acyl-alkyl C32:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C34:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C34:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C34:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C34:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C36:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C36:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C36:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C36:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C36:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C36:5	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C38:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C38:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C38:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C38:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C38:5	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C38:6	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C40:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C40:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C40:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C40:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C40:5	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C40:6	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C42:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C42:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C42:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C42:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C42:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C42:5	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C44:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C44:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C44:5	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine acyl-alkyl C44:6	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C24:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C26:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C28:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C30:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C30:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C32:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C32:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C32:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C32:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C34:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C34:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C34:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C34:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C36:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C36:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C36:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C36:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C36:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C36:5	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C36:6	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C38:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C38:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C38:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C38:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C38:5	SGS AXYS MLM-001	MLM-001		Y												Y							Y												

Accreditation Scope
SGS AXYS Analytical Services Ltd.
(formerly AXYS Analytical Services Ltd.)
file ref.: ACC-101 Rev. 35

				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Metho	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD
	Phosphatidylcholine diacyl C38:6	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C40:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C40:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C40:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C40:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C40:5	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C40:6	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C42:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C42:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C42:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C42:4	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C42:5	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Phosphatidylcholine diacyl C42:6	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Pimelylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Proline	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Propenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Propionylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Putrescine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sarcosine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Serine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Serotonin	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Spermidine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Spermine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C16:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C16:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C18:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C18:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C20:2	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C22:3	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C24:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C24:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C26:0	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Sphingomyeline C26:1	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Symmetric dimethylarginine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Taurine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	taurochenodeoxycholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	taurocholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	taurodeoxycholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	taurolithocholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	tauroursodexoycholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Tetradecadienylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	tetradecanoic acid (myristic acid)	SGS AXYS MLM-001	MLM-001														Y																			
	Tetradecanoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Tetradecenoylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Threonine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Tiglylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Total dimethylarginine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Tryptophan	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Tyrosine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	ursodexoycholic acid	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Valerylcarnitine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
	Valine	SGS AXYS MLM-001	MLM-001		Y												Y							Y												
TBBPA	Tetrabromobisphenol A	SGS AXYS MLA-079	MLA-079		Y																															

Accreditation Scope SGS AXYS Analytical Services Ltd. (formerly AXYS Analytical Services Ltd.) file ref.: ACC-101 Rev. 35				Pulp	Serum	Solids											Tissue							Urine	Water	Water, Non-Potable										
Compound Class	Compound	Accredited Method ID	SGS AXYS Method	CALA	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE	Maine DOH	ANAB	DoD	CALA	Florida DOH	Minnesota DOH	New Jersey DEP	Virginia DGS	ANAB	DoD	CALA	CALA	California DPH	Florida DOH	Minnesota DOH	New Jersey DEP	New York DOH	Virginia DGS	Washington DE *	Maine DOH	ANAB	Pennsylvania DEP	DoD

Note*

Analysis of pesticides and PCBs in non-potable water samples by AXYS method MLA-007, with the exception of NPDES or State permitted discharges and Stormwater applications, may fall within the scope of Washington State Department of Ecology solids matrix accreditation, subject to approval of the Ecology Project Manager.

Legend

Y	Accreditation scope
BFR	Brominated flame retardants (non-PBDPE)
BPA and mPE	Bisphenol A and mono-Phthalate Esters
HBCDD	Hexabromocyclododecane
OC Pesticides	Organochlorine Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PBDPE	Polybrominated diphenylethers
PCB	Polychlorinated Biphenyls
PCDDF	Polychlorinated dibenzodioxins/furans
PFAS	Per- and Polyfluoroalkyl Substances
PPCP	Pharmaceutical and Personal Care Products
TBBPA	Tetrabromobisphenol A
California DPH	California Department of Public Health, Lab ID 2911 (target analytes shown are those approved 2014)
Florida DOH	Florida Department of Health, Lab ID E871007, (NELAC Standard)
Pennsylvania DEP	Pennsylvania Department of Environmental Protection
Minnesota DOH	Minnesota Department of Health, Lab ID 232-999-430, (NELAC Standard)
New Jersey DEP	New Jersey Department of Environmental Protection, Lab ID CANA005, (NELAC Standard)
New York DOH	New York Department of Health, Lab ID 11674, (NELAC Standard)
Washington DE	Washington Department of Ecology, Lab ID C404
Virginia DGS	Virginia Department of General Services, Division of Consolidated Laboratory Services, Lab ID 460224, (NELAC Standard)
Maine DOH	Maine Center for Disease Control and Prevention, Department of Health and Human Services, Lab ID CN00003
DoD	US Department of Defense
CALA	Canadian Association for Laboratory Accreditation Inc., Lab ID A2637, (ISO/IEC 17025:2005 Standard)
ANAB	ANSI-ASQ National Accreditation Board, certificate ADE-1861, (ISO/IEC 17025:2005 and US DOD Standards)

CALA
Testing
Accreditation No. A 2637

ilac-MRA

ANAB
ACCREDITED
ISO/IEC 17025
DOD ELAP
Certificate ADE-1861

ilac-MRA

Evaluation of Sediments from Munger Landing for Toxicity to *Hyalella azteca*, *Chironomus dilutus*, and Bioaccumulation in *Lumbriculus variegatus*

By

Matthew TenEyck, Christine Polkinghorne,
Thomas Markee, and Olivia Anders

Lake Superior Research Institute
University of Wisconsin-Superior
Superior, WI

Final Report

To

Bay West, LLC
5 Empire Drive
St. Paul, MN 55103
(Chris Musson, Project Officer)

May 31, 2016

Table of Contents

List of Tables

List of Appendices

Introduction

The University of Wisconsin-Superior's Lake Superior Research Institute (LSRI) contracted with Bay West, LLC to evaluate sediments from Munger Landing (St. Louis River, Duluth, MN) sites for toxicity and bioaccumulation of chemicals toward several species of benthic invertebrates. Sediment samples were collected from a total of nine sites. The following tests were conducted: a 10-day Sediment Toxicity Test with *Hyalella azteca*, a 10-day Sediment Toxicity Test with *Chironomus dilutus*, and a 28-day Bioaccumulation Test with *Lumbriculus variegatus*. Survival and growth were determined as endpoints for both 10-day tests. All chemical analysis conducted by Pace Analytical was determined by Bay West.

Methods

Sediment Collection, Preparation and Chemical Analysis

Sediment was collected on December 3, 2015 by Bay West staff and placed in clean plastic five-gallon buckets (cleaned with10% Nitric acid rinse, HPLC (high performance liquid chromatography) grade acetone rinse, and copious amounts of deionized water with minimal head space. The Bay West staff delivered the sediment to LSRI on December 3, 2015. The samples were stored at 4.0˚C until they were homogenized. Table 1 describes the treatments and includes control sediments. Asterisks within table 1 indicate the sediments tested in the bioaccumulation test with *L. variegatus*.

Table 1: Sediment Identification and Designation

Treatment Identification	Designation
Silica Sand	Performance Control
West Bearskin Lake	Natural Sediment Control
BW15ML-004 *	Treatment
BW15ML-006	Treatment
BW15ML-010 *	Treatment
BW15ML-018	Treatment
BW15ML-022	Treatment
BW15ML-032 *	Treatment
BW15ML-034 *	Treatment
BW15ML-037	Treatment
BW15ML-038	Treatment

Prior to testing, the sediment was homogenized for two, 5-minute intervals using a commercial drill equipped with a stainless steel mortar paddle. Between the intervals, the sediment was stirred manually with a stainless steel spoon to further ensure homogeneity. After homogenization, sediment was immediately placed into the test exposure containers. Between homogenization of sediments, all equipment was cleaned with a lab soap solution, tap water, 10% nitric acid, HPLC grade acetone, and deionized water. Following homogenization, sediment subsamples were collected from BW15ML-004, BW15ML-010, BW15ML-022, BW15ML-032, BW15ML-034, BW15ML-037, and BW15ML-038 for determining polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) concentrations along with percent moisture. Total Organic Carbon (TOC) concentrations were measured on sediments BW15ML-004, BW15ML-010, BW15ML-032, and BW15ML-034. Sediment subsamples for analysis of selected metals and PCBs as Aroclors were collected from BW15ML-004, BW15ML -006, BW15ML-

010, BW15ML-018, BW15ML-022, BW15ML-032, BW15ML-034, BW15ML-037, and BW15ML-038. All sediment samples were sent to Pace Analytical for analysis.

Solid Phase Sediment Toxicity Tests

Solid phase sediment toxicity tests were performed with the freshwater species *H. azteca*, a crustacean; *C. dilutus*, an insect; and a bioaccumulation test with the oligochaete *L. variegatus*. The LSRI test protocols used were: "Conducting a 10-day Sediment Toxicity Test with *Hyalella azteca*" (LSRI SOP AT/20 v.6); "Conducting a 10-day Sediment Toxicity Test with *Chironomus dilutus*" (LSRI SOP AT/21 v.7); and "Conducting a 28-day Bioaccumulation Test for Sediment with the Oligochaete, *Lumbriculus variegatus*" (LSRI SOP AT/19 v.2). The SOPs are based upon EPA-developed methods (U.S. EPA, 2000). The objectives of each of the tests were slightly different and will be discussed below. In general, the objective was to determine whether the contaminants in the sediment were harmful to the test organisms or if certain contaminants in the sediments accumulated in the selected organism over a 28 day exposure (Table 2).

Toxicity tests with *H. azteca* and *C. dilutus*

For the 10-day tests, approximately 100 mL of homogenized sediment was placed into each 300 mL beaker containing two screened holes about two-thirds of the distance up the beaker walls to allow for water exchange between the beaker and the aquarium in which it was placed. Each aquarium contained eight replicate beakers for each species and sediment type tested. A set of eight replicate beakers were placed into a glass aquarium. The aquaria were then placed within the larger water baths set to maintain the desired test temperature (23.0 ± 1.0˚C).

10 day toxicity tests were initiated with 7-8 days old *H. azteca* and 10-12 day old *C. dilutus* (second and third instar). The tests were performed at water temperatures of 23.0 ± 1.0˚C. Renewal water was added twice each day over two hour renewal periods. The volume of renewal water added was a minimum of two volume replacements of the overlying water in each of the beakers. A 16L:8D photoperiod was maintained.

For all tests, the sediment was added one day prior to the addition of the test animals to allow the sediment to settle and overlying water to clear.

Ten organisms were added to all replicate beakers for both 10-day tests. All replicate beakers were fed equal volumes of food. *H. azteca* received 1.0 mL daily of a yeast, cereal leaves, and trout chow mixture containing approximately 1800 mg/L total suspended solids. *C. dilutus* were fed 1.5 mL daily of a 4.0 g/L Tetrafin® suspension. During all tests, dissolved oxygen and temperature were measured twice daily. For both 10-day tests, pH and conductivity were measured three times a week. Hardness, alkalinity, and ammonia were measured on days 0 and 9. At the end of the appropriate exposure period, sediment from each beaker was sieved through a #40 mesh sieve (0.425 mm), rinsed into a clear Pyrex® pan, placed over a light table, and the surviving organisms retrieved. The *H. azteca* were placed into dried, pre-weighed aluminum pans and dried at approximately 60˚C for at least 24 hours to obtain dry weight measurements. Ash-free dry weights were determined on the *C. dilutus* by placing previously ashed and weighed pans containing the animals in a muffle furnace at 550˚C for approximately 2 hours. After ashing, the pans containing the organisms were cooled in a desiccator and weighed. Weights were determined to 0.01 mg for *H. azteca* and *C. dilutus.*

Bioaccumulation test with *L. variegatus*

For the bioaccumulation test, approximately 3000 g of homogenized sediment was placed in each glass aquaria and renewal water was directly delivered into the aquaria. The aquaria were then placed within the larger water bath to maintain the desired test temperature (23.0 ± 1.0˚C). Approximately 15 g (wet weight) of mixed age *L. variegatus* was added to each of the five replicate aquaria used for the four sediments tested in the bioaccumulation exposures. The *L. variegatus* were not fed during the test. Dissolved oxygen and temperature were measured twice daily while pH, conductivity, hardness, alkalinity, and ammonia were measured on days 1, 7, 14, 21, and 27. At the end of the 28 day exposure period, the sediment containing the *L. variegatus* was sieved through a #60 mesh sieve (0.250 mm), rinsed into a clear Pyrex® pan, placed over a light table, and the surviving organisms retrieved. After separating the organisms from remaining sediment, the organisms were placed in clean lab water and allowed to depurate overnight. Wet weights were determined on *L. variegatus* prior to placing them in amber vials and freezing. Weights were determined to 0.1 g for *L. variegatus*. The *L. variegatus* tissue was sent to Pace Analytical for determining percent moisture and selected metals on all of the tissue samples. Composited tissue samples, consisting of the five replicate samples from each site tested, were also analyzed for PCBs, lipids, PCDDs, and PCDFs.

Table 2: Test Specifics

Test	Method	Condition	Fed	Age of Organisms at Test Initiation	Endpoint
10-day *H. azteca*	USEPA 2000, LSRI SOP AT/20 v.6	Sediment from 9 sites and 2 control sediments.	1.0 mL daily of a yeast, cereal leaves, and trout chow mixture at approximately 1800 mg/L total suspended solids.	7-8 days	Mortality, weight
10-day *C. dilutus*	USEPA 2000, LSRI SOP AT/21 v.7	Sediment from 9 sites and 2 control sediments.	1.5 mL daily of a 4.0 g/L Tetrafin® suspension.	Second or third instar, 10-12 days old.	Mortality, weight
28-day *L. variegatus*	USEPA 2000, LSRI SOP AT/19 v.2	Sediment from 4 sites.	No feeding	Mixed Age	Bioaccumulation

Statistical Analysis

Data were analyzed using the SigmaStat® program (Jandel Corporation, 1995). Data analyses included: general descriptive statistics, normality, homogeneity of variance, one-way analysis of variance (ANOVA), and a suite of tests for comparison between treatment means. Comparisons between control and treatment groups of normal and equal variance data were analyzed using the Bonferroni t-test. Non-normalized data were analyzed using a non-parametric treatment comparison (Kruskal-Wallis one way analysis of variance on ranks). Dunn's test was used for all pairwise comparison tests for nonparametric data. Mean percent survival and mean dry weight values for the laboratory control sediments and the appropriate reference sediment were analyzed with a statistical significance level of 0.05. Statistical analyses raw data files are kept on file in the Lake Superior Research Institute and are available upon request.

Quality Assurance/Quality Control

Toxicity tests were initiated with healthy, vigorous animals. Reference toxicant tests were performed with all test species within three weeks before or after starting the respective test. Percent survival and dry weights of survivors in control sediments were compared to published test acceptability criteria (U.S.EPA, 2000) to determine the overall performance of the animals and the test system. Empty aluminum drying pans along with Class I standardized weights were used as a check for the organisms drying process and the performance of the balance. Test conditions were monitored twice daily for temperature and dissolved oxygen to maintain test acceptability criteria. Temperatures were, on average, to be 23.0 ± 1.0˚C and instantaneously to be 23.0 ± 3.0˚C. Dissolved oxygen was not allowed to drop below 2.5 mg/L. All testing meters were calibrated according to the frequency suggested in the SOPs, depending upon meter type, to ensure optimal performance. Reference standards and duplicate samples were used in the analysis of ammonia, alkalinity, and hardness. For ammonia analysis, spiked samples were used to indicate whether interferences were present that would affect the reported ammonia values.

The LSRI quality assurance and quality control manager staged a competency test on January 5th, 2016 involving all staff with the potential to participate in organism collection on the final day of the 10-day toxicity tests with *H. azteca* and *C. dilutus*. Staff members were required to retrieve 90% of the organisms added to prove competency. According to LSRI SOP AT/20, v.6 and AT/21, v.7, ten *H. azteca* and ten *C. dilutus*, respectively, were added to a 300-mL beaker containing 100 mL West Bearskin Lake control sediment and 175 mL overlying water. After one hour, recovery was determined following the procedure outlined in the "Test Termination" section of each SOP. The competency test method and results were recorded on a "Certificate of Training Completion/Competency Test Form". The quality assurance and quality control manager performed inspections of logbooks, measurements, and instrumentation used during the tests. The sediment tests were conducted with a high degree of quality assurance/quality control criteria.

Results

Sediment Analysis

Pace Analytical determined polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) concentrations for seven sediments. Those seven sediments were some of those used in the *H. azteca* and *C. dilutus* 10-Day sediment toxicity tests and four of them were used in the bioaccumulation exposures with *L. variegatus*. No statistical comparisons were run on the data from Pace Analytical, but a summary of the data can be found in Table 3. Sediment BW15ML-032 had the highest concentration of all PCDDs and PCDFs aside from the total TCDF. Sediment BW15ML-010 contained the highest amount of total TCDF. Sediment BW15ML-032 also contained the highest total 2,3,7,8-TCDD Equivalence (based on 2005 WHO Factors), which signifies potential for toxicity. Total PCDDs and PCDFs are representative of all 2,3,7,8-substituted isomers found in the sediment. The exact concentrations are only given for isomers for which Pace Analytical used carbon 13 labeled internal standards.

Table 3: Analysis of polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) in seven sediments used for 10 day *Hyalella azteca* and *Chironomus dilutus* tests and a 28 day *Lumbriculus variegatus* bioaccumulation test. Concentrations are in ng/Kg. TCDD Equivalence values based on 2005 WHO Factors. Analysis was done by Pace Analytical

Compound	BW15ML-004	BW15ML-010	BW15ML-022	BW15ML-032	BW15ML-034	BW15ML-037	BW15ML-038
2,3,7,8-TCDF	2.60	4.50	0.46 [a b c]	4.8	1.30 [a]	0.90 [a b c]	3.4
Total TCDF	5.60	74.00	10.00	44.0	13.00	11.00	28.0
2,3,7,8-TCDD	ND	0.88 [a]	ND	2.1	0.63 [a]	0.27 [a b c]	0.92 [a b c]
Total TCDD	0.48 [a]	7.40	0.26 [a]	18.0	4.50	1.40 [a]	6.3
1,2,3,7,8-PeCDF	0.33 [a b c]	1.60 [a]	0.23 [a b c]	2.3 [a]	0.55 [a]	0.44 [a d]	1.6 [a]
2,3,4,7,8-PeCDF	1.40 [a]	6.30 [a]	0.69 [a]	7.2 [a]	1.50 [a]	0.91 [a]	4.5 [a]
Total PeCDF	9.80	83.00	11.00	120.0	27.00	14.00	62.0
1,2,3.7.8-PeCDD	1.30 [a]	2.20 [a]	0.14 [a b c]	6.2 [a]	1.60 [a]	0.48 [a]	2.1 [a]
Total PeCDD	5.30 [a]	21.00	1.80 [a]	58.0	12.00	3.60 [a]	20.0
1,2,3,4,7,8-HxCDF	1.50 [a]	7.20 [a]	0.77 [a b c]	21.0	3.50 [a]	1.30 [a]	21.0
1,2,3,6,7,8-HxCDF	1.40 [a]	9.00 [a]	0.76 [a]	37.0	6.80 [a]	1.70 [a]	13.0
2,3,4,6,7,8-HxCDF	0.58 [a]	5.40 [a]	0.62 [a]	14.0	2.70 [a]	1.00 [a]	4.8 [a]
1,2,3,7,8,9-HxCDF	ND	1.10 [a]	0.15 [a b c]	3.2 [a b c]	0.71 [a]	0.43 [a]	1.7 [a]
Total HxCDF	61.00	170.00	12.00	350.0	150.00	39.00	190.0
1,2,3,4,7,8-HxCDD	0.89 [a]	2.20 [a]	0.26 [a]	6.0 [a]	1.60 [a]	0.50 [a]	2.1 [a]
1,2,3,6,7,8-HxCDD	5.90 [a]	15.00	1.20 [a]	48.0	11.00	3.30 [a]	14.0
1,2,3,7,8,9-HxCDD	2.70 [a]	7.80 [a]	0.74 [a]	26.0	6.50 [a]	1.70 [a]	7.3 [a]
Total HxCDD	70.00	130.00	9.90	410.0	97.00	30.00	130.0
1,2,3,4,6,7,8-HpCDF	79.00	270.00	16.00	1800.0	250.00	85.00	310.0
1,2,3,4,7,8,9-HpCDF	1.30 [a]	5.50 [a]	0.73 [a]	13.0	2.2 [a b c]	0.85 [a b c]	9.3
Total HpCDF	280.00	560.00	32.00	3300.0	480.00	150.00	610.0
1,2,3,4,6,7,8-HpCDD	91.00	170.00	18.00	420.0	140.00	40.00	200.0
Total HpCDD	280.00	380.00	43.00	1000.0	350.00	99.00	440.0
OCDF	64.00	170.00	17.00	820.0	160.00	50.00	280.0
OCDD	970.00	1600.00	140.00	4200.0	1500.00	410.00	2100.0
Total 2,3,7,8-TCDD Equivalence	5.3	15	1.3	50	11	3.5	17

[a] Value estimated due to falling below the calibrated range of the instrument.
[b] Interference present, incorrect isotope ratios obtained.
[c] Concentration was recorded as an estimated maximum possible concentration (EMPC).
[d] Value less than 10 times higher than the method blank level and may be partially attributed to the background. Not considered statistically different from the background.

Four sediments were analyzed for total organic carbon (TOC) concentrations. The samples were analyzed in quadruplicate. The mean concentrations and standard deviations are provided in Table 4.

Table 4: Average Total Organic Carbon (TOC) value (in mg/kg) for four sediments used in the sediment toxicity tests

Sample ID	Total Organic Carbon (mg/kg)
BW15ML-004	57800 ± 12100
BW15ML-010	43500 ± 9388
BW15ML-032	34100 ± 6225
BW15ML-034	31300 ± 8109

All sediments used in testing were sent to Pace Analytical for metals analysis and the results were reported directly to Bay West. Sediment BW15ML-010 was analyzed in duplicate (ID BW15ML-110) and is kept in Table 5 as a separate Sample ID. The concentrations are provided in Table 5.

Table 5: Sediment Metals Analysis Completed by Pace Analytical

Sample ID	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Lead (mg/L)	Mercury (mg/L)	Nickel (mg/L)	Zinc (mg/L)
BW15ML-004	14.0	1.6	39.6	46.4	162	0.36	30.3	522
BW15ML-006	6.9	1.1	42.7	61.0	73.8	0.22	43.0	261
BW15ML-010	7.1	0.96	46.1	53.9	58.1	0.20	44.1	234
BW15ML-110	7.0	0.91	46.5	53.0	58.7	0.21	43.8	230
BW15ML-018	8.2	1.1	33.9	42.6	81.0	0.34	28.6	285
BW15ML-022	2.7	0.21	30.3	29.1	12.2	0.029	64.3	70.5
BW15ML-032	8.5	1.5	40.6	43.5	99.8	0.41	32.3	375
BW15ML-034	7.4	1.3	38.5	42.3	81.4	0.45	32.0	307
BW15ML-037	7.2	0.91	44.6	42.3	57.5	0.20	37.3	237
BW15ML-038	9.3	1.8	44.3	74.2	110	1.4	34.6	425

All sediments used in testing were also analyzed by Pace Analytical for PCBs as Aroclors. These results were also reported directly to Bay West. Again, sediment BW15ML-010 was analyzed in duplicate (ID BW15ML-110) and is kept in Table 6 as a separate sample ID. Concentrations are given in Table 6.

Table 6: Sediment Aroclor Analysis Completed by Pace Analytical

Sample ID	Aroclor 1016 (µg/kg)	Aroclor 1221 (µg/kg)	Aroclor 1232 (µg/kg)	Aroclor 1242 (µg/kg)	Aroclor 1248 (µg/kg)	Aroclor 1254 (µg/kg)	Aroclor 1260 (µg/kg)	Aroclor 1262 (µg/kg)	Aroclor 1268 (µg/kg)
BW15ML-004	ND	ND	ND	ND	ND	ND	176	ND	ND
BW15ML-006	ND	ND	ND	ND	ND	ND	764	ND	ND
BW15ML-010	ND	ND	ND	ND	ND	ND	307	ND	ND
BW15ML-110	ND	ND	ND	ND	ND	ND	285	ND	ND
BW15ML-018	ND	ND	ND	ND	ND	ND	289	ND	ND
BW15ML-022	ND	ND	ND	ND	ND	ND	86.9	ND	ND
BW15ML-032	ND	ND	ND	ND	ND	ND	397	ND	ND
BW15ML-034	ND	ND	ND	ND	ND	ND	451	ND	ND
BW15ML-037	ND	ND	ND	ND	ND	ND	333	ND	ND
BW15ML-038	ND	ND	ND	ND	ND	ND	2110	ND	ND

Hyalella azteca 10-day Test

Mean percent survival for all exposures was high (80-100%, table 7). The control sediments, Silica Sand and West Bearskin Lake, had values of 83% and 93% respectively (table 7). All treatment exposures ranged from 80-100% survival (table 7). No significant (p>0.05) difference was found for survival when compared to the West Bearskin Lake control.

Table 7: *Hyalella azteca* Average Survival and Percent Survival ± Standard Deviation

Sample ID	Average Survival ± Std. Dev.	Percent Survival ± Std. Dev.
Silica Sand	8.3 ± 1.16	83 ± 12%
West Bearskin Lake	9.3 ± 1.04	93 ± 10%
BW15ML-004	8.0 ± 1.41	80 ± 14%
BW15ML-006	9.4 ± 1.06	94 ± 11%
BW15ML-010	9.8 ± 0.46	98 ± 5%
BW15ML-018	9.1 ± 0.83	91 ± 8%
BW15ML-022	10.0 ± 0.53	100 ± 5%
BW15ML-032	8.9 ± 0.64	89 ± 6%
BW15ML-034	8.9 ± 1.64	89 ± 16%
BW15ML-037	9.1 ± 0.99	91 ± 10%
BW15ML-038	8.1 ± 0.99	81 ± 10%

Control sediments had dry weight values per surviving organism of 0.045 ± 0.008 mg (Sand) and 0.066 ± 0.013 mg (West Bearskin Lake) (table 8). Dry weights per organism in treatment exposures ranged from 0.035 ± 0.015 to 0.079 ± 0.013 mg (table 8). Upon comparing with West Bearskin Lake, significant differences were found with four sediments: BW15ML-018 (p=0.017), BW15ML-032 (p<0.001), BW15ML-037 (p=0.011), and BW15ML-038 (p=0.017) (table 8). The *H. Azteca* exposed to these four sediments had significantly lower weights than the organisms from the West Bearskin Lake sediment exposure.

Table 8: Average *Hyalella azteca* Dry Weight

Sample ID	Weight/org (mg) ± Std. Dev.
Silica Sand	0.045 ± 0.008
West Bearskin Lake	0.066 ± 0.013
BW15ML-004	0.055 ± 0.011
BW15ML-006	0.072 ± 0.010
BW15ML-010	0.063 ± 0.006
BW15ML-018	0.047 ± 0.017 [Q]
BW15ML-022	0.079 ± 0.013
BW15ML-032	0.035 ± 0.015 [Q]
BW15ML-034	0.050 ± 0.007
BW15ML-037	0.046 ± 0.011 [Q]
BW15ML-038	0.047 ± 0.011 [Q]

[Q] Statistically different from West Bearskin Lake control sediment

The average water temperature during the *H. azteca* 10-Day sediment toxicity test was 23.8˚C ± 0.4 (standard deviation) which was within the quality assurance range of 23.0 ± 1.0˚C (table 9). Dissolved oxygen did not drop below 4.3 mg/L (table 9). Mean pH values ranged from 7.55 to 8.09 and average conductivity measurements were in the range of 140.8 to 148.7 (µS/cm) (table 9). Average hardness values ranged from 44.3 to 51.3 mg/L and mean alkalinity concentrations were between 43.7 and 49.8 mg/L (table 9). Ammonia samples were collected and preserved in H_2SO_4 until analyzed. Mean ammonia values ranged from 0.08 to 0.21 mg/L (table 9). The alkalinity and hardness values did not vary by more than 50% during the test. Because the ammonia values were all low (≤0.36 mg/L), there were some values that varied by more than 50% within replicates but the actual differences were small.

Table 9: Average Values (minimum, maximum) for Water Chemistry Parameters of overlying water used in the 10 Day Sediment Toxicity Test with *Hyalella azteca*

Sample ID	Temperature (°C) [a]	Dissolved Oxygen (mg/L) [a]	pH [b]	Conductivity (μS/cm) [c]	Hardness (mg/L $CaCO_3$) [c]	Alkalinity (mg/L $CaCO_3$) [c]	Ammonia (mg/L) [c]
Silica Sand	24.3 (24.0, 24.6)	7.6 (7.0, 8.3)	8.09 (8.01, 8.15)	143.6 (142.2, 145.0)	46.8 (45.2, 48.4)	43.7 (37.6, 46.4)	0.11 (0.06, 0.17)
West Bearskin Lake	23.7 (23.3, 24.1)	7.4 (6.1, 8.3)	7.97 (7.71, 8.06)	140.8 (136.8, 145.3)	44.3 (41.6, 45.6)	44.8 (42.0, 49.2)	0.09 (0.08, 0.10)
BW15ML-004	24.0 (23.3, 24.5)	7.1 (5.5, 8.9)	7.82 (7.60, 8.07)	146.8 (143.5, 149.1)	49.8 (45.6, 54.0)	46.7 (45.2, 47.6)	0.08 (0.06, 0.11)
BW15ML-006	23.8 (23.4, 24.2)	7.1 (4.4, 8.6)	7.55 (7.12, 8.03)	145.2 (143.0, 147.3)	47.0 (46.0, 48.4)	48.0 (47.6, 48.4)	0.21 (0.10, 0.36)
BW15ML-010	23.6 (23.3, 24.1)	7.4 (5.8, 9.0)	7.81 (7.46, 8.18)	147.5 (142.2, 152.8)	51.3 (50.0, 52.4)	48.9 (48.0, 51.2)	0.08 (0.06, 0.11)
BW15ML-018	23.9 (23.3, 24.6)	7.2 (5.8, 8.7)	7.86 (7.58, 8.12)	145.8 (142.4, 149.2)	49.2 (48.0, 50.8)	47.1 (45.6, 49.2)	0.08 (0.06, 0.11)
BW15ML-022	24.0 (23.4, 24.4)	6.9 (4.9, 8.5)	7.69 (7.33, 8.03)	147.0 (143.6, 150.2)	47.6 (44.4, 50.8)	47.9 (45.6, 50.4)	0.13 (0.07, 0.19)
BW15ML-032	23.4 (22.8, 23.8)	7.4 (5.9, 8.7)	7.86 (7.69, 8.06)	146.3 (143.6, 149.1)	46.3 (45.2, 47.2)	49.5 (48.0, 50.4)	0.09 (0.06, 0.13)
BW15ML-034	23.5 (23.0, 24.0)	7.5 (6.4, 8.9)	7.93 (7.64, 8.07)	146.4 (142.5, 148.7)	48.8 (46.4, 51.2)	46.9 (44.0, 48.0)	0.09 (0.07, 0.14)
BW15ML-037	23.4 (23.0, 24.0)	7.6 (6.0, 8.8)	7.99 (7.77, 8.09)	145.3 (142.3, 148.2)	47.7 (46.8, 48.4)	46.5 (45.2, 47.2)	0.08 (0.06, 0.11)
BW15ML-038	24.0 (23.6, 24.4)	7.3 (4.3, 9.0)	8.04 (7.83, 8.21)	148.7 (145.7, 151.9)	50.1 (47.2, 52.4)	49.8 (48.4, 51.2)	0.08 (0.07, 0.10)

[a] Temperature and Dissolved Oxygen were measured twice daily, before and after water renewal
[b] pH was measured on days 0, 2, 4, 7 and 9
[c] Conductivity, Hardness, Alkalinity, and Ammonia were measured on days 0 and 9

Chironomus dilutus 10-day Test

The control sediments, Silica Sand and West Bearskin Lake, had survival values of 94% and 100% respectively (table 10). Treatment exposures ranged from 78-100% survival (table 10). Upon comparing with West Bearskin Lake, survival in sediment BW15ML-032 was found to be statistically lower (p<0.05). All other treatment sediments were not found to be statistically different.

Table 10: *Chironomus dilutus* Average Survival and Percent Survival ± Standard Deviation

Sample ID	Average Survival ± Std. Dev.	Average Percent Survival ± Std. Dev.
Silica Sand	9.4 ± 1.18	94 ± 12%
West Bearskin Lake	10 ± 0.00	100 ± 0%
BW15ML-004	8.6 ± 3.11	86 ± 31%
BW15ML-006	9.5 ± 0.76	95 ± 8%
BW15ML-010	10 ± 0.00	100 ± 0%
BW15ML-018	9.7 ± 0.46	98 ± 5%
BW15ML-022	9.5 ± 0.53	95 ± 5%
BW15ML-032	7.8 ± 1.16 [Q]	78 ± 12% [Q]
BW15ML-034	9.1 ± 0.58	91 ± 6%
BW15ML-037	9.4 ± 0.74	94 ± 7%
BW15ML-038	9.1 ± 1.13	91 ± 11%

[Q] Statistically different from West Bearskin Lake control sediment

Mean ash free dry weights for all exposures ranged from 0.55 ± 0.09 to 0.85 ± 0.09 mg/organism (table 11). Control sediments had values of 0.55 ± 0.09 mg/organism (Sand) and 0.66 ± 0.08 mg/organism (West Bearskin) (table 11). Treatment exposures ranged from 0.65 ± 0.08 to 0.85 ± 0.09 mg/organism (table 11). Upon comparing with West Bearskin Lake, statistical differences were found with BW15ML-006 and BW15ML-022 (p<0.05). Weights for both of these sediments were statistically higher than the control sediments.

Table 11: Average *Chironomus dilutus* Ash Free Dry Weight (AFDW) in mg/organism

Sample ID	AFDW (mg/org) ± Std. Dev.
Silica Sand	0.55 ± 0.09
West Bearskin Lake	0.66 ± 0.08
BW15ML-004	0.73 ± 0.33
BW15ML-006	0.80 ± 0.07 [Q]
BW15ML-010	0.73 ± 0.06
BW15ML-018	0.69 ± 0.05
BW15ML-022	0.85 ± 0.09 [Q]
BW15ML-032	0.69 ± 0.10
BW15ML-034	0.71 ± 0.09
BW15ML-037	0.67 ± 0.06
BW15ML-038	0.65 ± 0.08

[Q] Statistically different from West Bearskin control sediment

The average water temperature during the *C. dilutus* 10-Day sediment toxicity test was 22.8˚C ± 0.3 (standard deviation) which was within the quality assurance range of 23.0 ± 1.0˚C (table 12). Dissolved oxygen did not drop below 4.5 mg/L (table 12). Mean pH values ranged from 7.65 to 7.99 and average conductivity measurements were in the range of 145.8 to 163.1 (µS/cm) (table 12). Average hardness values ranged from 46.1 to 61.5 mg/L and mean alkalinity concentrations were between 42.7 and 54.7 mg/L (table 12). Ammonia samples were collected and preserved in H_2SO_4 until analyzed. Mean ammonia values ranged from 0.09 to 0.32 mg/L (table 12). The alkalinity and hardness values did not vary by more than 50% during the test. Because the ammonia values were all low (≤0.38 mg/L), there were some values that varied by more than 50% within replicates but the actual differences were small.

Table 12: Average Values (minimum, maximum) for Water Chemistry Parameters of overlying water used in the 10 Day Sediment Toxicity Test with *Chironomus dilutus*

Sample ID	Temperature (°C) [a]	Dissolved Oxygen (mg/L) [a]	pH [b]	Conductivity (µS/cm) [c]	Hardness (mg/L $CaCO_3$) [c]	Alkalinity (mg/L $CaCO_3$) [c]	Ammonia (mg/L) [c]
Silica Sand	22.9 (22.1, 23.5)	7.7 (6.6, 9.2)	7.99 (7.83, 8.11)	152.7 (149.7, 156.3)	48.5 (48.0, 48.8)	48.5 (46.8, 50.8)	0.22 (0.06, 0.38)
West Bearskin Lake	22.9 (22.1, 23.4)	7.6 (4.5, 9.1)	7.72 (7.28, 8.04)	145.8 (142.2, 149.5)	46.1 (44.4, 50.0)	42.7 (39.2, 44.4)	0.20 (0.13, 0.27)
BW15ML-004	22.8 (22.0, 23.4)	7.8 (5.7, 9.6)	7.85 (7.71, 8.00)	160.8 (157.5, 162.7	57.3 (51.2, 65.2)	47.9 (46.8, 48.8)	0.09 (0.09, 0.11)
BW15ML-006	22.7 (22.1, 23.2)	7.5 (4.9, 9.0)	7.65 (7.25, 7.93)	155.8 (154.5, 158.9)	49.2 (47.6, 52.4)	48.1 (47.6, 48.8)	0.32 (0.27, 0.36)
BW15ML-010	22.9 (22.0, 23.4)	7.4 (5.3, 9.1)	7.72 (7.47, 7.99)	155.9 (149.9, 162.3)	54.5 (50.8, 58.8)	49.2 (48.0, 52.0)	0.10 (0.08, 0.14)
BW15ML-018	22.7 (21.9, 23.2)	7.3 (5.7, 8.9)	7.80 (7.55, 7.98)	156.2 (150.9, 161.9)	56.0 (52.4, 64.4)	50.4 (49.2, 52.8)	0.10 (0.09, 0.11)
BW15ML-022	22.8 (22.0, 23.3)	7.2 (2.9, 8.9)	7.85 (7.69, 8.05)	158.6 (156.1, 161.1)	50.3 (48.0, 52.4)	49.7 (47.6, 51.6)	0.14 (0.12, 0.16)
BW15ML-032	23.1 (22.3, 23.8)	7.9 (6.3, 9.4)	7.92 (7.68, 8.02)	162.6 (162.0, 163.3)	54.9 (50.4, 61.6)	49.7 (48.8, 51.2)	0.14 (0.09, 0.20)
BW15ML-034	22.9 (22.0, 23.4)	7.3 (4.9, 9.2)	7.77 (7.55, 8.02)	158.3 (154.7, 159.7)	52.1 (48.8, 54.4)	45.5 (43.6, 46.5)	0.11 (0.10, 0.14)
BW15ML-037	22.8 (22.2, 23.2)	7.8 (6.2, 9.0)	7.85 (7.63, 7.97)	155.7 (152.6, 158.8)	54.7 (53.2, 56.4)	52.2 (50.0, 54.4)	0.11 (0.10, 0.12)
BW15ML-038	22.8 (22.0, 23.4)	7.6 (5.7, 9.1)	7.86 (7.64, 8.06)	163.1 (162.1, 164.5)	61.5 (56.0, 67.6)	54.7 (53.6, 56.4)	0.13 (0.10, 0.16)

[a] Temperature and Dissolved Oxygen were measured twice daily, before and after water renewal
[b] pH was measured on days 0, 2, 4, 7 and 9
[c] Conductivity, Hardness, Alkalinity, and Ammonia were measured on days 0 and 9

Lumbriculus variegatus 28-day Bioaccumulation Study

Bay West selected four sediments to be used in the bioaccumulation test (BW15ML-004, BW15ML-010, BW15ML-032, BW15ML-034). As observed, no major change of mass was noted from the amount of *L. variegatus* tissue at the beginning of the test verses the end of the test (table 13).

Table 13: Average initial and recovered weight ± Standard Deviation of *Lumbriculus variegatus* tissue used in the 28 Day Bioaccumulation Test

Sample ID	Initial Wet Weight (g)	Recovered Wet Weight (g)
BW15ML-004	15.5 ± 0.1	12.4 ± 1.1
BW15ML-010	15.5 ± 0.2	13.9 ± 0.7
BW15ML-032	15.4 ± 0.2	12.7 ± 0.9
BW15ML-034	15.6 ± 0.4	14.0 ± 1.0

The average water temperature during the *L. variegatus* 28-Day bioaccumulation test was 22.4˚C ± 0.7 which was within the quality assurance range of 23.0 ± 1.0˚C (table 14). Temperatures were within the quality assurance range of 23.0 ± 3.0˚C for instantaneous measurements aside from a minimum value of 19.5 found in replicate 1 of BW15ML-032 on day 0 (table 14). Dissolved oxygen did not drop below 5.8 mg/L (table 14). Mean pH values ranged from 7.67 to 7.76 and average conductivity measurements were in the range of 152.4 to 156.5 (µS/cm) (table 14). Average hardness values during the *L. variegatus* bioaccumulation test ranged from 50.2 – 51.4 mg/L $CaCO_3$ while mean alkalinity values were between 41.7 – 45.4 mg/L $CaCO_3$ (table 14). Ammonia samples were collected and preserved in H_2SO_4 until analyzed. Average ammonia concentrations in the samples ranged from 0.13 – 0.32 mg/L (table 14). The alkalinity and hardness values did not vary by more than 50% during the test. Because the ammonia values were all low (≤0.73 mg/L), there were some values that varied by more than 50% within replicates but the actual differences were small.

Table 14: Average Values (minimum, maximum) for Water Chemistry Parameters of overlying water used in the 28 Day Sediment Bioaccumulation Test with *Lumbriculus variegatus*

Sample ID	Temperature (°C) [a]	Dissolved Oxygen (mg/L) [a]	pH [b]	Conductivity (µS/cm) [b]	Hardness (mg/L $CaCO_3$) [b]	Alkalinity (mg/L $CaCO_3$) [b]	Ammonia (mg/L) [b]
BW15ML-004	22.7 (20.0, 24.2)	7.5 (6.0, 8.5)	7.75 (7.60, 7.96)	156.5 (145.6, 167.8)	51.2 (45.3, 59.2)	44.6 (40.8, 48.0)	0.13 (0.07, 0.18)
BW15ML-010	22.2 (20.4, 23.2)	7.4 (5.8, 9.2)	7.67 (7.54, 7.89)	152.4 (145.0, 158.6)	50.6 (43.3, 64.6)	41.6 (37.6, 46.0)	0.32 (0.12, 0.73)
BW15ML-032	22.5 (19.5, 24.2)	7.6 (6.1, 8.6)	7.76 (7.60, 7.97)	154.3 (143.9, 164.0)	51.4 (45.3, 58.8)	45.4 (42.0, 48.8)	0.13 (0.08, 0.23)
BW15ML-034	22.5 (20.3, 23.6)	7.5 (6.4, 8.5)	7.73 (7.58, 7.97)	153.9 (144.7, 160.3)	50.2 (46.1, 57.4)	45.4 (41.6, 50.8)	0.16 (0.08, 0.24)

[a] Temperature and Dissolved Oxygen were measured twice daily, before and after water renewal
[b] pH, Conductivity, Hardness, Alkalinity, and Ammonia were measured on days 0, 7, 14, 21, and 27

Pace Analytical determined polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) concentrations for *L. variegatus* tissue samples after the 28-Day bioaccumulation sediment test and for a sample of Pre-test *L. variegatus* tissue. Tissue from BW15ML-032 and BW15ML-034 tended to contain the highest total PCDDs and PCDFs (table 15). Total PCDDs and PCDFs are representative of all 2,3,7,8-substituted isomers found in the sediment. The exact concentrations are only given for isomers for which Pace Analytical used carbon 13 labeled internal standards.

Table 15: Concentrations of polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) found in *Lumbriculus variegatus* tissue from a 28 Day Sediment Bioaccumulation Test. Analysis was done by Pace Analytical. All values are in ng/Kg. Concentrations are based on estimated detection limits (EDLs). TCDD Equivalence values based on ITE Factors.

Compound	MLS-LV-1 PRE	BW15ML-004	BW15ML-010	BW15ML-032	BW15ML-034
2,3,7,8-TCDF	0.47 [a]	1.80	0.92 [a]	1.80	1.9
Total TCDF	1.00 [a]	17.00	21.00	22.00	24.0
2,3,7,8-TCDD	ND	0.66 [a]	ND	0.84 [a]	0.74 [a b c]
Total TCDD	ND	1.90	ND	6.10	6.8
1,2,3,7,8-PeCDF	ND	0.27 [a]	ND	0.67 [a]	0.48 [a b c]
2,3,4,7,8-PeCDF	ND	0.85 [a]	0.65 [a]	1.80 [a]	1.4 [a]
Total PeCDF	ND	11.00	10.00 [a]	29.00	24.0
1,2,3.7.8-PeCDD	ND	0.60 [a]	ND	1.50 [a]	1.6 [a]
Total PeCDD	ND	7.00 [a]	ND	12.00 [a]	11.0 [a]
1,2,3,4,7,8-HxCDF	ND	0.58 [a]	ND	1.30 [a]	1.2 [a]
1,2,3,6,7,8-HxCDF	ND	0.46 [a]	ND	2.50 [a]	2.3 [a]
2,3,4,6,7,8-HxCDF	ND	0.34 [a b c]	ND	0.92 [a]	1.0 [a]
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND	ND
Total HxCDF	ND	14.00	4.10 [a]	47.00	40.0
1,2,3,4,7,8-HxCDD	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	ND	2.50 [a]	ND	3.70 [a]	3.8 [a]
1,2,3,7,8,9-HxCDD	ND	1.10 [a]	ND	1.50 [a]	1.7 [a]
Total HxCDD	ND	22.00	2.30 [a]	25.00	24.0
1,2,3,4,6,7,8-HpCDF	ND	6.80	2.50 [a]	27.00	20.0
1,2,3,4,7,8,9-HpCDF	ND	ND	ND	ND	ND
Total HpCDF	ND	14.00	2.50 [a]	51.00	40.0
1,2,3,4,6,7,8-HpCDD	ND	6.70	1.30 [a]	8.50	7.8
Total HpCDD	ND	24.00	5.00 [a]	23.00	24.0
OCDF	ND	1.60	1.60 [a]	4.40 [a]	4.6 [a]
OCDD	ND	62.00	11.00	52.00	70.0
Total 2,3,7,8-TCDD Equivalence	0.047	2.3	0.47	4.1	3.8

[a] Value estimated due to falling below the calibrated range of the instrument.
[b] Interference present, incorrect isotope ratios obtained.
[c] Concentration was recorded as an estimated maximum possible concentration (EMPC).

Pace Analytical performed metal analysis on the *L. variegatus* tissue obtained after the 28-Day bioaccumulation test. They were also supplied with a Pre-test sample of *L. variegatus* tissue for before and after comparison. All test samples had increases in arsenic levels as compared to the *L. variegatus* Pre-test concentration of arsenic (table 16). It was also observed that organisms exposed to sediment BW15ML-032 contained higher levels of chromium, lead and nickel when compared to the Pre-test sample and organisms exposed to the other sediments used in the bioaccumulation study (table 16).

Table 16: Average Concentrations (Standard Deviation) of Various Metals found in Tissue Samples (n=5) of *Lumbriculus variegatus* used in a 28 Day Sediment Bioaccumulation Test. Only one sample was analyzed for MLS-LV-1 PRE.

Sample ID	Arsenic (mg/Kg)	Cadmium (mg/Kg)	Chromium (mg/Kg)	Copper (mg/Kg)	Lead (mg/Kg)	Nickel (mg/Kg)	Zinc (mg/Kg)
MLS-LV-1 PRE	0.16	0.040 ^{y}	0.063 ^{y}	2.5	0.25	0.17	28.4
BW15ML-004	1.0 (0.1)	0.032 ^{y} (0.004)	0.17 (0.09)	2.3 (0.2)	0.70 (032)	0.16 (0.06)	28.3 (1.6)
BW15ML-010	1.3 (0.1)	0.016 ^{y} (0.002)	0.092 ^{y} (0.040)	1.7 (0.1)	0.22 (0.10)	0.12 (0.05)	23.7 (1.6)
BW15ML-032	1.2 (0.1)	0.038 ^{y} (0.007)	0.40 (0.22)	2.7 (0.3)	1.1 (0.7)	0.59 (0.69)	28.8 (1.6)
BW15ML-034	1.2 (0.1)	0.030 ^{y} (0.005)	0.22 (0.09)	2.4 (0.1)	0.55 (0.18)	0.20 (0.06)	28.0 (1.2)

^{y} Values estimated due to falling below the Limit of Quantification and above the Limit of Detection.

Quality Assurance and Quality Control

Table 17 summarizes the data quality indicators and performance measurement results for the tests performed with the Munger Landing sediment. Reference toxicant tests were performed within three weeks of sediment testing with all three species of organisms used. All three organisms had LC_{50} values for KCl within two standard deviations of the historical average indicating that the organisms used for the tests were healthy. Control charts are available upon request.

Nine LSRI staff members participated in the organism recovery competency test and all staff members achieved 100% organism recovery for both species. Duplicate counts were done on 100% of the replicates of *H. azteca* and *C. dilutus* recovered from the exposure beakers. There was 0% Relative Percent Difference (RPD) with the *H. azteca* counts and 0.97% RPD with the *C. dilutus* counts.

The required number of samples were analyzed in duplicate to verify precision for alkalinity, hardness and ammonia analysis and the maximum RPD for all three was 8.96% for ammonia analysis in the *C. dilutus* tests. This value is well within the Data Quality Objective of <20% RPD for duplicate analysis. Spike recovery values for ammonia were also within the data quality acceptance range.

Table 17: Quality Assurance and Control Limits for all Sediment Toxicity Tests and Results from Testing

<table>
<tr><th>Data Quality Indicator</th><th>Evaluation Process/Performance Measurement</th><th>Data Quality Objective</th><th colspan="3">Performance Measurement Result</th></tr>
<tr><td rowspan="6">Bias</td><td rowspan="3">Experiment Bias: Monthly reference toxicant tests are conducted on test organisms. Performance is measured by sensitivity of the test organisms relative to historical values.</td><td rowspan="3">LC$_{50}$ value within 2 standard deviations of the historical LC$_{50}$ average</td><td colspan="3">H. azteca: LC$_{50}$ value from reference toxicant test performed 09 December 2016 (449.5 mg/L KCl)was within 2 SD of the historical average</td></tr>
<tr><td colspan="3">C. dilutus: LC$_{50}$ value from reference toxicant test performed 30 December 2016 (6681 mg/L KCl) was within 2 SD of the historical average</td></tr>
<tr><td colspan="3">L. variegatus: LC$_{50}$ value from reference toxicant test performed 06 January 2016 (794.6 mg/L KCl) was within 2 SD of the historical average</td></tr>
<tr><td rowspan="3">Operator Bias: Experimental units (10%) are counted by two separate analysts – with performance measured by Average relative percent difference (RPD) of the number of live test organisms counted for all second analyses.</td><td rowspan="3">Organism Addition: 100% replicates checked before and after addition

Organism Recovery: At least 90% Recovery of organisms in competency training</td><td>H. azteca Test:</td><td>Organism Addition: 100% replicates checked before and after addition</td><td>Organism Recovery: All Staff Recovered 100% in Training, 100% replicates checked after recovery; RPD = 0% ± 0</td></tr>
<tr><td>C. dilutus Test:</td><td>Organism Addition: 100% replicates checked before and after addition</td><td>Organism Recovery: All Staff Recovered 100% in Training,100% of replicates checked after recovery; RPD= 0.97% ±3.5</td></tr>
<tr><td>L. variegatus Test:</td><td>Not Applicable – Mass measurements</td><td>Not Applicable – Mass measurements</td></tr>
<tr><td rowspan="2">Comparability</td><td rowspan="2">Routine procedures are conducted according to appropriate SOPs to ensure consistency between tests.</td><td rowspan="2">Not Applicable – Qualitative</td><td colspan="3">The following LSRI SOPs were used for all Solid Phase Sediment Testing:
LSRI/SOP/AT/19v.2
LSRI/SOP/AT/20v.6
LSRI/SOP/AT/21v.7</td></tr>
<tr><td colspan="3">The following LSRI SOPs were used for all water quality analyses conducted during the tests:
LSRI/SOP/GLM/01v.2 – Procedure for Measuring Alkalinity
LSRI/SOP/GLM/02v.2 – Procedure for Measuring Total Hardness
LSRI/SOP/SA/25v.3 – Ammonia (NH_3) Analysis by Specific Ion Electrode</td></tr>
</table>

Data Quality Indicator	Evaluation Process/Performance Measurement	Data Quality Objective	Performance Measurement Result	Data Quality Indicator	Evaluation Process/Performance Measurement
Precision	Samples (10%) are collected and analyzed in duplicate – with performance measured by average relative percent difference (RPD) of all duplicate analyses performed during test trials.	<20% average (± SD) RPD	***H. azteca* Test:**	**Ammonia**: 11% analyzed in duplicate	**Ammonia**: 4.75% (± 2.3%) RPD
				Hardness: 14% analyzed in duplicate	**Hardness**: 1.40% (± 1.9%) RPD
				Alkalinity: 14% analyzed in duplicate	**Alkalinity**: 3.91% (± 4.2%) RPD
			***C. dilutus* Test:**	**Ammonia**: 11% analyzed in duplicate	**Ammonia**: 8.96% (± 4.9%) RPD
				Hardness: 14% analyzed in duplicate	**Hardness**: 3.92% (± 4.0%) RPD
				Alkalinity: 14% analyzed in duplicate	**Alkalinity**: 2.17% (± 2.2%) RPD
			***L. variegatus* Test:**	**Ammonia**:12.5% analyzed in duplicate	**Ammonia**: 7.88% (± 7.0%) RPD
				Hardness: 20% analyzed in duplicate	**Hardness**: 4.42% (± 4.6%) RPD
				Alkalinity: 20% analyzed in duplicate	**Alkalinity**: 1.72% (± 1.3%) RPD
Bias	Performance is measured by average percent spike-recovery (%SPR) of all analyses performed during test trials.	75%-110% average (± SD) SPR	***H. azteca* Test:**		**Ammonia**: 100.1% (± 9.2%) SPR
			***C. dilutus* Test:**		**Ammonia:** 101.6% (± 6.9%) SPR
			***L. variegatus* Test:**		**Ammonia:** 108.1% (± 4.6%) SPR
Representativeness	Control and treatment samples are handled and analyzed in the same manner.	Not Applicable – Qualitative	All control and treatment samples were collected, handled, and analyzed in the same manner (using the appropriate SLRI SOPs).		

Conclusions

The Lake Superior Research Institute (LSRI) contracted with Bay West, LLC to evaluate the toxicity and bioaccumulation potential of sediments collected from Munger Landing.

Sediment BW15ML-032 had significantly reduced survival in the *C. dilutus* test and significantly reduced weight in the *H. azteca* test. Data indicates that the low survival and weights were not from experimental methods as the control and other treatment sediments had high survival and higher weights. During testing, qualitative observations of the *H. azteca* avoiding sediment BW15ML-032 occurred on multiple days after addition to sediment. Sediment avoidance was also observed once with *H. azteca* during testing for BW15ML-038. Sediments BW15ML-018, BW15ML-037, and BW15ML-038 also had significantly lower weights for *H. azteca* when compared to West Bearskin Lake.

In the 10-day *C. dilutus* test, sediments BW15ML-006 and BW15ML-022 produced significantly greater average weight for the *C. dilutus* when compared to West Bearskin Lake. These sediments may have contained more organic matter to supplement the diet of the *C. dilutus*.

During the 28-Day bioaccumulation test with *L. variegatus*, the oligochaetes appeared unaffected in both weight and behavior by sediment BW15ML-032 which caused low survival in the *C. dilutus* test and low weight in the *H. azteca* test. During testing, an observation was made, the oligochaetes burrowed quicker into the BW15ML-010 sediments replicates more than any of the other sediments. No major change in mass of tissue was observed in any of the replicates. The minimal loss that did occur may have been a result of not every organism being recovered or a difference in the amount of moisture present when the wet weights were determined.

In summary, sediment contaminants at location BW15ML-032 resulted in reduced survival of *C. dilutus* and reduced weight of *H. azteca*. Sediment contaminants at locations BW15ML-018, BW15ML-037, and BW15ML-038 resulted in the reduced growth of *H. azteca* during laboratory testing. Arsenic concentrations in the tested sediments likely contributed to increased levels of arsenic in *L. variegatus* and concentrations of chromium, lead, and nickel at location BW15ML-032 likely contributed to increased concentrations of these metals in *L. variegatus* after laboratory exposure.

Acknowledgments

We would like to thank all of the LSRI staff that put in copious amounts of hours picking organisms: Kimberly Beesley, Steve Gebhard, Kelsey Prihoda, Deanna Regan, Heidi Saillard, and Kara Tudor. We would also like to thank all of the students for their hard work helping take water chemistry measurements and picking organisms.

References

Lake Superior Research Institute. 1994. SOP AT/19v.2 – Conducting a 28-Day Bioaccumulation Sediment Toxicity Test with the Oligochaete, *Lumbriculus variegatus*.

Lake Superior Research Institute. 1994. SOP AT/20v.6 – Conducting a 10-Day Sediment Toxicity Test with *Hyalella azteca*.

Lake Superior Research Institute. 1994. SOP AT/21v.7 – Conducting a 10-Day Sediment Toxicity Test with *Chironomus dilutus*.

U.S. EPA. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates. EPA/600/R-99/064. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. 20460.

Appendices

Appendix 1
Biological and Chemical Analysis Data Tables

Appendix Table 1: Survival and Growth of *H. azteca* following the 10 day Sediment Toxicity Test

Sample ID	Test Sediment	Number of Survivors (10)	Average Survival	Standard Deviation	Percent Survival	Total Dry Weight (g)	Individual Dry Weight (mg)	Average Dry Weight (mg)	Standard Deviation
HA1	Silica Sand	8				0.00037	0.046		
HA2	Silica Sand	8				0.00029	0.036		
HA3	Silica Sand	7				0.00034	0.048		
HA4	Silica Sand	10				0.00043	0.043		
HA5	Silica Sand	8				0.00031	0.038		
HA6	Silica Sand	10				0.00041	0.041		
HA7	Silica Sand	7				0.00034	0.048		
HA8	Silica Sand	8				0.00049	0.061		
HA	**Silica Sand**		**8.25**	**1.16**	**82.5%**			**0.045**	**0.008**
HB1	West Bearskin Lake	9				0.00078	0.087		
HB2	West Bearskin Lake	10				0.00063	0.063		
HB3	West Bearskin Lake	7				0.00054	0.077		
HB4	West Bearskin Lake	9				0.00068	0.076		
HB5	West Bearskin Lake	10				0.00063	0.063		
HB6	West Bearskin Lake	9				0.00056	0.062		
HB7	West Bearskin Lake	10				0.00053	0.053		
HB8	West Bearskin Lake	10				0.00050	0.050		
HB	**West Bearskin Lake**		**9.25**	**1.04**	**92.5%**			**0.066**	**0.013**
HC1	BW15ML-034	10				0.00048	0.048		
HC2	BW15ML-034	11				0.00056	0.051		
HC3	BW15ML-034	10				0.00053	0.053		
HC4	BW15ML-034	10				0.00058	0.058		
HC5	BW15ML-034	8				0.00040	0.050		
HC6	BW15ML-034	6				0.00036	0.060		
HC7	BW15ML-034	8				0.00030	0.038		
HC8	BW15ML-034	8				0.00035	0.044		
HC	**BW15ML-034**		**8.88**	**1.64**	**88.8%**			**0.050**	**0.007**
HD1	BW15ML-018	10				0.00042	0.042		
HD2	BW15ML-018	10				0.00056	0.056		
HD3	BW15ML-018	9				0.00055	0.061		
HD4	BW15ML-018	10				0.00040	0.040		
HD5	BW15ML-018	8				0.00016	0.020		
HD6	BW15ML-018	8				0.00062	0.078		
HD7	BW15ML-018	9				0.00037	0.041		
HD8	BW15ML-018	9				0.00037	0.041		
HD	**BW15ML-018**		**9.13**	**0.83**	**91.3%**			**0.047**	**0.017**
HE1	BW15ML-022	9				0.00066	0.073		
HE2	BW15ML-022	10				0.00089	0.089		
HE3	BW15ML-022	10				0.00079	0.079		
HE4	BW15ML-022	10				0.00086	0.086		
HE5	BW15ML-022	10				0.00087	0.087		
HE6	BW15ML-022	10				0.00094	0.094		
HE7	BW15ML-022	11				0.00076	0.069		
HE8	BW15ML-022	10				0.00056	0.056		
HE	**BW15ML-022**		**10**	**0.53**	**100.0%**			**0.079**	**0.013**

Sample ID	Test Sediment	Number of Survivors (10)	Average Survival	Standard Deviation	Percent Survival	Total Dry Weight (g)	Individual Dry Weight (mg)	Average Dry Weight (mg)	Standard Deviation
HF1	BW15ML-037	10				0.00051	0.051		
HF2	BW15ML-037	7				0.00031	0.044		
HF3	BW15ML-037	9				0.00052	0.058		
HF4	BW15ML-037	9				0.00033	0.037		
HF5	BW15ML-037	10				0.00052	0.052		
HF6	BW15ML-037	9				0.00049	0.054		
HF7	BW15ML-037	10				0.00050	0.050		
HF8	BW15ML-037	9				0.00023	0.026		
HF	**BW15ML-037**		**9.13**	**0.99**	**91.3%**			**0.046**	**0.011**
HG1	BW15ML-032	9				0.00039	0.043		
HG2	BW15ML-032	9				0.00035	0.039		
HG3	BW15ML-032	8				0.00038	0.048		
HG4	BW15ML-032	9				0.00001	0.001		
HG5	BW15ML-032	8				0.00031	0.039		
HG6	BW15ML-032	9				0.00036	0.040		
HG7	BW15ML-032	9				0.00029	0.032		
HG8	BW15ML-032	10				0.00042	0.042		
HG	**BW15ML-032**		**8.88**	**0.64**	**88.8%**			**0.035**	**0.015**
HH1	BW15ML-038	7				0.00025	0.036		
HH2	BW15ML-038	9				0.00038	0.042		
HH3	BW15ML-038	7				0.00038	0.054		
HH4	BW15ML-038	10				0.00035	0.035		
HH5	BW15ML-038	8				0.00049	0.061		
HH6	BW15ML-038	8				0.00050	0.063		
HH7	BW15ML-038	8				0.00035	0.044		
HH8	BW15ML-038	8				0.00035	0.044		
HH	**BW15ML-038**		**8.13**	**0.99**	**81.3%**			**0.047**	**0.011**
HI1	BW15ML-006	9				0.00054	0.060		
HI2	BW15ML-006	10				0.00068	0.068		
HI3	BW15ML-006	10				0.00094	0.094		
HI4	BW15ML-006	9				0.00058	0.064		
HI5	BW15ML-006	11				0.00073	0.066		
HI6	BW15ML-006	8				0.00058	0.073		
HI7	BW15ML-006	10				0.00078	0.078		
HI8	BW15ML-006	8				0.00060	0.075		
HI	**BW15ML-006**		**9.38**	**1.06**	**93.8%**			**0.072**	**0.011**
HJ1	BW15ML-010	10				0.00068	0.068		
HJ2	BW15ML-010	9				0.00062	0.069		
HJ3	BW15ML-010	10				0.00059	0.059		
HJ4	BW15ML-010	9				0.00064	0.071		
HJ5	BW15ML-010	10				0.00065	0.065		
HJ6	BW15ML-010	10				0.00056	0.056		
HJ7	BW15ML-010	10				0.00062	0.062		
HJ8	BW15ML-010	10				0.00055	0.055		
HJ	**BW15ML-010**		**9.75**	**0.46**	**97.5%**			**0.063**	**0.006**

Sample ID	Test Sediment	Number of Survivors (10)	Average Survival	Standard Deviation	Percent Survival	Total Dry Weight (g)	Individual Dry Weight (mg)	Average Dry Weight (mg)	Standard Deviation
HK1	BW15ML-004	6				0.00028	0.047		
HK2	BW15ML-004	10				0.00051	0.051		
HK3	BW15ML-004	10				0.00075	0.075		
HK4	BW15ML-004	7				0.00044	0.063		
HK5	BW15ML-004	8				0.00051	0.064		
HK6	BW15ML-004	7				0.00028	0.040		
HK7	BW15ML-004	8				0.00038	0.048		
HK8	BW15ML-004	8				0.00045	0.056		
HK	**BW15ML-004**		**8.0**	**1.41**	**80.0%**			**0.055**	**0.011**

Appendix Table 2: Temperature (˚C) Water Chemistry Parameter for *H. azteca* during the 10-Day Sediment Toxicity Test

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
HA1	24.0	24.5							24.1										24.2	24.6					
HA2	24.0					24.4								24.5					24.3						
HA3	24.1							24.5		24.5						24.6			24.4						
HA4	24.1	24.5	24.3	24.5	24.2	24.4	24.3	24.6	24.2	24.4	24.3	24.4	24.3	24.5	24.3	24.5	24.3	24.5	24.2	24.5	24.2				
HA5	24.0				24.3								24.2						24.3						
HA6	24.0		24.3								24.3						24.4		24.3		24.6				
HA7	24.0						24.4								24.3				24.3						
HA8	24.0			24.5								24.5						24.6	24.4				24.3	24.0	24.6
HB1	23.3	24.0							23.4										23.6	24.1					
HB2	23.3					23.8								23.8					23.5						
HB3	23.4							23.7		23.9						24.0			23.6						
HB4	23.4	24.0	23.4	23.9	23.5	23.7	23.5	23.8	23.4	23.9	23.5	23.7	23.5	23.9	23.6	24.0	23.5	23.9	23.5	24.1	23.8				
HB5	23.5				23.5								23.6						23.6						
HB6	23.4		23.5								23.6						23.6		23.6		23.8				
HB7	23.5						23.5								23.6				23.6						
HB8	23.5			23.9								23.8						23.9	23.6				23.7	23.3	24.1
HC1	23.1	23.8							23.0										23.3	23.9					
HC2	23.0					23.9								24.0					23.4						
HC3	23.1				23.6			24.0		23.7						23.7			23.4						
HC4	23.1	23.8	23.6	23.9	23.6	23.9	23.5	23.9	23.0	23.8	23.6	23.7	23.4	24.0	23.5	23.7	23.4	23.6	23.4	24.0	23.8				
HC5	23.2												23.5						23.3						
HC6	23.4		23.5								23.6						23.2		23.4		23.6				
HC7	23.3						23.5								23.3				23.3						
HC8	23.4			23.9								23.7						23.6	23.3				23.5	23.0	24.0
HD1	23.5	24.1							23.5										24.0	24.5					
HD2	23.6					24.1								24.3					24.0						
HD3	23.4							24.2		24.1						24.3			23.9						
HD4	23.3	23.9	23.7	24.1	23.7	24.1	23.7	24.2	23.5	24.1	23.9	24.2	23.8	24.3	23.8	24.2	24.0	24.3	23.9	24.4	24.2				
HD5	23.8				23.9								23.8						24.1						
HD6	23.5		23.5								23.9						24.0		23.9		24.6				
HD7	23.4						23.8								23.8				24.0						
HD8	23.3			24.2								24.1						24.3	23.9				23.9	23.3	24.6

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
HE1	23.6	24.2							23.6										24.0	24.2					
HE2	23.7					24.0								24.2					24.0						
HE3	23.6							24.1		24.0						24.3			24.1						
HE4	23.7	24.2	23.7	24.1	23.8	23.8	23.7	24.2	23.4	24.0	24.0	24.1	23.9	24.2	23.9	24.3	24.0	24.3	24.0	24.3	24.3				
HE5	23.7				24.0								24.0						24.1						
HE6	23.7		23.9								24.0						24.1		24.0		24.4				
HE7	23.9						23.8								24.0				24.0						
HE8	23.8			24.2								24.2						24.4	24.0				24.0	23.4	24.4
HF1	23.1	23.5							23.0										23.3	24.0					
HF2	23.0					23.4								23.6					23.2						
HF3	23.1							23.7		23.6						23.8			23.3						
HF4	23.1	23.5	23.3	23.7	23.4	23.6	23.2	23.7	23.0	23.6	23.2	23.5	23.2	23.6	23.2	23.6	23.3	23.7	23.2	23.7	23.7				
HF5	23.1				23.4								23.3						23.2						
HF6	23.2		23.2								23.3						23.2		23.3		23.7				
HF7	23.1						23.3								23.2				23.3						
HF8	23.2			23.7								23.6						23.6	23.2				23.4	23.0	24.0
HG1	23.2	23.7							22.8										23.4	23.4					
HG2	23.2					23.6								23.7					23.3						
HG3	23.2							23.7		23.6						23.5			23.2						
HG4	23.2	23.7	23.3	23.7	23.1	23.4	23.2	23.7	22.9	23.7	23.2	23.5	23.2	23.4	23.0	23.5	23.2	23.7	23.2	23.5	23.6				
HG5	23.4				23.2								23.2						23.2						
HG6	23.3		23.3								23.3						23.2		23.4		23.7				
HG7	23.3						23.2								23.2				23.3						
HG8	23.3			23.8								23.7						23.8	23.3				23.4	22.8	23.8
HH1	23.9	24.1							23.8										24.0	24.4					
HH2	23.8					24.1								24.2					24.0						
HH3	23.7							24.2		24.2						24.3			24.1						
HH4	23.6	24.1	23.9	24.1	23.7	24.2	23.9	24.2	23.8	24.1	24.0	24.1	24.0	24.3	23.7	24.3	24.0	24.3	24.1	24.4	24.3				
HH5	23.8				23.9								23.8						24.1						
HH6	23.8		23.9								24.0						24.0		24.0		24.4				
HH7	24.0						24.0								23.8				24.1						
HH8	24.0			24.2								24.1						24.3	24.0				24.0	23.6	24.4

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
HI1	23.4	23.9							23.4										23.7	24.0					
HI2	23.4					23.9								23.9					23.8						
HI3	23.6							23.8		23.9						24.1			23.7						
HI4	23.6	24.0	23.7	24.1	23.8	23.8	23.8	23.8	23.7	23.9	23.7	23.9	23.5	23.9	23.5	24.1	23.8	24.1	23.8	24.2	23.9				
HI5	23.5				23.6								23.6						23.7						
HI6	23.4		23.7								23.8						23.8		23.8		24.1				
HI7	23.5						23.5								23.8				23.8						
HI8	23.5			24.0								24.0						24.1	23.8				23.8	23.4	24.2
HJ1	23.4	23.7							23.3										23.4	23.9					
HJ2	23.4					23.5								23.9					23.6						
HJ3	23.4							23.9		23.8						23.8			23.5						
HJ4	23.3	23.5	23.4	23.8	23.5	23.6	23.5	23.9	23.4	23.6	23.8	23.9	23.6	23.9	23.4	23.8	23.7	23.9	23.5	24.1	23.9				
HJ5	23.4				23.4								23.5						23.5						
HJ6	23.4		23.5								23.7						23.6		23.5		24.0				
HJ7	23.5						23.5								23.4				23.5						
HJ8	23.5			24.0								23.8						24.0	23.5				23.6	23.3	24.1
HK1	23.7	24.0							23.4										23.9	24.4					
HK2	23.7					24.0								24.2					23.9						
HK3	23.7							24.0		24.0						24.3			23.9						
HK4	23.8	24.2	23.9	24.1	23.4	23.9	23.8	24.0	23.3	24.0	23.8	24.0	23.7	24.2	23.7	24.3	23.5	24.2	24.0	24.4	24.2				
HK5	23.9				24.0								23.9						24.1						
HK6	23.8		23.8								23.9						24.0		24.2		24.5				
HK7	23.8						24.0								23.8				24.2						
HK8	23.9			24.4								24.2						24.4	24.1				24.0	23.3	24.5

Appendix Table 3: Dissolved Oxygen (mg/L) Water Chemistry Parameter for *H. azteca* during the 10-Day Sediment Toxicity Test

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
HA1	7.1	7.8							7.4										7.5	8.0					
HA2	7.3					7.4								7.8					7.4						
HA3	7.3							7.4		7.7						7.8			7.1						
HA4	7.2	8.3	7.7	7.4	7.6	7.6	7.6	7.1	7.5	7.9	7.1	7.9	7.7	7.8	8.2	7.7	7.6	7.4	7.7	8.2	8.2				
HA5	7.1				7.6								7.7						7.4						
HA6	7.2		7.4								7.6						7.0		7.5		7.6				
HA7	7.0						7.2								8.1				7.8						
HA8	7.1			7.5								7.9						7.7	7.2				7.6	7.0	8.3
HB1	7.0	8.0							7.3										7.2	7.9					
HB2	6.5					7.7								7.8					7.6						
HB3	6.8							7.1		7.4						7.5			7.5						
HB4	6.4	7.9	7.7	8.1	7.5	8.3	7.3	7.0	7.3	7.4	7.6	7.6	7.5	7.8	8.1	7.4	7.3	7.5	7.3	7.7	7.9				
HB5	6.8				7.5								7.7						7.3						
HB6	6.4		7.6								7.7						7.4		6.9		8.0				
HB7	6.9						6.6								8.2				7.0						
HB8	6.8			7.7								6.1						7.6	7.2				7.4	6.1	8.3
HC1	6.8	7.9							8.7										7.1	8.1					
HC2	6.6					7.4								7.4					7.0						
HC3	6.4							7.1		8.9						7.4			7.4						
HC4	6.4	8.3	7.7	7.7	7.5	7.3	7.2	6.9	8.3	8.8	7.6	8.1	8.0	7.8	8.3	7.6	7.3	8.3	7.4	8.1	7.7				
HC5	6.4				7.3								7.5						7.2						
HC6	6.4		7.7								7.6						7.1		7.9		7.7				
HC7	6.6						7.2								8.5				7.2						
HC8	6.9			7.5								7.7						7.8	7.4				7.5	6.4	8.9
HD1	6.6	7.4							8.7										8.1	7.4					
HD2	6.5					6.8								7.4					7.1						
HD3	6.3							6.5		7.4						7.3			6.5						
HD4	6.0	8.1	7.3	7.6	6.8	6.8	6.0	6.7	8.1	7.6	7.2	7.5	7.6	7.6	8.4	7.4	7.0	7.2	7.0	7.4	7.4				
HD5	6.1				7.7								7.8						6.7						
HD6	6.0		8.2								7.4						7.5		7.1		7.4				
HD7	5.8						6.6								8.0				6.8						
HD8	6.1			7.5								7.5						7.3	6.7				7.2	5.8	8.7

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
HE1	4.9	7.2							6.3										6.9	7.2					
HE2	5.6					7.2								7.3					7.2						
HE3	5.5							6.7		7.6						7.3			6.6						
HE4	5.2	7.3	6.6	8.5	7.0	7.6	6.4	6.5	6.8	7.0	7.6	7.4	7.2	7.3	7.6	7.4	7.1	7.2	6.7	7.3	7.2				
HE5	5.5				7.0								7.3						6.5						
HE6	5.9		8.1								6.9						6.8		6.7		6.8				
HE7	5.4						6.8								7.6				6.7						
HE8	5.1			7.6								7.1						7.2	7.1				6.9	4.9	8.5
HF1	6.7	8.4							8.0										7.1	7.6					
HF2	6.4					8.7								7.9					7.4						
HF3	6.9							7.5		7.9						7.6			7.3						
HF4	6.0	8.6	8.7	8.5	7.4	7.3	7.3	7.2	8.6	7.7	7.7	7.5	7.7	7.6	8.2	7.8	7.7	7.8	7.8	8.2	7.7				
HF5	6.5				7.3								7.7						7.4						
HF6	7.0		8.1								7.6						7.7		7.4		8.8				
HF7	7.1						7.2								8.0				7.2						
HF8	7.0			7.6								7.6						7.5	7.4				7.6	6.0	8.8
HG1	5.9	8.1							8.5										8.4	8.4					
HG2	6.0					7.4								8.0					7.2						
HG3	6.5							7.3		7.6						7.2			7.2						
HG4	6.0	7.8	7.8	7.2	7.2	7.7	7.3	6.9	8.3	7.4	7.7	7.6	7.7	8.4	8.6	7.3	7.1	7.1	6.5	8.2	7.6				
HG5	6.2				7.0								7.2						6.9						
HG6	6.6		8.7								7.6						7.3		7.6		7.4				
HG7	6.7						7.9								7.9				7.1						
HG8	6.4			7.5								7.4						7.4	6.5				7.4	5.9	8.7
HH1	5.5	8.2							8.1										7.6	7.9					
HH2	4.3					7.1								8.1					7.4						
HH3	6.6							7.4		7.9						7.1			6.9						
HH4	6.5	8.2	7.9	8.8	7.7	7.2	6.9	7.0	9.0	8.3	7.2	7.6	7.6	7.8	8.5	7.4	6.9	7.1	6.9	7.8	7.0				
HH5	5.9				7.6								7.4						7.1						
HH6	6.3		7.3								7.4						7.1		6.5		7.0				
HH7	6.3						6.8								8.0				6.6						
HH8	6.6			8.2								7.4						7.5	6.8				7.3	4.3	9.0

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
HI1	5.1	7.7							7.6										7.1	7.7					
HI2	6.4					7.5								7.5					7.3						
HI3	6.7							7.6		7.7						7.4			7.1						
HI4	5.9	6.8	7.6	7.2	7.3	7.4	7.1	7.3	8.6	7.7	7.0	7.6	7.6	7.4	7.2	7.4	7.3	7.4	7.0	7.5	7.4				
HI5	5.1				7.0								7.6						7.3						
HI6	4.4		7.6								7.6						7.5		7.2		8.0				
HI7	6.0						6.0								7.6				7.5						
HI8	4.5			7.7								7.3						7.6	8.1				7.1	4.4	8.6
HJ1	5.8	7.6							7.9										7.0	7.5					
HJ2	6.3					8.5								7.5					6.9						
HJ3	5.8							6.6		7.7						7.2			7.4						
HJ4	5.9	8.4	8.4	8.7	7.3	8.0	6.7	6.8	7.8	8.0	7.4	7.7	7.6	8.0	7.5	7.5	7.1	8.0	7.9	7.6	8.0				
HJ5	6.5				7.9								7.6						7.4						
HJ6	6.2		9.0								7.3						6.9		6.6		7.2				
HJ7	7.1						6.8								7.3				6.4						
HJ8	6.4			8.3								7.3						7.5	7.3				7.4	5.8	9.0
HK1	6.0	8.2							7.4										7.1	7.2					
HK2	6.1					8.1								7.3					7.5						
HK3	5.5							6.8		6.8						6.8			6.5						
HK4	6.1	7.7	7.2	7.7	7.1	6.5	6.6	6.4	7.9	6.7	6.2	7.1	8.0	7.4	7.9	7.0	7.0	7.8	7.4	7.3	6.9				
HK5	6.8				8.2								7.8						7.1						
HK6	6.4		8.9								7.3						7.2		7.1		7.6				
HK7	6.5						7.6								6.4				7.3						
HK8	5.9			7.2								7.6						7.5	7.2				7.1	5.5	8.9

Appendix Table 4: pH Water Chemistry Parameter for *H. azteca* during the 10-Day Sediment Toxicity Test

Day	0	2	4	7	9			
am/pm	am	am	am	am	am	Average	Min	Max
HA1	8.01		8.09		8.07			
HA4	8.07	8.03	8.14	8.07	8.11			
HA5	8.09	8.15			8.11			
HA7				8.1				
HA8	8.08				8.11	8.09	8.01	8.15
HB1	7.97		8.02		8.04			
HB4	7.71	8.02	8.02	7.97	8.01			
HB5	7.95	8			8.06			
HB7				7.98				
HB8	7.88				8.04	7.97	7.71	8.06
HC1	7.64		8.03		8			
HC4	7.91	8.01	8.07	8.07	8.03			
HC5	7.66	7.96			8.01			
HC7				8.04				
HC8	7.97				8	7.93	7.64	8.07
HD1	7.58		7.99		8.06			
HD4	7.67	7.74	7.94	8.03	8.07			
HD5	7.67	7.96			8.09			
HD7				8.02				
HD8	7.65				8.12	7.86	7.58	8.12
HE1	7.38		7.7		7.93			
HE4	7.51	7.76	7.74	7.94	8			
HE5	7.43	7.94			8.03			
HE7				7.98				
HE8	7.33				7.92	7.69	7.33	8.03
HF1	7.92		8.03		8.06			
HF4	7.89	8.08	8.09	8.02	8.06			
HF5	7.77	8.06			8.05			
HF7				8.02				
HF8	7.94				8.05	7.99	7.77	8.09

Day	0	2	4	7	9			
am/pm	am	am	am	am	am	Average	Min	Max
HG1	7.72		8.06		7.96			
HG4	7.69	7.81	8.05	8.02	7.83			
HG5	7.74	7.83			7.91			
HG7				7.97				
HG8	7.79				7.87	7.86	7.69	8.06
HH1	7.83		8.12		8.17			
HH4	7.88	7.93	8.13	8.13	8.2			
HH5	7.9	8.05			8.16			
HH7				8.12				
HH8	7.97				8.21	8.04	7.83	8.21
HI1	7.16		7.95		7.92			
HI4	7.3	7.93	8.02	7.78	7.89			
HI5	7.12	7.74			7.92			
HI7				8.03				
HI8	7.16				7.91	7.55	7.12	8.03
HJ1	7.46		7.92		8.17			
HJ4	7.51	7.87	7.97	8.08	8.16			
HJ5	7.58	7.88			8.16			
HJ7				8.1				
HJ8	7.52				8.18	7.814	7.46	8.18
HK1	7.66		7.76		7.98			
HK4	7.71	7.6	7.74	7.88	7.99			
HK5	7.97	8.04			8.07			
HK7				7.67				
HK8	7.8				8.05	7.823	7.6	8.07

Appendix Table 5: Conductivity (µS/cm) Water Chemistry Parameter for *H. azteca* during the 10-Day Sediment Toxicity Test

Day	0	9			
am/pm	am	am	Average	Min	Max
HA1	142.3	144.7			
HA8	142.2	145	143.6	142.2	145.0
HB1	136.8	145.3			
HB8	136.9	144.3	140.8	136.8	145.3
HC1	146	148.7			
HC8	142.5	148.2	146.4	142.5	148.7
HD1	143.6	147.9			
HD8	142.4	149.2	145.8	142.4	149.2
HE1	144.8	149.3			
HE8	143.6	150.2	147.0	143.6	150.2
HF1	142.3	147.6			
HF8	143.2	148.2	145.3	142.3	148.2
HG1	144.6	148			
HG8	143.6	149.1	146.3	143.6	149.1
HH1	145.7	150.6			
HH8	146.7	151.9	148.7	145.7	151.9
HI1	144.6	146			
HI8	143	147.3	145.2	143.0	147.3
HJ1	142.2	152.8			
HJ8	142.6	152.3	147.5	142.2	152.8
HK1	143.5	149.1			
HK8	145.6	148.8	146.8	143.5	149.1

Appendix Table 6: Ammonia (mg/L) Water Chemistry Parameter for *H. azteca* during the 10-Day Sediment Toxicity Test

Day	0	9			
am/pm	am	am	Average	Min	Max
HA1	0.063	0.17			
HA8	0.063	0.16	0.11	0.06	0.17
HB1	0.08	0.10			
HB8	0.08	0.10	0.09	0.08	0.10
HC1	0.14	0.07			
HC8	0.07	0.07	0.09	0.07	0.14
HD1	0.07	0.063			
HD8	0.11	0.063	0.08	0.06	0.11
HE1	0.17	0.07			
HE8	0.185	0.09	0.13	0.07	0.19
HF1	0.11	0.07			
HF8	0.08	0.06	0.08	0.06	0.11
HG1	0.11	0.063			
HG8	0.13	0.063	0.09	0.06	0.13
HH1	0.095	0.08			
HH8	0.09	0.07	0.08	0.07	0.10
HI1	0.36	0.12			
HI8	0.25	0.10	0.21	0.10	0.36
HJ1	0.11	0.07			
HJ8	0.08	0.063	0.08	0.06	0.11
HK1	0.1	0.063			
HK8	0.11	0.063	0.08	0.06	0.11

Appendix Table 7: Hardness (mg/L $CaCO_3$) Water Chemistry Parameter for *H. azteca* during the 10-Day Sediment Toxicity Test

Day	0	9			
am/pm	am	am	Average	Min	Max
HA3	45.2	48.4			
HA6	45.6	48	46.8	45.2	48.4
HB3	44.8	45.6			
HB6	41.6	45.2	44.3	41.6	45.6
HC3	51.2	48			
HC6	46.4	49.6	48.8	46.4	51.2
HD3	50.8	49.2			
HD6	48.8	48	49.2	48.0	50.8
HE3	45.6	50.8			
HE6	44.4	49.6	47.6	44.4	50.8
HF3	46.8	48			
HF6	48.4	47.6	47.7	46.8	48.4
HG3	45.2	45.6			
HG6	47.2	47.2	46.3	45.2	47.2
HH3	52.4	47.2			
HH6	51.2	49.6	50.1	47.2	52.4
HI3	47.2	46			
HI6	48.4	46.4	47.0	46.0	48.4
HJ3	52.4	52.4			
HJ6	50	50.4	51.3	50	52.4
HK3	52	47.6			
HK6	54.0	45.6	49.8	45.6	54

Appendix Table 8: Alkalinity (mg/L $CaCO_3$) Water Chemistry Parameter for *H. azteca* during the 10-Day Sediment Toxicity Test

Day	0	9			
am/pm	am	am	Average	Min	Max
HA2	46	44.8			
HA5	46.4	37.6	43.7	37.6	46.4
HB2	43.2	49.2			
HB5	44.8	42	44.8	42.0	49.2
HC2	48	48			
HC5	44	47.6	46.9	44.0	48.0
HD2	46	47.6			
HD5	45.6	49.2	47.1	45.6	49.2
HE2	46	50.4			
HE5	45.6	49.6	47.9	45.6	50.4
HF2	45.2	47.2			
HF5	46.4	47.2	46.5	45.2	47.2
HG2	50	48			
HG5	50.4	49.6	49.5	48.0	50.4
HH2	50.4	49.2			
HH5	51.2	48.4	49.8	48.4	51.2
HI2	48	47.6			
HI5	48.4	48	48.0	47.6	48.4
HJ2	48.4	51.2			
HJ5	48	48	48.9	48	51.2
HK2	47.2	45.2			
HK5	46.8	47.6	46.7	45.2	47.6

Appendix Table 9: Survival and Growth of *C. dilutus* following the 10 day Sediment Toxicity Test

Sample ID	Test Sediment	Number of Survivors (10)	Average Survival	Standard Deviation	Percent Survival	Total Dry Weight (mg)	Individual Dry Weight (mg)	Average Dry Weight (mg)	Standard Deviation
CA1	Silica Sand	10				5.55	0.555		
CA2	Silica Sand	10				5.63	0.563		
CA3	Silica Sand	10				5.43	0.543		
CA4	Silica Sand	8				4.84	0.605		
CA5	Silica Sand	10				6.31	0.631		
CA6	Silica Sand	7				4.68	0.669		
CA7	Silica Sand	10				4.1	0.410		
CA8	Silica Sand	10				4.23	0.423		
CA	**Silica Sand**		**9.38**	**1.19**	**93.8%**			**0.550**	**0.092**
CB1	West Bearskin Lake	10				5.51	0.551		
CB2	West Bearskin Lake	10				5.57	0.557		
CB3	West Bearskin Lake	10				6.53	0.653		
CB4	West Bearskin Lake	10				6.63	0.663		
CB5	West Bearskin Lake	10				7.74	0.774		
CB6	West Bearskin Lake	10				6.75	0.675		
CB7	West Bearskin Lake	10				6.57	0.657		
CB8	West Bearskin Lake	10				7.49	0.749		
CB	**West Bearskin Lake**		**10**	**0.00**	**100.0%**			**0.660**	**0.079**
CC1	BW15ML-034	10				6.61	0.661		
CC2	BW15ML-034	8				5.15	0.644		
CC3	BW15ML-034	9				7.72	0.858		
CC4	BW15ML-034	10				5.85	0.585		
CC5	BW15ML-034	11				7.39	0.672		
CC6	BW15ML-034	8				6.03	0.754		
CC7	BW15ML-034	8				6.21	0.776		
CC8	BW15ML-034	9				6.55	0.728		
CC	**BW15ML-034**		**9.13**	**0.58**	**91.3%**			**0.710**	**0.086**
CD1	BW15ML-018	10				6.77	0.677		
CD2	BW15ML-018	10				6.99	0.699		
CD3	BW15ML-018	10				6.83	0.683		
CD4	BW15ML-018	10				6.88	0.688		
CD5	BW15ML-018	10				6.14	0.614		
CD6	BW15ML-018	9				7.24	0.804		
CD7	BW15ML-018	9				6.45	0.717		
CD8	BW15ML-018	10				6.65	0.665		
CD	**BW15ML-018**		**9.75**	**0.46**	**97.5%**			**0.693**	**0.054**
CE1	BW15ML-022	10				7.67	0.767		
CE2	BW15ML-022	9				7.25	0.806		
CE3	BW15ML-022	10				8.26	0.826		
CE4	BW15ML-022	9				8.06	0.896		
CE5	BW15ML-022	9				7.92	0.880		
CE6	BW15ML-022	10				10.3	1.030		
CE7	BW15ML-022	10				7.57	0.757		
CE8	BW15ML-022	9				7.83	0.870		
CE	**BW15ML-022**		**9.50**	**0.53**	**95.0%**			**0.854**	**0.088**

Sample ID	Test Sediment	Number of Survivors (10)	Average Survival	Standard Deviation	Percent Survival	Total Dry Weight (mg)	Individual Dry Weight (mg)	Average Dry Weight (mg)	Standard Deviation
CF1	BW15ML-037	10				6.14	0.614		
CF2	BW15ML-037	10				6.37	0.637		
CF3	BW15ML-037	8				6.1	0.762		
CF4	BW15ML-037	9				6.69	0.743		
CF5	BW15ML-037	9				6.12	0.680		
CF6	BW15ML-037	10				6.37	0.637		
CF7	BW15ML-037	9				5.95	0.661		
CF8	BW15ML-037	10				6.3	0.630		
CF	**BW15ML-037**		**9.38**	**0.744**	**93.8%**			**0.671**	**0.055**
CG1	BW15ML-032	9				5.89	0.654		
CG2	BW15ML-032	8				5.74	0.718		
CG3	BW15ML-032	7				5.73	0.819		
CG4	BW15ML-032	7				5.01	0.716		
CG5	BW15ML-032	9				5.73	0.637		
CG6	BW15ML-032	7				5.76	0.823		
CG7	BW15ML-032	9				5.04	0.560		
CG8	BW15ML-032	6				3.41	0.568		
CG	**BW15ML-032**		**7.75**	**1.17**	**77.5%**			**0.687**	**0.101**
CH1	BW15ML-038	7				5.42	0.774		
CH2	BW15ML-038	9				6.06	0.673		
CH3	BW15ML-038	10				5.67	0.567		
CH4	BW15ML-038	9				6.06	0.673		
CH5	BW15ML-038	8				5.93	0.741		
CH6	BW15ML-038	10				6.18	0.618		
CH7	BW15ML-038	10				5.98	0.598		
CH8	BW15ML-038	10				5.66	0.566		
CH	**BW15ML-038**		**9.13**	**1.13**	**91.3%**			**0.651**	**0.078**
CI1	BW15ML-006	8				7.01	0.876		
CI2	BW15ML-006	10				6.83	0.683		
CI3	BW15ML-006	10				7.79	0.779		
CI4	BW15ML-006	10				7.99	0.799		
CI5	BW15ML-006	10				7.44	0.744		
CI6	BW15ML-006	10				8.49	0.849		
CI7	BW15ML-006	9				7.87	0.874		
CI8	BW15ML-006	9				7.08	0.787		
CI	**BW15ML-006**		**9.50**	**0.76**	**95.0%**			**0.799**	**0.067**
CJ1	BW15ML-010	10				7.35	0.735		
CJ2	BW15ML-010	10				7.36	0.736		
CJ3	BW15ML-010	10				7.95	0.795		
CJ4	BW15ML-010	10				7	0.700		
CJ5	BW15ML-010	10				7.1	0.710		
CJ6	BW15ML-010	10				7.85	0.785		
CJ7	BW15ML-010	10				7.75	0.775		
CJ8	BW15ML-010	10				6.14	0.614		
CJ	**BW15ML-010**		**10**	**0.00**	**100.0%**			**0.731**	**0.059**

Sample ID	Test Sediment	Number of Survivors (10)	Average Survival	Standard Deviation	Percent Survival	Total Dry Weight (g)	Individual Dry Weight (mg)	Average Dry Weight (mg)	Standard Deviation
CK1	BW15ML-004	9				5.58	0.620		
CK2	BW15ML-004	10				6.5	0.650		
CK3	BW15ML-004	9				5.57	0.619		
CK4	BW15ML-004	10				6.19	0.619		
CK5	BW15ML-004	10				5.16	0.516		
CK6	BW15ML-004	1				1.54	1.540		
CK7	BW15ML-004	10				6.47	0.647		
CK8	BW15ML-004	10				6.06	0.606		
CK	**BW15ML-004**		**8.63**	**3.11**	**86.3%**			**0.727**	**0.331**

Appendix Table 10: Temperature (˚C) Water Chemistry Parameter for *C. dilutus* during the 10-Day Sediment Toxicity Test

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
CA1	22.1	22.8							22.8										22.8	23.0					
CA2	22.4					22.9								23.1					22.9						
CA3	22.3							22.9		23.0						23.1			22.9						
CA4	22.3	22.9	23.0	23.1	23.0	23.0	23.2	23.0	22.9	23.1	23.2	23.3	23.2	23.1	22.8	23.1	23.0	22.8	22.9	23.0	23.1				
CA5	22.3				23.0								23.3						22.9						
CA6	22.3		22.8								23.2						23.1		23.0		23.1				
CA7	22.5						23.5								23.1				23.0						
CA8	22.4			23.0								23.3						22.8	23.0				22.9	22.1	23.5
CB1	22.2	22.9							22.8										23.1	23.0					
CB2	22.2					23.3								23.2					23.2						
CB3	22.2							23.3		22.6						23.2			23.2						
CB4	22.1	22.8	22.8	23.0	22.6	23.1	23.4	23.4	22.6	22.7	23.3	23.3	23.3	23.1	22.9	23.1	22.9	23.0	23.1	23.1	23.1				
CB5	22.1				22.7								23.1						23.0						
CB6	22.2		22.8								23.1						22.9		23.0		23.0				
CB7	22.3						23.2								23.0				23.1						
CB8	22.3			22.9								23.3						22.8	23.1				22.9	22.1	23.4
CC1	22.0	22.8							22.6										23.1	23.0					
CC2	22.1					23.1								23.1					23.2						
CC3	22.1							23.3		22.5						23.1			23.1						
CC4	22.1	22.8	22.8	22.8	22.8	23.1	23.1	23.4	22.7	22.8	23.1	23.2	23.0	23.0	22.7	23.2	22.9	23.2	23.1	23.0	23.0				
CC5	22.1				22.8								23.1						23.1						
CC6	22.0		22.9								23.2						22.7		23.1		23.1				
CC7	22.3						23.3								23.0				23.2						
CC8	22.2			23.2								23.2						23.2	23.1				22.9	22.0	23.4
CD1	22.1	22.8							22.5										22.9	22.7					
CD2	22.1					22.9								22.9					22.8						
CD3	21.9							23.2		22.9						22.8			22.9						
CD4	21.9	22.8	22.7	22.7	22.6	22.8	23.0	23.1	22.5	22.8	22.9	23.0	22.9	23.0	22.7	22.8	22.7	22.8	22.8	22.8	22.8				
CD5	22.0				22.7								23.0						23.0						
CD6	22.0		22.6								22.8						22.7		22.9		22.8				
CD7	22.0						22.9								23.0				23.0						
CD8	22.1			22.9								23.1						23.0	22.9				22.7	21.9	23.2

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
CE1	22.0	22.8							22.4										22.9	22.7					
CE2	22.1					23.0								23.1					22.9						
CE3	22.1							23.3		22.7						22.8			22.9						
CE4	22.1	23.0	23.1	23.1	22.7	23.0	23.0	23.3	22.4	22.8	22.9	23.1	22.9	23.0	22.9	22.9	22.6	22.7	22.8	22.7	22.7				
CE5	22.2				22.8								23.0						22.9						
CE6	22.2		22.9								22.9						22.7		22.8		22.8				
CE7	22.2						23.1								22.9				22.9						
CE8	22.3			23.2								23.1						22.8	23.0				22.8	22.0	23.3
CF1	22.2	22.9							22.5										22.8	22.7					
CF2	22.2					23.1								23.0					22.9						
CF3	22.2							23.2		22.7						23.1			22.8						
CF4	22.2	22.8	22.7	23.1	22.6	23.1	23.1	23.2	22.3	22.7	22.9	22.9	23.0	23.0	23.0	23.2	22.8	22.7	22.8	22.6	22.8				
CF5	22.2				22.8								23.1						22.9						
CF6	22.2		22.9								22.9						22.8		22.8		22.8				
F7	22.3						23.0								23.1				22.8						
CF8	22.3			23.2								23.0						23.0	22.9				22.8	22.2	23.2
CG1	22.6	23.4							22.7										23.0	23.2					
CG2	22.4					23.3								23.0					23.0						
CG3	22.4							23.7		22.9						23.4			23.0						
CG4	22.4	23.4	23.2	23.8	23.1	23.2	23.1	23.6	22.4	23.1	23.2	23.3	23.1	23.0	23.3	23.5	23.1	23.3	23.1	23.1	23.2				
CG5	22.3				23.0								23.2						23.1						
CG6	22.4		23.2								23.2						23.0		23.2		23.2				
CG7	22.4						23.2								23.3				23.2						
CG8	22.6			23.7								23.3						23.3	23.3				23.1	22.3	23.8
CH1	22.0	23.1							22.6										22.9	22.6					
CH2	22.1					23.0								22.9					23.0						
CH3	22.0							23.4		22.8						22.9			22.9						
CH4	22.0	23.0	22.9	23.0	22.9	22.8	22.9	23.3	22.6	22.9	22.8	23.0	22.9	22.8	23.0	22.9	22.5	23.0	22.9	22.9	22.9				
CH5	22.0				22.8								23.0						22.9						
CH6	22.0		22.9								22.8						22.8		22.9		22.9				
CH7	22.0						22.8								22.9				23.0						
CH8	22.1			23.4								23.1						23.0	23.0				22.8	22.0	23.4

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
CI1	22.1	22.8							22.2										22.6	22.5					
CI2	22.1					22.8								22.7					22.9						
CI3	22.1							23.1		22.6						23.1			22.7						
CI4	22.1	22.7	22.7	23.0	22.8	22.9	22.8	23.0	22.4	22.7	22.8	22.9	22.8	22.7	22.8	23.0	22.6	22.8	22.7	22.6	22.7				
CI5	22.2				22.8								22.8						22.7						
CI6	22.2		22.7								22.6						22.5		22.6		22.8				
CI7	22.1						22.7								22.9				22.7						
CI8	22.2			23.2								22.9						22.7	22.8				22.7	22.1	23.2
CJ1	22.0	23.1							23.0										22.9	22.7					
CJ2	22.0					22.9								23.0					22.8						
CJ3	22.0							23.4		22.9						23.2			22.9						
CJ4	22.3	23.2	22.9	23.0	22.9	23.0	22.8	23.4	22.9	23.0	23.0	23.1	23.0	23.0	23.0	23.3	22.9	23.1	22.9	22.4	22.8				
CJ5	22.1				23.0								23.0						22.9						
CJ6	22.2		22.9								23.0						23.0		22.9		22.8				
CJ7	22.2						22.9								23.1				23.0						
CJ8	22.3			23.3								23.1						23.0	23.2				22.9	22.0	23.4
CK1	22.0	23.1							22.8										23.0	22.6					
CK2	22.0					22.8								22.8					23.0						
CK3	22.1							23.0		22.7						22.9			23.1						
CK4	22.0	23.1	22.8	23.2	22.8	22.8	22.7	23.0	22.7	22.8	22.8	22.9	22.8	22.8	22.9	23.1	22.7	22.8	23.1	22.5	22.8				
CK5	22.1				22.9								22.9						23.2						
CK6	22.0		23.0								22.8						22.8		23.1		22.8				
CK7	22.2						22.7								22.9				23.1						
CK8	22.1			23.4								22.9						22.8	23.1				22.8	22.0	23.4

Appendix Table 11: Dissolved Oxygen (mg/L) Water Chemistry Parameter for *C. dilutus* during the 10-Day Sediment Toxicity Test

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
CA1	6.7	7.8							7.4										7.1	8.2					
CA2	7.2					9.2								8.2					7.4						
CA3	7.5							6.6		8.1						7.8			7.6						
CA4	7.3	8.9	7.5	7.6	7.3	8.0	7.0	7.5	8.1	7.6	7.6	7.6	8.1	8.6	7.8	7.7	8.3	7.9	7.5	7.9	8.1				
CA5	7.1				6.8								7.9						7.0						
CA6	7.2		7.3								7.7						8.4		7.5		7.5				
CA7	7.0						7.5								7.8				7.3						
CA8	6.8			8.4								7.8						8.4	7.4				7.7	6.6	9.2
CB1	6.6	8.5							9.0										7.5	8.1					
CB2	6.9					8.2								8.6					7.8						
CB3	6.7							7.6		8.9						7.9			7.9						
CB4	6.0	7.9	7.5	8.9	5.5	7.8	7.9	7.3	9.1	9.0	7.3	7.8	7.5	8.7	8.9	8.3	8.9	9.0	7.7	8.0	7.3				
CB5	5.8				4.5								7.1						7.6						
CB6	6.1		7.0								6.1						8.9		7.5		7.6				
CB7	6.1						5.4								8.4				7.7						
CB8	6.4			8.1								7.2						8.7	7.4				7.6	4.5	9.1
CC1	6.2	7.6							9.1										7.9	7.9					
CC2	5.3					7.8								9.2					7.8						
CC3	6.3							7.7		8.8						7.6			7.5						
CC4	6.2	7.6	6.2	8.8	8.0	9.1	7.1	7.3	8.4	7.8	6.4	7.7	8.3	9.1	8.4	7.5	8.6	8.8	7.1	8.2	8.5				
CC5	5.9				6.5								5.3						6.5						
CC6	6.5		5.6								4.9						7.2		6.0		5.7				
CC7	6.1						6.6								6.7				6.9						
CC8	7.0			7.4								8.0						8.0	6.8				7.3	4.9	9.2
CD1	7.1	7.8							7.7										6.5	7.7					
CD2	7.2					8.9								8.6					7.2						
CD3	6.7							7.8		6.9						7.6			7.0						
CD4	7.3	7.4	6.6	8.7	7.1	8.7	6.7	7.4	6.7	6.6	6.4	7.9	6.4	8.2	6.6	7.3	6.6	7.4	7.0	7.7	7.0				
CD5	7.9				7.0								8.6						7.4						
CD6	6.2		8.2								5.7						7.7		6.8		6.9				
CD7	7.2						5.9								7.5				7.1						
CD8	7.2			7.0								7.8						8.1	7.4				7.3	5.7	8.9

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
CE1	6.9	8.0							8.0										7.1	7.7	7.6				
CE2	7.2					8.1								8.4					6.8						
CE3	6.1							7.5		6.5						8.1			5.7						
CE4	6.9	8.1	7.6	8.0	7.7	8.8	7.0	7.3	8.1	7.1	5.2	7.8	8.0	8.5	7.5	7.6	8.9	8.6	6.8	7.9	7.1				
CE5	7.0				8.0								7.1						6.5						
CE6	6.9		7.2								4.4						4.5		5.9		2.9				
CE7	7.3						7.1								6.6				5.0		7.0				
CE8	7.4			8.2								8.1						8.0	6.6				7.2	2.9	8.9
CF1	7.5	9.0							8.2										7.9	8.6					
CF2	7.5					8.4								8.7					7.9						
CF3	6.8							7.8		8.8						8.7			7.9						
CF4	7.2	8.2	7.6	7.9	7.8	8.7	6.8	7.6	8.5	8.1	7.6	8.5	8.3	8.7	7.5	8.1	7.5	8.1	6.2	8.3	6.2				
CF5	7.3				7.8								8.1						7.7						
CF6	7.2		6.6								7.0						7.9		7.0		8.2				
F7	7.1						6.2								7.7				7.6						
CF8	7.3			7.7								8.2						7.9	7.6				7.8	6.2	9.0
CG1	6.9	8.9							8.8										7.5	8.1					
CG2	7.2					7.3								8.2					7.3						
CG3	7.1							7.6		8.5						8.2			7.4						
CG4	7.4	8.1	8.2	8.9	8.2	8.6	6.9	7.8	8.0	9.2	7.7	8.5	8.0	8.6	9.0	8.5	9.4	7.9	7.8	7.9	8.8				
CG5	6.3				8.1								8.1						7.7						
CG6	6.3		7.5								7.7						7.9		7.4		7.6				
CG7	7.2						7.0								7.3				7.5						
CG8	7.2			9.3								8.5						7.8	7.7				7.9	6.3	9.4
CH1	6.4	8.6							8.9										7.8	8.3					
CH2	5.8					8.2								8.1					8.0						
CH3	6.6							7.8		8.5						7.2			7.3						
CH4	6.4	8.3	8.2	8.2	7.9	9.1	7.4	8.3	8.7	7.3	7.4	7.9	7.7	8.7	6.6	7.3	8.0	8.0	7.1	7.4	5.7				
CH5	6.9				8.2								7.3						7.4						
CH6	6.6		8.6								7.7						8.8		7.7		7.5				
CH7	6.3						6.4								5.9				7.5						
CH8	6.4			8.1								7.7						8.4	7.2				7.6	5.7	9.1

Day	0		1		2		3		4		5		6		7		8		9		10				
am/pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am		Average	Min	Max
CI1	6.4	8.8							7.9										6.8	8.8					
CI2	6.4					8.1								7.8					7.6						
CI3	7.5							6.6		8.1						8.2			7.3						
CI4	7.7	8.0	5.7	8.6	7.7	9.0	6.3	6.8	7.4	8.1	5.5	7.9	7.7	8.0	8.1	8.1	8.6	8.2	7.4	8.1	8.1				
CI5	7.5				8.9								7.4						7.3						
CI6	6.6		8.6								5.8						8.4		7.2		8.2				
CI7	6.4						5.4								7.2				4.9						
CI8	6.5			8.4								7.9						7.4	7.4				7.5	4.9	9.0
CJ1	7.2	8.8							8.2										6.6	8.3					
CJ2	6.7					7.4								8.0					5.3						
CJ3	7.1							7.2		8.1						8.1			7.1						
CJ4	7.6	8.2	8.1	8.6	6.0	8.0	7.4	7.3	8.2	8.3	8.1	7.9	7.3	8.0	7.9	7.7	7.6	7.9	7.1	8.2	7.5				
CJ5	6.4				6.2								6.7						6.0						
CJ6	7.3		7.7								7.6						7.6		6.3		6.2				
CJ7	7.4						5.8								6.2				5.8						
CJ8	7.3			9.1								7.5						7.9	7.1				7.4	5.3	9.1
CK1	7.7	9.0							8.1										8.3	9.1					
CK2	6.7					8.7								8.2					8.3						
CK3	7.4							7.1		9.0						8.4			7.6						
CK4	7.4	8.0	7.9	9.1	8.9	8.7	7.0	7.5	8.1	7.6	5.7	8.1	7.5	7.8	7.5	6.7	7.8	8.5	7.5	8.9	7.8				
CK5	7.6				8.5								7.6						7.7						
CK6	6.5		8.1								6.7						9.2		7.7		8.0				
CK7	6.2						6.6								7.8				7.6						
CK8	7.2			9.6								8.2						7.6	7.1				7.8	5.7	9.6

Appendix Table 12: pH Water Chemistry Parameter for *C. dilutus* during the 10-Day Sediment Toxicity Test

Day	0	2	4	7	9			
am/pm	am	am	am	am	am	Average	Min	Max
CA1	8.07		7.83		8.01			
CA4	8.1	7.88	8.01	7.98	8			
CA5	8.1	7.89			7.89			
CA7				8.07				
CA8	8.11				8.04	7.99	7.83	8.11
CB1	7.95		8.02		7.92			
CB4	7.75	7.42	8.04	8.01	7.88			
CB5	7.48	7.28			7.83			
CB7				7.98				
CB8	7.66				7.81	7.72	7.28	8.04
CC1	7.6		8.02		7.93			
CC4	7.58	7.78	7.96	7.93	7.88			
CC5	7.55	7.62			7.73			
CC7				7.76				
CC8	7.92				7.88	7.77	7.55	8.02
CD1	7.93		7.7		7.58			
CD4	7.92	7.88	7.55	7.6	7.81			
CD5	7.92	7.83			7.97			
CD7				7.98				
CD8	7.93				7.93	7.80	7.55	7.98
CE1	7.88		7.71		7.87			
CE4	7.96	7.93	7.7	7.92	7.85			
CE5	7.94	8.05			7.78			
CE7				7.69				
CE8	7.99				7.87	7.85	7.69	8.05
CF1	7.97		7.78		7.94			
CF4	7.9	7.66	7.77	7.89	7.63			
CF5	7.89	7.93			7.93			
CF7				7.97				
CF8	7.97				7.93	7.85	7.63	7.97

Day	0	2	4	7	9			
am/pm	am	am	am	am	am	Average	Min	Max
CG1	7.98		8.01		7.97			
CG4	7.91	7.9	7.93	7.99	7.95			
CG5	7.68	7.82			7.92			
CG7				7.97				
CG8	7.98				8.02	7.92	7.68	8.02
CH1	7.75		8.04		7.97			
CH4	7.64	8.04	8.06	7.83	7.84			
CH5	7.83	7.99			7.93			
CH7				7.64				
CH8	7.8				7.99	7.86	7.64	8.06
CI1	7.48		7.63		7.65			
CI4	7.75	7.89	7.51	7.78	7.76			
CI5	7.79	7.93			7.74			
CI7				7.75				
CI8	7.25				7.76	7.65	7.25	7.93
CJ1	7.78		7.93		7.69			
CJ4	7.94	7.47	7.99	7.93	7.82			
CJ5	7.55	7.57			7.7			
CJ7				7.59				
CJ8	7.92				7.69	7.72	7.47	7.99
CK1	7.91		7.86		8			
CK4	7.77	7.77	7.78	7.89	7.9			
CK5	7.8	7.8			7.99			
CK7				7.89				
CK8	7.71				7.91	7.85	7.71	8.00

Appendix Table 13: Conductivity (µS/cm) Water Chemistry Parameter for *C. dilutus* during the 10-Day Sediment Toxicity Test

Day	0	9			
am/pm	am	am	Average	Min	Max
CA1	150.2	154.7			
CA8	149.7	156.3	152.7	149.7	156.3
CB1	142.2	148.9			
CB8	142.4	149.5	145.8	142.2	149.5
CC1	159.3	159.5			
CC8	154.7	159.7	158.3	154.7	159.7
CD1	150.9	161.9			
CD8	151.3	160.8	156.2	150.9	161.9
CE1	156.6	160.6			
CE8	156.1	161.1	158.6	156.1	161.1
CF1	152.6	158.2			
CF8	153.3	158.8	155.7	152.6	158.8
CG1	162.7	162.0			
CG8	163.3	162.2	162.6	162.0	163.3
CH1	162.6	163.1			
CH8	162.1	164.5	163.1	162.1	164.5
CI1	154.5	154.9			
CI8	158.9	154.7	155.8	154.5	158.9
CJ1	149.9	162.3			
CJ8	150.0	161.2	155.9	149.9	162.3
CK1	157.5	160.9			
CK8	162.7	162.2	160.8	157.5	162.7

Appendix Table 14: Ammonia (mg/L) Water Chemistry Parameter for *C. dilutus* during the 10-Day Sediment Toxicity Test

Day	0	9			
am/pm	am	am	Average	Min	Max
CA1	0.063	0.38			
CA8	0.063	0.37	0.22	0.06	0.38
CB1	0.16	0.27			
CB8	0.13	0.23	0.20	0.13	0.27
CC1	0.135	0.1			
CC8	0.1	0.1	0.11	0.10	0.14
CD1	0.10	0.11			
CD8	0.09	0.09	0.10	0.09	0.11
CE1	0.16	0.12			
CE8	0.15	0.12	0.14	0.12	0.16
CF1	0.11	0.10			
CF8	0.12	0.10	0.11	0.10	0.12
CG1	0.18	0.09			
CG8	0.20	0.09	0.14	0.09	0.20
CH1	0.16	0.10			
CH8	0.16	0.10	0.13	0.10	0.16
CI1	0.36	0.33			
CI8	0.31	0.27	0.32	0.27	0.36
CJ1	0.09	0.14			
CJ8	0.08	0.10	0.10	0.08	0.14
CK1	0.09	0.09			
CK8	0.09	0.11	0.09	0.09	0.11

Appendix Table 15: Hardness (mg/L CaCO3) Water Chemistry Parameter for *C. dilutus* during the 10-Day Sediment Toxicity Test

Day	0	9			
am/pm	am	am	Average	Min	Max
CA3	48.8	48			
CA6	48.8	48.4	48.5	48.0	48.8
CB3	44.4	44.8			
CB6	50.0	45.2	46.1	44.4	50.0
CC3	54.4	48.8			
CC6	53.2	*	52.1	48.8	54.4
CD3	54.4	64.4			
CD6	52.4	52.8	56.0	52.4	64.4
CE3	51.6	49.2			
CE6	52.4	48	50.3	48.0	52.4
CF3	54	53.2			
CF6	55.2	56.4	54.7	53.2	56.4
CG3	55.6	50.4			
CG6	61.6	52.0	54.9	50.4	61.6
CH3	64.4	58.0			
CH6	67.6	56.0	61.5	56.0	67.6
CI3	48.4	47.6			
CI6	52.4	48.4	49.2	47.6	52.4
CJ3	58.8	52.8			
CJ6	55.6	50.8	54.5	50.8	58.8
CK3	65.2	51.2			
CK6	59.2	53.6	57.3	51.2	65.2

* Buffer was not added to sample prior to titration so this value was not included.

Appendix Table 16: Alkalinity (mg/L $CaCO_3$) Water Chemistry Parameter for *C. dilutus* during the 10-Day Sediment Toxicity Test

am/pm	am	am	Average	Min	Max
CA2	46.8	50.8			
CA5	47.2	49.2	48.5	46.8	50.8
CB2	43.2	44			
CB5	39.2	44.4	42.7	39.2	44.4
CC2	46.4	43.6			
CC5	46.5	45.6	45.5	43.6	46.5
CD2	49.2	52.8			
CD5	49.6	50.0	50.4	49.2	52.8
CE2	50.4	49.2			
CE5	51.6	47.6	49.7	47.6	51.6
CF2	50.0	52.8			
CF5	51.6	54.4	52.2	50.0	54.4
CG2	50.0	48.8			
CG5	48.8	51.2	49.7	48.8	51.2
CH2	53.6	54.8			
CH5	54.0	56.4	54.7	53.6	56.4
CI2	47.6	48.0			
CI5	48.0	48.8	48.1	47.6	48.8
CJ2	48.4	52.0			
CJ5	48.0	48.4	49.2	48.0	52.0
CK2	48.8	48.4			
CK5	46.8	47.6	47.9	46.8	48.8

Appendix Table 17: Analysis of polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) in seven sediments used for 10-day *H. azteca* and *C. dilutus* tests and the 28-day *L. variegatus* bioaccumulation test

Client ID	Compound	Result	EMPC	RL	Units	Qualifiers	TEQ	Matrix	EDL
BW15ML-038-0-0.15	2,3,7,8-TCDF	3.4	0	0.15	ng/Kg		0.34	Soil	0.15
	2,3,7,8-TCDD	0	0.92	0.22	ng/Kg	IJ	0.92	Soil	0.22
	1,2,3,7,8-PeCDF	1.6	0	0.11	ng/Kg	J	0.049	Soil	0.11
	2,3,4,7,8-PeCDF	4.5	0	0.077	ng/Kg	J	1.4	Soil	0.077
	1,2,3,7,8-PeCDD	2.1	0	0.11	ng/Kg	J	2.1	Soil	0.11
	1,2,3,4,7,8-HxCDF	21	0	0.072	ng/Kg		2.1	Soil	0.072
	1,2,3,6,7,8-HxCDF	13	0	0.12	ng/Kg		1.3	Soil	0.12
	2,3,4,6,7,8-HxCDF	4.8	0	0.082	ng/Kg	J	0.48	Soil	0.082
	1,2,3,7,8,9-HxCDF	1.7	0	0.12	ng/Kg	J	0.17	Soil	0.12
	1,2,3,4,7,8-HxCDD	2.1	0	0.2	ng/Kg	J	0.21	Soil	0.2
	1,2,3,6,7,8-HxCDD	14	0	0.2	ng/Kg		1.4	Soil	0.2
	1,2,3,7,8,9-HxCDD	7.3	0	0.19	ng/Kg	J	0.73	Soil	0.19
	1,2,3,4,6,7,8-HpCDF	310	0	0.25	ng/Kg		3.1	Soil	0.25
	1,2,3,4,7,8,9-HpCDF	9.3	0	0.24	ng/Kg		0.093	Soil	0.24
	1,2,3,4,6,7,8-HpCDD	200	0	0.95	ng/Kg		2	Soil	0.95
	OCDF	280	0	0.19	ng/Kg		0.085	Soil	0.19
	OCDD	2100	0	0.21	ng/Kg		0.63	Soil	0.21
	Total TCDF	28	0	0.15	ng/Kg		0	Soil	0.15
	Total TCDD	6.3	0	0.22	ng/Kg		0	Soil	0.22
	Total PeCDF	62	0	0.094	ng/Kg		0	Soil	0.094
	Total PeCDD	20	0	0.11	ng/Kg		0	Soil	0.11
	Total HxCDF	190	0	0.098	ng/Kg		0	Soil	0.098
	Total HxCDD	130	0	0.2	ng/Kg		0	Soil	0.2
	Total HpCDF	610	0	0.25	ng/Kg		0	Soil	0.25
	Total HpCDD	440	0	0.95	ng/Kg		0	Soil	0.95
	TEQ	17	0	0	ng/Kg		0	Soil	0
BW15ML-032-0-0.15	2,3,7,8-TCDF	4.8	0	0.3	ng/Kg		0.48	Soil	0.3
	2,3,7,8-TCDD	2.1	0	0.26	ng/Kg		2.1	Soil	0.26
	1,2,3,7,8-PeCDF	2.3	0	0.13	ng/Kg	J	0.068	Soil	0.13
	2,3,4,7,8-PeCDF	7.2	0	0.11	ng/Kg	J	2.2	Soil	0.11
	1,2,3,7,8-PeCDD	6.2	0	0.09	ng/Kg	J	6.2	Soil	0.09
	1,2,3,4,7,8-HxCDF	21	0	0.28	ng/Kg		2.1	Soil	0.28
	1,2,3,6,7,8-HxCDF	37	0	0.25	ng/Kg		3.7	Soil	0.25
	2,3,4,6,7,8-HxCDF	14	0	0.23	ng/Kg		1.4	Soil	0.23
	1,2,3,7,8,9-HxCDF	0	3.2	0.18	ng/Kg	IJ	0.32	Soil	0.18
	1,2,3,4,7,8-HxCDD	6	0	0.33	ng/Kg	J	0.6	Soil	0.33
	1,2,3,6,7,8-HxCDD	48	0	0.28	ng/Kg		4.8	Soil	0.28
	1,2,3,7,8,9-HxCDD	26	0	0.27	ng/Kg		2.6	Soil	0.27
	1,2,3,4,6,7,8-HpCDF	1800	0	0.41	ng/Kg		18	Soil	0.41
	1,2,3,4,7,8,9-HpCDF	13	0	0.38	ng/Kg		0.13	Soil	0.38
	1,2,3,4,6,7,8-HpCDD	420	0	0.84	ng/Kg		4.2	Soil	0.84
	OCDF	820	0	0.13	ng/Kg		0.25	Soil	0.13
	OCDD	4200	0	0.14	ng/Kg		1.3	Soil	0.14
	Total TCDF	44	0	0.3	ng/Kg		0	Soil	0.3
	Total TCDD	18	0	0.26	ng/Kg		0	Soil	0.26
	Total PeCDF	120	0	0.12	ng/Kg		0	Soil	0.12
	Total PeCDD	58	0	0.09	ng/Kg		0	Soil	0.09
	Total HxCDF	350	0	0.23	ng/Kg		0	Soil	0.23
	Total HxCDD	410	0	0.29	ng/Kg		0	Soil	0.29
	Total HpCDF	3300	0	0.4	ng/Kg		0	Soil	0.4
	Total HpCDD	1000	0	0.84	ng/Kg		0	Soil	0.84
	TEQ	50	0	0	ng/Kg		0	Soil	0

Client ID	Compound	Result	EMPC	RL	Units	Qualifiers	TEQ	Matrix	EDL
BW15ML-034-0-0.15	2,3,7,8-TCDF	1.3	0	0.31	ng/Kg	J	0.13	Soil	0.31
	2,3,7,8-TCDD	0.63	0	0.28	ng/Kg	J	0.63	Soil	0.28
	1,2,3,7,8-PeCDF	0.55	0	0.12	ng/Kg	J	0.017	Soil	0.12
	2,3,4,7,8-PeCDF	1.5	0	0.11	ng/Kg	J	0.45	Soil	0.11
	1,2,3,7,8-PeCDD	1.6	0	0.13	ng/Kg	J	1.6	Soil	0.13
	1,2,3,4,7,8-HxCDF	3.5	0	0.096	ng/Kg	J	0.35	Soil	0.096
	1,2,3,6,7,8-HxCDF	6.8	0	0.14	ng/Kg	J	0.68	Soil	0.14
	2,3,4,6,7,8-HxCDF	2.7	0	0.11	ng/Kg	J	0.27	Soil	0.11
	1,2,3,7,8,9-HxCDF	0.71	0	0.077	ng/Kg	J	0.071	Soil	0.077
	1,2,3,4,7,8-HxCDD	1.6	0	0.12	ng/Kg	J	0.16	Soil	0.12
	1,2,3,6,7,8-HxCDD	11	0	0.092	ng/Kg		1.1	Soil	0.092
	1,2,3,7,8,9-HxCDD	6.5	0	0.19	ng/Kg	J	0.65	Soil	0.19
	1,2,3,4,6,7,8-HpCDF	250	0	0.17	ng/Kg		2.5	Soil	0.17
	1,2,3,4,7,8,9-HpCDF	0	2.2	0.14	ng/Kg	IJ	0.022	Soil	0.14
	1,2,3,4,6,7,8-HpCDD	140	0	0.53	ng/Kg		1.4	Soil	0.53
	OCDF	160	0	0.13	ng/Kg		0.048	Soil	0.13
	OCDD	1500	0	0.14	ng/Kg		0.45	Soil	0.14
	Total TCDF	13	0	0.31	ng/Kg		0	Soil	0.31
	Total TCDD	4.5	0	0.28	ng/Kg		0	Soil	0.28
	Total PeCDF	27	0	0.11	ng/Kg		0	Soil	0.11
	Total PeCDD	12	0	0.13	ng/Kg		0	Soil	0.13
	Total HxCDF	150	0	0.1	ng/Kg		0	Soil	0.1
	Total HxCDD	97	0	0.13	ng/Kg		0	Soil	0.13
	Total HpCDF	480	0	0.15	ng/Kg		0	Soil	0.15
	Total HpCDD	350	0	0.53	ng/Kg		0	Soil	0.53
	TEQ	11	0	0	ng/Kg		0	Soil	0
BW15ML-037-0-0.15	2,3,7,8-TCDF	0	0.9	0.23	ng/Kg	IJ	0.09	Soil	0.23
	2,3,7,8-TCDD	0	0.27	0.26	ng/Kg	IJ	0.27	Soil	0.26
	1,2,3,7,8-PeCDF	0.44	0	0.14	ng/Kg	BJ	0.013	Soil	0.14
	2,3,4,7,8-PeCDF	0.91	0	0.14	ng/Kg	J	0.27	Soil	0.14
	1,2,3,7,8-PeCDD	0.48	0	0.19	ng/Kg	J	0.48	Soil	0.19
	1,2,3,4,7,8-HxCDF	1.3	0	0.084	ng/Kg	J	0.13	Soil	0.084
	1,2,3,6,7,8-HxCDF	1.7	0	0.1	ng/Kg	J	0.17	Soil	0.1
	2,3,4,6,7,8-HxCDF	1	0	0.063	ng/Kg	J	0.1	Soil	0.063
	1,2,3,7,8,9-HxCDF	0.43	0	0.1	ng/Kg	J	0.043	Soil	0.1
	1,2,3,4,7,8-HxCDD	0.5	0	0.15	ng/Kg	J	0.05	Soil	0.15
	1,2,3,6,7,8-HxCDD	3.3	0	0.21	ng/Kg	J	0.33	Soil	0.21
	1,2,3,7,8,9-HxCDD	1.7	0	0.21	ng/Kg	J	0.17	Soil	0.21
	1,2,3,4,6,7,8-HpCDF	85	0	0.083	ng/Kg		0.85	Soil	0.083
	1,2,3,4,7,8,9-HpCDF	0	0.85	0.17	ng/Kg	IJ	0.0085	Soil	0.17
	1,2,3,4,6,7,8-HpCDD	40	0	0.29	ng/Kg		0.4	Soil	0.29
	OCDF	50	0	0.19	ng/Kg		0.015	Soil	0.19
	OCDD	410	0	0.26	ng/Kg		0.12	Soil	0.26
	Total TCDF	11	0	0.23	ng/Kg		0	Soil	0.23
	Total TCDD	1.4	0	0.26	ng/Kg	J	0	Soil	0.26
	Total PeCDF	14	0	0.14	ng/Kg		0	Soil	0.14
	Total PeCDD	3.6	0	0.19	ng/Kg	J	0	Soil	0.19
	Total HxCDF	39	0	0.088	ng/Kg		0	Soil	0.088
	Total HxCDD	30	0	0.19	ng/Kg		0	Soil	0.19
	Total HpCDF	150	0	0.13	ng/Kg		0	Soil	0.13
	Total HpCDD	99	0	0.29	ng/Kg		0	Soil	0.29
	TEQ	3.5	0	0	ng/Kg		0	Soil	0

Client ID	Compound	Result	EMPC	RL	Units	Qualifiers	TEQ	Matrix	EDL
BW15ML-004-0-0.15	2,3,7,8-TCDF	2.6	0	0.54	ng/Kg		0.26	Soil	0.54
	2,3,7,8-TCDD	ND	0	0.35	ng/Kg		0	Soil	0.35
	1,2,3,7,8-PeCDF	0	0.33	0.1	ng/Kg	IJ	0.01	Soil	0.1
	2,3,4,7,8-PeCDF	1.4	0	0.14	ng/Kg	J	0.41	Soil	0.14
	1,2,3,7,8-PeCDD	1.3	0	0.26	ng/Kg	J	1.3	Soil	0.26
	1,2,3,4,7,8-HxCDF	1.5	0	0.16	ng/Kg	J	0.15	Soil	0.16
	1,2,3,6,7,8-HxCDF	1.4	0	0.1	ng/Kg	J	0.14	Soil	0.1
	2,3,4,6,7,8-HxCDF	0.58	0	0.095	ng/Kg	J	0.058	Soil	0.095
	1,2,3,7,8,9-HxCDF	ND	0	0.52	ng/Kg		0	Soil	0.52
	1,2,3,4,7,8-HxCDD	0.89	0	0.062	ng/Kg	J	0.089	Soil	0.062
	1,2,3,6,7,8-HxCDD	5.9	0	0.13	ng/Kg	J	0.59	Soil	0.13
	1,2,3,7,8,9-HxCDD	2.7	0	0.12	ng/Kg	J	0.27	Soil	0.12
	1,2,3,4,6,7,8-HpCDF	79	0	0.41	ng/Kg		0.79	Soil	0.41
	1,2,3,4,7,8,9-HpCDF	1.3	0	0.17	ng/Kg	J	0.013	Soil	0.17
	1,2,3,4,6,7,8-HpCDD	91	0	0.17	ng/Kg		0.91	Soil	0.17
	OCDF	64	0	0.19	ng/Kg		0.019	Soil	0.19
	OCDD	970	0	0.23	ng/Kg		0.29	Soil	0.23
	Total TCDF	5.6	0	0.54	ng/Kg		0	Soil	0.54
	Total TCDD	0.48	0	0.35	ng/Kg	J	0	Soil	0.35
	Total PeCDF	9.8	0	0.12	ng/Kg		0	Soil	0.12
	Total PeCDD	5.3	0	0.26	ng/Kg	J	0	Soil	0.26
	Total HxCDF	61	0	0.22	ng/Kg		0	Soil	0.22
	Total HxCDD	70	0	0.1	ng/Kg		0	Soil	0.1
	Total HpCDF	280	0	0.29	ng/Kg		0	Soil	0.29
	Total HpCDD	280	0	0.17	ng/Kg		0	Soil	0.17
	TEQ	5.3	0	0	ng/Kg		0	Soil	0
BW15ML-010-0-0.15	2,3,7,8-TCDF	4.5	0	0.38	ng/Kg		0.45	Soil	0.38
	2,3,7,8-TCDD	0.88	0	0.33	ng/Kg	J	0.88	Soil	0.33
	1,2,3,7,8-PeCDF	1.6	0	0.15	ng/Kg	J	0.048	Soil	0.15
	2,3,4,7,8-PeCDF	6.3	0	0.15	ng/Kg	J	1.9	Soil	0.15
	1,2,3,7,8-PeCDD	2.2	0	0.14	ng/Kg	J	2.2	Soil	0.14
	1,2,3,4,7,8-HxCDF	7.2	0	0.15	ng/Kg	J	0.72	Soil	0.15
	1,2,3,6,7,8-HxCDF	9	0	0.09	ng/Kg	J	0.9	Soil	0.09
	2,3,4,6,7,8-HxCDF	5.4	0	0.11	ng/Kg	J	0.54	Soil	0.11
	1,2,3,7,8,9-HxCDF	1.1	0	0.17	ng/Kg	J	0.11	Soil	0.17
	1,2,3,4,7,8-HxCDD	2.2	0	0.14	ng/Kg	J	0.22	Soil	0.14
	1,2,3,6,7,8-HxCDD	15	0	0.13	ng/Kg		1.5	Soil	0.13
	1,2,3,7,8,9-HxCDD	7.8	0	0.16	ng/Kg	J	0.78	Soil	0.16
	1,2,3,4,6,7,8-HpCDF	270	0	0.16	ng/Kg		2.7	Soil	0.16
	1,2,3,4,7,8,9-HpCDF	5.5	0	0.29	ng/Kg	J	0.055	Soil	0.29
	1,2,3,4,6,7,8-HpCDD	170	0	0.36	ng/Kg		1.7	Soil	0.36
	OCDF	170	0	0.23	ng/Kg		0.051	Soil	0.23
	OCDD	1600	0	0.18	ng/Kg		0.48	Soil	0.18
	Total TCDF	74	0	0.38	ng/Kg		0	Soil	0.38
	Total TCDD	7.4	0	0.33	ng/Kg		0	Soil	0.33
	Total PeCDF	83	0	0.15	ng/Kg		0	Soil	0.15
	Total PeCDD	21	0	0.14	ng/Kg		0	Soil	0.14
	Total HxCDF	170	0	0.13	ng/Kg		0	Soil	0.13
	Total HxCDD	130	0	0.15	ng/Kg		0	Soil	0.15
	Total HpCDF	560	0	0.22	ng/Kg		0	Soil	0.22
	Total HpCDD	380	0	0.36	ng/Kg		0	Soil	0.36
	TEQ	15	0	0	ng/Kg		0	Soil	0

Client ID	Compound	Result	EMPC	RL	Units	Qualifiers	TEQ	Matrix	EDL
BW15ML-022-0-0.15	2,3,7,8-TCDF	0	0.46	0.18	ng/Kg	IJ	0.046	Soil	0.18
	2,3,7,8-TCDD	ND	0	0.15	ng/Kg		0	Soil	0.15
	1,2,3,7,8-PeCDF	0	0.23	0.15	ng/Kg	IJ	0.007	Soil	0.15
	2,3,4,7,8-PeCDF	0.69	0	0.1	ng/Kg	J	0.21	Soil	0.1
	1,2,3,7,8-PeCDD	0	0.14	0.074	ng/Kg	IJ	0.14	Soil	0.074
	1,2,3,4,7,8-HxCDF	0	0.77	0.049	ng/Kg	IJ	0.077	Soil	0.049
	1,2,3,6,7,8-HxCDF	0.76	0	0.044	ng/Kg	J	0.076	Soil	0.044
	2,3,4,6,7,8-HxCDF	0.62	0	0.053	ng/Kg	J	0.062	Soil	0.053
	1,2,3,7,8,9-HxCDF	0	0.15	0.033	ng/Kg	IJ	0.015	Soil	0.033
	1,2,3,4,7,8-HxCDD	0.26	0	0.066	ng/Kg	J	0.026	Soil	0.066
	1,2,3,6,7,8-HxCDD	1.2	0	0.12	ng/Kg	J	0.12	Soil	0.12
	1,2,3,7,8,9-HxCDD	0.74	0	0.05	ng/Kg	J	0.074	Soil	0.05
	1,2,3,4,6,7,8-HpCDF	16	0	0.063	ng/Kg		0.16	Soil	0.063
	1,2,3,4,7,8,9-HpCDF	0.73	0	0.057	ng/Kg	J	0.0073	Soil	0.057
	1,2,3,4,6,7,8-HpCDD	18	0	0.087	ng/Kg		0.18	Soil	0.087
	OCDF	17	0	0.13	ng/Kg		0.0052	Soil	0.13
	OCDD	140	0	0.11	ng/Kg		0.043	Soil	0.11
	Total TCDF	10	0	0.18	ng/Kg		0	Soil	0.18
	Total TCDD	0.26	0	0.15	ng/Kg	J	0	Soil	0.15
	Total PeCDF	11	0	0.12	ng/Kg		0	Soil	0.12
	Total PeCDD	1.8	0	0.074	ng/Kg	J	0	Soil	0.074
	Total HxCDF	12	0	0.045	ng/Kg		0	Soil	0.045
	Total HxCDD	9.9	0	0.079	ng/Kg		0	Soil	0.079
	Total HpCDF	32	0	0.06	ng/Kg		0	Soil	0.06
	Total HpCDD	43	0	0.087	ng/Kg		0	Soil	0.087
	TEQ	1.3	0	0	ng/Kg		0	Soil	0

Compounds were marked with the qualifier “I” when incorrect isotopes were found during analysis. Compounds were marked with the qualifier “J” when concentrations found were below the calibration range and should be considered estimates.

Appendix Table 18: Percent Moisture and Total Organic Carbon for Four Sediments used in the 10-Day *H. azteca* and *C. dilutus* tests and the 28-Day *L. variegatus* test

Sample ID	Matrix	Analyte	Result	Units	PRL	MDL	RPD
BW15ML-032-0-0.15	Solid	Percent Moisture	55.8	%	0.10	0.10	
	Solid	Total Organic Carbon	25200	mg/kg	3130	1010	
	Solid	Total Organic Carbon	43200	mg/kg	3210	1030	
	Solid	Total Organic Carbon	27400	mg/kg	3210	1040	
	Solid	Total Organic Carbon	29500	mg/kg	3170	1020	
	Solid	Mean Total Organic Carbon	31300	mg/kg	3180	1020	
BW15ML-034-0-0.15	Solid	Percent Moisture	55.8	%	0.10	0.10	
	Solid	Total Organic Carbon	31300	mg/kg	2510	811	
	Solid	Total Organic Carbon	41700	mg/kg	2740	882	
	Solid	Total Organic Carbon	27300	mg/kg	2690	866	
	Solid	Total Organic Carbon	36200	mg/kg	2480	798	
	Solid	Mean Total Organic Carbon	34100	mg/kg	2600	839	
BW15ML-004-0-0.15	Solid	Percent Moisture	62.5	%	0.10	0.10	
	Solid	Total Organic Carbon	64900	mg/kg	3790	1220	
	Solid	Total Organic Carbon	63900	mg/kg	4270	1380	
	Solid	Total Organic Carbon	62700	mg/kg	4370	1410	
	Solid	Total Organic Carbon	39700	mg/kg	4180	1350	
	Solid	Mean Total Organic Carbon	57800	mg/kg	4150	1340	
BW15ML-010-0-0.15	Solid	Percent Moisture	68.7	%	0.10	0.10	
	Solid	Total Organic Carbon	35300	mg/kg	4240	1370	
	Solid	Total Organic Carbon	54000	mg/kg	3710	1200	
	Solid	Total Organic Carbon	35900	mg/kg	3500	1130	
	Solid	Total Organic Carbon	48900	mg/kg	4050	1310	
	Solid	Mean Total Organic Carbon	43500	mg/kg	3880	1250	
DUP	Solid	Percent Moisture	56.2	%	0.10	0.10	1
BLANK	Solid	Mean Total Organic Carbon	ND	mg/kg	391	126	
LCS	Solid	Mean Total Organic Carbon	79	%	1240	399	
MS	Solid	Mean Total Organic Carbon	95	%	7380	2380	
MSD	Solid	Mean Total Organic Carbon	81	%	5970	1920	24

Appendix Table 19: Initial and Recovered Wet Weight of *L. variegatus* tissue for the 28-day Bioaccumulation Test

Sample ID	Test Sediment	Initial Weight	Average Initial Weight	Standard Deviation	Weight Recovered	Average Recovered Weight	Standard Deviation
LA1	BW15ML-032	15.2			11.3		
LA2	BW15ML-032	15.7			12.9		
LA3	BW15ML-032	15.3			12.4		
LA4	BW15ML-032	15.4			13.4		
LA5	BW15ML-032	15.3			13.3		
LA	**BW15ML-032**		**15.4**	**0.19**		**12.7**	**0.856**
LB1	BW15ML-004	15.3			12		
LB2	BW15ML-004	15.5			11.1		
LB3	BW15ML-004	15.6			13.7		
LB4	BW15ML-004	15.6			13.4		
LB5	BW15ML-004	15.5			11.7		
LB	**BW15ML-004**		**15.5**	**0.12**		**12.4**	**1.121**
LC1	BW15ML-034	15.3			15.6		
LC2	BW15ML-034	15.4			13.7		
LC3	BW15ML-034	15.9			13		
LC4	BW15ML-034	15.2			13.2		
LC5	BW15ML-034	16			14.3		
LC	**BW15ML-034**		**15.6**	**0.37**		**14.0**	**1.045**
LD1	BW15ML-010	15.4			13.9		
LD2	BW15ML-010	15.3			14.5		
LD3	BW15ML-010	15.5			13		
LD4	BW15ML-010	15.4			13.7		
LD5	BW15ML-010	15.8			14.6		
LD	**BW15ML-010**		**15.5**	**0.19**		**13.9**	**0.650**

Appendix Table 20: Temperature (˚C) Water Chemistry Parameter for *L. variegatus* during the 28-Day Bioaccumulation Test

Day	am/ pm	LA1	LA2	LA3	LA4	LA5	LB1	LB2	LB3	LB4	LB5	LC1	LC2	LC3	LC4	LC5	LD1	LD2	LD3	LD4	LD5
0	am	19.5	21.3	21.6	20.9	20.6	20.4	21.2	21.7	20.3	20.0	20.8	21.6	20.3	20.9	20.9	20.7	21.1	21.2	20.4	20.7
	pm	21.0		22.6		21.8	22.2		22.7		21.5	21.5		22.3		22.1	21.5		22.2		21.5
1	am		22.3		22.8			22.1		22.7			22.4		22.7			22.0		22.2	
	pm	21.3		23.0		22.4	22.9		23.0		22.0	22.0		22.8		22.7	22.0		22.7		22.3
2	am		22.3		23.3			22.1		23.1			22.6		23.1			22.0		22.9	
	pm	22.0		23.2		22.8	23.3		23.4		22.2	22.2		23.0		23.1	22.4		22.9		22.8
3	am		21.7		23.0			21.8		22.8			22.7		22.2			21.8		22.5	
	pm	21.5		22.8		22.1	22.2		23.0		21.9	21.3		22.4		22.2	21.6		22.1		21.6
4	am		21.2		22.5			21.5		22.1			21.7		22.2			21.3		21.9	
	pm	21.1		22.4		21.9	22.2		22.6		21.5	21.2		22.2		22.1	21.4		21.9		21.4
5	am		21.1		22.4			21.4		22.1			21.5		22.2			21.0		21.6	
	pm	21.4		22.5		22.0	22.2		22.6		21.9	21.3		22.2		22.1	21.2		21.9		21.4
6	am		21.6		22.4			21.8		22.3			21.9		22.0			21.4		21.7	
	pm	21.2		22.3		22.0	22.2		22.1		21.4	21.3		21.5		22.2	21.1		21.8		21.5
7	am		21.7		21.9			22.0		21.8			21.9		22.0			21.6		21.4	
	pm	21.5		22.5		22.1	22.5		22.6		21.5	21.3		22.3		22.4	21.2		22.0		21.8
8	am		22.0		23.0			22.4		23.1			22.3		22.7			22.1		22.6	
	pm	21.8		22.7		22.3	22.7		22.7		21.8	21.3		22.5		22.6	21.3		22.3		22.0
9	am		21.9		22.9			22.1		23.0			22.2		22.8			21.9		22.3	
	pm	21.7		22.9		22.4	22.7		22.9		22.0	21.7		22.3		22.7	21.7		22.4		22.1
10	am		22.0		22.8			22.4		22.9			22.4		22.6			22.3		22.1	
	pm	21.9		23.0		22.5	22.6		23.2		22.4	21.4		22.3		22.6	21.9		22.4		21.9
11	am		22.3		23.6			22.7		23.3			22.6		22.9			22.4		22.6	
	pm	22.0		23.1		22.8	23.2		23.2		22.4	22.0		22.7		23.0	22.3		22.7		22.4
12	am		22.4		23.8			23.2		23.7			23.0		23.1			22.9		22.8	
	pm	21.8		23.2		22.8	23.2		23.1		22.3	22.0		23.0		23.1	22.6		22.9		22.6
13	am		22.3		23.5			22.5		23.5			22.7		23.0			22.5		22.5	
	pm	21.6		23.2		22.6	23.1		23.0		22.2	21.9		23.0		22.9	21.8		22.7		22.2
14	am		22.3		22.6			22.4		22.6			22.6		22.5			22.2		21.8	
	pm	21.6		23.1		22.7	23.1		23.0		22.1	21.8		22.9		22.9	21.8		22.6		22.3
15	am		22.5		23.5			22.6		23.5			22.7		22.9			22.3		22.6	
	pm	21.8		23.1		22.8	23.2		22.8		22.3	22.2		22.8		23.1	22.0		22.3		22.1
16	am		22.3		23.4			22.8		23.4			22.9		23.0			22.5		22.7	
	pm	21.5		23.3		23.0	23.3		23.0		22.5	21.9		23.1		23.2	22.0		22.7		22.5
17	am		22.5		23.9			23.0		23.4			23.0		23.1			22.8		22.8	
	pm	22.4		23.6		23.2	23.6		23.3		23.0	22.4		23.3		23.4	22.5		23.1		22.4
18	am		22.7		24.0			23.3		23.9			23.3		23.5			23.0		23.2	
	pm	22.4		23.6		23.2	23.5		23.3		23.0	22.5		23.0		23.2	22.6		23.0		22.3
19	am		22.8		24.1			23.2		24.1			23.1		23.3			22.9		23.1	
	pm	21.9		23.6		23.4	23.5		22.8		22.8	22.9		23.3		23.6	22.6		23.1		22.4

Day	am/ pm	LA1	LA2	LA3	LA4	LA5	LB1	LB2	LB3	LB4	LB5	LC1	LC2	LC3	LC4	LC5	LD1	LD2	LD3	LD4	LD5
20	am		22.8		23.9			23.2		24.1			23.1		23.2			22.9		23.0	
	pm	21.6		23.5		23.1	23.4		23.0		22.7	22.8		23.2		23.2	22.5		22.9		22.3
21	am		22.6		22.6			22.9		22.9			22.8		22.3			22.5		22.0	
	pm	21.7		23.2		22.8	23.1		22.6		22.4	22.6		22.7		23.0	22.3		22.6		22.0
22	am		22.3		23.5			22.7		23.7			22.7		22.8			22.3		22.1	
	pm	20.8		23.0		22.4	22.7		22.5		22.1	22.3		22.5		22.6	21.8		22.4		21.9
23	am		22.3		23.5			22.4		23.5			22.5		22.8			22.2		22.4	
	pm	21.0		23.1		22.8	23.1		22.7		22.3	22.5		22.8		23.0	22.1		22.6		22.0
24	am		22.3		23.4			22.7		23.5			22.6		22.5			22.4		22.3	
	pm	22.0		23.4		22.9	23.3		23.1		22.5	22.1		23.2		23.1	22.2		22.8		22.3
25	am		23.3		24.2			23.1		24.2			23.2		23.3			22.9		23.2	
	pm	22.5		23.7		23.3	23.5		23.4		23.1	22.7		23.2		23.3	22.7		23.2		22.5
26	am		22.6		23.7			22.7		23.8			22.8		22.8			22.4		22.5	
	pm	21.3		23.0		22.4	22.7		22.7		22.2	21.7		22.6		22.7	21.9		22.4		21.8
27	am	21.1	22.0	22.8	23.0	22.2	22.5	22.3	22.5	22.9	21.9	21.5	22.1	22.3	22.5	22.4	21.5	22.0	22.1	21.8	21.4
	pm	21.3		22.9		22.2	22.7		22.5		22.0	21.3		22.6		22.5	21.6		22.2		21.9
28	am		21.6		22.7			21.9		22.5			21.8		22.4			21.6		21.6	
29	am		-		-			-		-			21.8		22.2			21.1		22.1	
Average					**22.5**					**22.7**					**22.5**					**22.2**	
	Min				**19.5**					**20.0**					**20.3**					**20.4**	
	Max				**24.2**					**24.2**					**23.6**					**23.2**	

Appendix Table 21: Dissolved Oxygen (mg/L) Water Chemistry Parameter for *L. variegatus* during the 28-Day Bioaccumulation Test

Day	am/pm	LA1	LA2	LA3	LA4	LA5	LB1	LB2	LB3	LB4	LA5	LC1	LC2	LC3	LC4	LC5	LD1	LD2	LD3	LD4	LD5
0	am	8.0	7.8	7.9	7.3	7.7	8.1	7.6	7.4	8.1	8.0	7.6	7.7	7.9	7.4	7.5	7.6	7.8	8.1	8.1	7.5
	pm	7.7		7.3		7.1	6.5		6.2		7.2	7.5		7.4		7.0	6.7		7.2		7.3
1	am		7.6		6.9			7.5		7.4			7.6		7.1			7.4		7.4	
	pm	7.8		7.5		7.3	6.9		6.9		7.5	7.4		7.2		7.2	7.1		7.5		7.1
2	am		7.7		7.4			7.4		7.3			7.4		7.1			7.3		7.4	
	pm	7.8		7.3		7.5	6.9		7.1		7.5	7.6		7.6		7.3	6.7		7.2		6.8
3	am		8.3		7.8			7.6		8.1			7.7		7.6			7.0		7.3	
	pm	8.1		7.9		7.9	8.0		7.3		7.8	7.9		8.0		7.5	7.5		7.6		7.1
4	am		7.9		7.4			7.8		7.6			7.7		7.4			7.3		7.4	
	pm	8.2		7.7		7.8	7.8		7.2		7.6	7.6		7.8		7.3	7.7		7.5		7.3
5	am		8.3		8.1			8.0		8.0			8.0		7.7			7.6		7.3	
	pm	8.0		7.6		7.8	7.6		7.4		7.7	7.8		7.8		7.6	7.9		7.5		7.1
6	am		7.9		7.9			7.4		7.3			7.7		7.3			6.9		7.8	
	pm	8.2		7.6		7.8	7.6		8.1		7.8	8.1		7.7		7.3	7.7		7.6		7.2
7	am		7.9		7.6			7.5		7.5			7.7		7.2			6.9		7.1	
	pm	7.9		7.5		7.5	7.3		7.1		7.5	7.6		7.6		7.3	7.4		7.1		6.9
8	am		7.7		7.3			7.4		7.3			7.3		6.9			6.8		6.7	
	pm	7.8		7.5		7.6	7.6		7.2		7.5	7.6		7.5		7.1	7.5		7.0		6.9
9	am		7.7		7.4			7.5		7.3			7.5		7.3			6.7		7.1	
	pm	8.1		7.5		7.7	7.9		7.1		7.7	7.8		7.7		7.2	7.1		7.2		6.6
10	am		7.2		6.8			7.0		6.9			7.0		6.5			6.3		6.7	
	pm	7.6		7.3		7.2	6.8		6.6		7.0	7.2		7.2		6.7	6.5		6.5		6.4
11	am		7.7		7.4			6.7		7.4			7.6		7.2			7.1		7.2	
	pm	7.1		6.6		7.2	7.0		6.3		6.9	7.2		6.9		6.7	5.8		6.0		5.8
12	am		7.6		7.1			6.3		7.0			7.3		7.0			6.5		7.0	
	pm	7.8		7.3		7.4	7.4		7.1		7.3	7.5		7.4		7.1	6.4		6.8		6.4
13	am		7.6		7.3			7.5		7.1			7.6		7.0			6.8		7.5	
	pm	7.9		7.9		7.7	7.6		6.9		7.3	7.4		7.4		7.4	7.4		7.7		7.6
14	am		7.5		7.4			7.2		7.2			7.3		6.9			7.2		7.1	
	pm	7.5		7.0		7.2	6.8		6.5		7.0	7.2		7.3		7.0	7.2		6.4		7.2
15	am		7.6		7.0			7.3		6.9			7.3		7.2			6.9		7.0	
	pm	7.7		7.2		7.3	7.2		7.3		7.1	7.0		7.4		6.7	7.4		7.5		7.4
16	am		7.4		7.6			7.5		7.0			7.5		7.4			7.5		7.2	
	pm	7.7		6.9		7.3	7.4		7.2		7.0	7.6		7.2		6.7	7.4		6.9		7.0
17	am		6.2		6.1			6.7		6.0			6.8		6.7			6.7		7.0	
	pm	7.8		7.0		7.3	7.3		7.3		7.1	7.3		7.1		6.8	7.2		6.8		7.3
18	am		6.6		6.8			6.9		6.5			6.5		6.4			6.5		6.9	
	pm	7.1		6.7		6.8	6.9		6.8		6.7	6.7		6.7		6.5	6.4		6.5		7.1
19	am		7.3		7.9			7.3		7.9			7.3		7.4			7.4		7.3	
	pm	7.1		7.0		7.3	7.5		7.6		7.1	6.9		7.4		6.6	7.2		6.9		7.4

Day	am/pm	LA1	LA2	LA3	LA4	LA5	LB1	LB2	LB3	LB4	LA5	LC1	LC2	LC3	LC4	LC5	LD1	LD2	LD3	LD4	LD5
20	**am**		7.4		7.0			7.3		7.0			7.5		7.0			7.4		7.5	
	pm	8.3		7.8		8.1	8.2		8.3		8.2	8.1		8.1		7.8	7.8		7.7		8.0
21	**am**		7.9		7.9			8.4		8.1			7.9		7.4			7.9		8.0	
	pm	8.4		7.8		7.8	8.2		8.1		7.7	8.0		8.0		7.2	7.9		7.8		8.3
22	**am**		8.1		7.8			8.1		7.8			8.1		7.5			8.3		8.1	
	pm	8.5		7.7		7.9	8.2		8.5		8.4	8.0		8.2		7.5	8.1		7.9		8.6
23	**am**		8.2		7.9			8.3		7.7			8.3		7.8			8.0		8.1	
	pm	8.6		7.8		7.9	7.9		8.3		8.0	7.7		8.2		7.6	8.2		8.2		8.3
24	**am**		8.1		8.1			8.0		8.0			8.0		7.9			8.0		8.0	
	pm	7.9		7.5		7.7	8.0		8.0		7.7	7.7		8.0		7.8	8.5		8.3		8.2
25	**am**		7.7		7.4			8.1		7.5			7.8		7.8			8.2		7.8	
	pm	7.9		7.4		7.7	7.9		7.9		7.6	7.8		7.8		7.8	7.9		7.6		8.1
26	**am**		8.0		7.6			8.2		7.7			8.4		7.9			8.1		8.4	
	pm	8.5		7.7		7.9	8.1		8.5		8.0	8.2		8.1		8.2	8.1		8.1		8.6
27	**am**	8.4	8.2	7.8	8.1	8.1	8.5	8.3	8.4	7.9	8.2	8.1	8.5	8.4	7.8	7.7	8.4	8.3	8.3	8.7	9.2
	pm	8.3		7.6		7.6	8.1		8.2		7.7	8.0		8.4		7.4	8.0		7.9		8.0
28	**am**		8.0		7.4			8.0		8.2			8.3		7.8			8.5		8.6	
29	**am**		-		-			-		-			7.7		7.6			7.8		7.8	
Average					**7.6**					**7.5**					**7.5**					**7.4**	
	Min				**6.1**					**6.0**					**6.4**					**5.8**	
	Max				**8.6**					**8.5**					**8.5**					**9.2**	

Appendix Table 22: pH Water Chemistry Parameter for *L. variegatus* during the 28-Day Bioaccumulation Test

Day	0	7	14	21	27			
am/pm	am	am	am	pm	pm	Average	Min	Max
LA1	7.97				7.68			
LA2		7.80						
LA3			7.70					
LA4	7.95	7.83	7.76	7.60	7.74			
LA5				7.70		7.76	7.60	7.97
LB1	7.93				7.77			
LB2		7.84						
LB3			7.60					
LB4	7.96	7.84	7.72	7.64	7.72			
LB5				7.64		7.75	7.60	7.96
LC1	7.96				7.70			
LC2		7.84						
LC3			7.76					
LC4	7.97	7.70	7.68	7.62	7.69			
LC5				7.58		7.73	7.58	7.97
LD1	7.89				7.71			
LD2		7.54						
LD3			7.58					
LD4	7.89	7.59	7.60	7.67	7.73			
LD5				7.64		7.67	7.54	7.89

Appendix Table 23: Conductivity (µS/cm) Water Chemistry Parameter for *L. variegatus* during the 28-Day Bioaccumulation Test

Day	0	7	14	21	27			
am/pm	am	am	am	pm	pm	Average	Min	Max
LA1	164.0				147.2			
LA2		159.0						
LA3			155.8					
LA4	162.0	156.8	152.2	152.5	143.9			
LA5				149.3		154.3	143.9	164.0
LB1	166.0				145.6			
LB2		159.4						
LB3			156.0					
LB4	167.8	160.2	156.4	153.4	146.0			
LB5				154.3		156.5	145.6	167.8
LC1	158.7				146.7			
LC2		157.9						
LC3			154.6					
LC4	160.3	158.1	153.1	152.1	144.7			
LC5				152.4		153.9	144.7	160.3
LD1	158.6				147.3			
LD2		153.0						
LD3			149.0					
LD4	157.6	153.2	153.6	152.9	145.0			
LD5				154.2		152.4	145.0	158.6

Appendix Table 24: Ammonia (mg/L) Water Chemistry Parameter for *L. variegatus* during the 28-Day Bioaccumulation Test

Day	0	7	14	21	27			
am/pm	am	am	am	pm	pm	Average	Min	Max
LA1	0.23	0.08	0.14	0.14	0.11			
LA5	0.18	0.08	0.11	0.10	0.09	0.13	0.08	0.23
LB1	0.16	0.07	0.18	0.15	0.10			
LB5	0.16	0.07	0.15	0.13	0.09	0.13	0.07	0.18
LC1	0.20	0.08	0.17	0.13	0.11			
LC5	0.23	0.10	0.24	0.18	0.12	0.16	0.08	0.24
LD1	0.20	0.24	0.65	0.26	0.12			
LD5	0.19	0.34	0.73	0.30	0.12	0.32	0.12	0.73

Appendix Table 25: Hardness (mg/L CaCO3) Water Chemistry Parameter for *L. variegatus* during the 28-Day Bioaccumulation Test

Day	0	7	14	21	27			
am/pm	am	am	am	pm	pm	Average	Min	Max
LA1	51.6	54.0	52.6	48.1	48.5			
LA3	52.4	58.8	54.2	48.1	45.3	51.4	45.3	58.8
LB1	50.8	56.0	55.8	47.3	45.3			
LB3	52.8	59.2	50.6	45.7	48.1	51.2	45.3	59.2
LC1	46.8	52.4	53.8	47.7	46.1			
LC3	49.2	56.0	57.4	46.5	46.1	50.2	46.1	57.4
LD1	47.6	51.2	46.1	46.1	46.9			
LD3	49.2	64.4	64.6	46.1	43.3	50.6	43.3	64.6

Appendix Table 26: Alkalinity (mg/L CaCO3) Water Chemistry Parameters for *L. variegatus* during the 28-Day Bioaccumulation Test

Day	0	7	14	21	27			
am/pm	am	am	am	pm	pm	Average	Min	Max
LA2	46.8	48.4	45.2	44.0	42.0			
LA4	45.6	45.6	48.8	43.6	44.0	45.4	42.0	48.8
LB2	44.4	47.6	47.6	40.8	41.6			
LB4	44.8	47.2	48.0	42.8	40.8	44.6	40.8	48.0
LC2	45.2	48.0	46.4	43.2	41.6			
LC4	44.4	50.8	47.6	44.0	43.2	45.4	41.6	50.8
LD2	44.0	43.6	38.8	37.6	40.8			
LD4	44.4	46.0	39.2	40.4	41.6	41.6	37.6	46.0

Appendix Table 27: Analysis of polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs) in *L. variegatus* tissue upon completion of the 28-Day Bioaccumulation Test

Client ID	Compound	Result	EMPC	RL	Units	Qualifiers	TEQ	Matrix	EDL
BW15ML-004 COMP	2,3,7,8-TCDF	1.8	0	0.73	ng/Kg		0.18	Tissue	0.73
	2,3,7,8-TCDD	0.66	0	0.48	ng/Kg	J	0.66	Tissue	0.48
	1,2,3,7,8-PeCDF	0.27	0	0.27	ng/Kg	J	0.013	Tissue	0.27
	2,3,4,7,8-PeCDF	0.85	0	0.2	ng/Kg	J	0.43	Tissue	0.2
	1,2,3,7,8-PeCDD	0.6	0	0.27	ng/Kg	J	0.3	Tissue	0.27
	1,2,3,4,7,8-HxCDF	0.58	0	0.25	ng/Kg	J	0.058	Tissue	0.25
	1,2,3,6,7,8-HxCDF	0.46	0	0.3	ng/Kg	J	0.046	Tissue	0.3
	2,3,4,6,7,8-HxCDF	0	0.34	0.28	ng/Kg	IJ	0.034	Tissue	0.28
	1,2,3,7,8,9-HxCDF	ND	0	0.2	ng/Kg		0	Tissue	0.2
	1,2,3,4,7,8-HxCDD	ND	0	0.37	ng/Kg		0	Tissue	0.37
	1,2,3,6,7,8-HxCDD	2.5	0	0.37	ng/Kg	J	0.25	Tissue	0.37
	1,2,3,7,8,9-HxCDD	1.1	0	0.4	ng/Kg	J	0.11	Tissue	0.4
	1,2,3,4,6,7,8-HpCDF	6.8	0	0.47	ng/Kg		0.068	Tissue	0.47
	1,2,3,4,7,8,9-HpCDF	ND	0	0.72	ng/Kg		0	Tissue	0.72
	1,2,3,4,6,7,8-HpCDD	6.7	0	0.51	ng/Kg		0.067	Tissue	0.51
	OCDF	1.6	0	0.91	ng/Kg	J	0.0016	Tissue	0.91
	OCDD	62	0	1.3	ng/Kg		0.062	Tissue	1.3
	Total TCDF	17	0	0.73	ng/Kg		0	Tissue	0.73
	Total TCDD	1.9	0	0.48	ng/Kg		0	Tissue	0.48
	Total PeCDF	11	0	0.23	ng/Kg		0	Tissue	0.23
	Total PeCDD	7	0	0.27	ng/Kg	J	0	Tissue	0.27
	Total HxCDF	14	0	0.26	ng/Kg		0	Tissue	0.26
	Total HxCDD	22	0	0.38	ng/Kg		0	Tissue	0.38
	Total HpCDF	14	0	0.6	ng/Kg		0	Tissue	0.6
	Total HpCDD	24	0	0.51	ng/Kg		0	Tissue	0.51
	TEQ	2.3	0	0	ng/Kg		0	Tissue	0
BW15ML-032 COMP	2,3,7,8-TCDF	1.8	0	0.66	ng/Kg		0.18	Tissue	0.66
	2,3,7,8-TCDD	0.84	0	0.33	ng/Kg	J	0.84	Tissue	0.33
	1,2,3,7,8-PeCDF	0.67	0	0.41	ng/Kg	J	0.033	Tissue	0.41
	2,3,4,7,8-PeCDF	1.8	0	0.27	ng/Kg	J	0.89	Tissue	0.27
	1,2,3,7,8-PeCDD	1.5	0	0.34	ng/Kg	J	0.77	Tissue	0.34
	1,2,3,4,7,8-HxCDF	1.3	0	0.31	ng/Kg	J	0.13	Tissue	0.31
	1,2,3,6,7,8-HxCDF	2.5	0	0.28	ng/Kg	J	0.25	Tissue	0.28
	2,3,4,6,7,8-HxCDF	0.92	0	0.27	ng/Kg	J	0.092	Tissue	0.27
	1,2,3,7,8,9-HxCDF	ND	0	0.23	ng/Kg		0	Tissue	0.23
	1,2,3,4,7,8-HxCDD	ND	0	0.47	ng/Kg		0	Tissue	0.47
	1,2,3,6,7,8-HxCDD	3.7	0	0.49	ng/Kg	J	0.37	Tissue	0.49
	1,2,3,7,8,9-HxCDD	1.5	0	0.69	ng/Kg	J	0.15	Tissue	0.69
	1,2,3,4,6,7,8-HpCDF	27	0	0.39	ng/Kg		0.27	Tissue	0.39
	1,2,3,4,7,8,9-HpCDF	ND	0	0.5	ng/Kg		0	Tissue	0.5
	1,2,3,4,6,7,8-HpCDD	8.5	0	0.87	ng/Kg		0.085	Tissue	0.87
	OCDF	4.4	0	1	ng/Kg	J	0.0044	Tissue	1
	OCDD	52	0	1.9	ng/Kg		0.052	Tissue	1.9
	Total TCDF	22	0	0.66	ng/Kg		0	Tissue	0.66
	Total TCDD	6.1	0	0.33	ng/Kg		0	Tissue	0.33
	Total PeCDF	29	0	0.34	ng/Kg		0	Tissue	0.34
	Total PeCDD	12	0	0.34	ng/Kg	J	0	Tissue	0.34
	Total HxCDF	47	0	0.27	ng/Kg		0	Tissue	0.27
	Total HxCDD	25	0	0.55	ng/Kg		0	Tissue	0.55
	Total HpCDF	51	0	0.45	ng/Kg		0	Tissue	0.45
	Total HpCDD	23	0	0.87	ng/Kg		0	Tissue	0.87
	TEQ	4.1	0	0	ng/Kg		0	Tissue	0

Client ID	Compound	Result	EMPC	RL	Units	Qualifiers	TEQ	Matrix	EDL
MLS-LV-1 PRE	2,3,7,8-TCDF	0.47	0	0.21	ng/Kg	J	0.047	Tissue	0.21
	2,3,7,8-TCDD	ND	0	0.29	ng/Kg		0	Tissue	0.29
	1,2,3,7,8-PeCDF	ND	0	0.16	ng/Kg		0	Tissue	0.16
	2,3,4,7,8-PeCDF	ND	0	0.16	ng/Kg		0	Tissue	0.16
	1,2,3,7,8-PeCDD	ND	0	0.24	ng/Kg		0	Tissue	0.24
	1,2,3,4,7,8-HxCDF	ND	0	0.24	ng/Kg		0	Tissue	0.24
	1,2,3,6,7,8-HxCDF	ND	0	0.2	ng/Kg		0	Tissue	0.2
	2,3,4,6,7,8-HxCDF	ND	0	0.22	ng/Kg		0	Tissue	0.22
	1,2,3,7,8,9-HxCDF	ND	0	0.36	ng/Kg		0	Tissue	0.36
	1,2,3,4,7,8-HxCDD	ND	0	0.4	ng/Kg		0	Tissue	0.4
	1,2,3,6,7,8-HxCDD	ND	0	0.3	ng/Kg		0	Tissue	0.3
	1,2,3,7,8,9-HxCDD	ND	0	0.39	ng/Kg		0	Tissue	0.39
	1,2,3,4,6,7,8-HpCDF	ND	0	0.4	ng/Kg		0	Tissue	0.4
	1,2,3,4,7,8,9-HpCDF	ND	0	0.57	ng/Kg		0	Tissue	0.57
	1,2,3,4,6,7,8-HpCDD	ND	0	0.48	ng/Kg		0	Tissue	0.48
	OCDF	ND	0	0.87	ng/Kg		0	Tissue	0.87
	OCDD	ND	0	1.3	ng/Kg		0	Tissue	1.3
	Total TCDF	1	0	0.21	ng/Kg	J	0	Tissue	0.21
	Total TCDD	ND	0	0.29	ng/Kg		0	Tissue	0.29
	Total PeCDF	ND	0	0.16	ng/Kg		0	Tissue	0.16
	Total PeCDD	ND	0	0.24	ng/Kg		0	Tissue	0.24
	Total HxCDF	ND	0	0.25	ng/Kg		0	Tissue	0.25
	Total HxCDD	ND	0	0.36	ng/Kg		0	Tissue	0.36
	Total HpCDF	ND	0	0.48	ng/Kg		0	Tissue	0.48
	Total HpCDD	ND	0	0.48	ng/Kg		0	Tissue	0.48
	TEQ	0.047	0	0	ng/Kg		0	Tissue	0
BW15ML-034 COMP	2,3,7,8-TCDF	1.9	0	0.38	ng/Kg		0.19	Tissue	0.38
	2,3,7,8-TCDD	0	0.74	0.35	ng/Kg	IJ	0.74	Tissue	0.35
	1,2,3,7,8-PeCDF	0	0.48	0.28	ng/Kg	IJ	0.024	Tissue	0.28
	2,3,4,7,8-PeCDF	1.4	0	0.21	ng/Kg	J	0.7	Tissue	0.21
	1,2,3,7,8-PeCDD	1.6	0	0.33	ng/Kg	J	0.78	Tissue	0.33
	1,2,3,4,7,8-HxCDF	1.2	0	0.3	ng/Kg	J	0.12	Tissue	0.3
	1,2,3,6,7,8-HxCDF	2.3	0	0.3	ng/Kg	J	0.23	Tissue	0.3
	2,3,4,6,7,8-HxCDF	1	0	0.24	ng/Kg	J	0.1	Tissue	0.24
	1,2,3,7,8,9-HxCDF	ND	0	0.22	ng/Kg		0	Tissue	0.22
	1,2,3,4,7,8-HxCDD	ND	0	0.31	ng/Kg		0	Tissue	0.31
	1,2,3,6,7,8-HxCDD	3.8	0	0.48	ng/Kg	J	0.38	Tissue	0.48
	1,2,3,7,8,9-HxCDD	1.7	0	0.55	ng/Kg	J	0.17	Tissue	0.55
	1,2,3,4,6,7,8-HpCDF	20	0	0.45	ng/Kg		0.2	Tissue	0.45
	1,2,3,4,7,8,9-HpCDF	ND	0	0.63	ng/Kg		0	Tissue	0.63
	1,2,3,4,6,7,8-HpCDD	7.8	0	0.65	ng/Kg		0.078	Tissue	0.65
	OCDF	4.6	0	1	ng/Kg	J	0.0046	Tissue	1
	OCDD	70	0	1.5	ng/Kg		0.07	Tissue	1.5
	Total TCDF	24	0	0.38	ng/Kg		0	Tissue	0.38
	Total TCDD	6.8	0	0.35	ng/Kg		0	Tissue	0.35
	Total PeCDF	24	0	0.24	ng/Kg		0	Tissue	0.24
	Total PeCDD	11	0	0.33	ng/Kg	J	0	Tissue	0.33
	Total HxCDF	40	0	0.26	ng/Kg		0	Tissue	0.26
	Total HxCDD	24	0	0.45	ng/Kg		0	Tissue	0.45
	Total HpCDF	40	0	0.54	ng/Kg		0	Tissue	0.54
	Total HpCDD	24	0	0.65	ng/Kg		0	Tissue	0.65
	TEQ	3.8	0	0	ng/Kg		0	Tissue	0

Client ID	Compound	Result	EMPC	RL	Units	Qualifiers	TEQ	Matrix	EDL
BW15ML-010 COMP	2,3,7,8-TCDF	0.92	0	0.21	ng/Kg	J	0.092	Tissue	0.21
	2,3,7,8-TCDD	ND	0	0.36	ng/Kg		0	Tissue	0.36
	1,2,3,7,8-PeCDF	ND	0	0.24	ng/Kg		0	Tissue	0.24
	2,3,4,7,8-PeCDF	0.65	0	0.18	ng/Kg	J	0.32	Tissue	0.18
	1,2,3,7,8-PeCDD	ND	0	0.23	ng/Kg		0	Tissue	0.23
	1,2,3,4,7,8-HxCDF	ND	0	0.33	ng/Kg		0	Tissue	0.33
	1,2,3,6,7,8-HxCDF	ND	0	0.33	ng/Kg		0	Tissue	0.33
	2,3,4,6,7,8-HxCDF	ND	0	0.32	ng/Kg		0	Tissue	0.32
	1,2,3,7,8,9-HxCDF	ND	0	0.4	ng/Kg		0	Tissue	0.4
	1,2,3,4,7,8-HxCDD	ND	0	0.43	ng/Kg		0	Tissue	0.43
	1,2,3,6,7,8-HxCDD	ND	0	0.41	ng/Kg		0	Tissue	0.41
	1,2,3,7,8,9-HxCDD	ND	0	0.35	ng/Kg		0	Tissue	0.35
	1,2,3,4,6,7,8-HpCDF	2.5	0	0.38	ng/Kg	J	0.025	Tissue	0.38
	1,2,3,4,7,8,9-HpCDF	ND	0	0.58	ng/Kg		0	Tissue	0.58
	1,2,3,4,6,7,8-HpCDD	1.3	0	0.65	ng/Kg	J	0.013	Tissue	0.65
	OCDF	1.6	0	1.2	ng/Kg	J	0.0016	Tissue	1.2
	OCDD	11	0	1.8	ng/Kg		0.011	Tissue	1.8
	Total TCDF	21	0	0.21	ng/Kg		0	Tissue	0.21
	Total TCDD	ND	0	0.36	ng/Kg		0	Tissue	0.36
	Total PeCDF	10	0	0.21	ng/Kg	J	0	Tissue	0.21
	Total PeCDD	ND	0	0.23	ng/Kg		0	Tissue	0.23
	Total HxCDF	4.1	0	0.34	ng/Kg	J	0	Tissue	0.34
	Total HxCDD	2.3	0	0.4	ng/Kg	J	0	Tissue	0.4
	Total HpCDF	2.5	0	0.48	ng/Kg	J	0	Tissue	0.48
	Total HpCDD	5	0	0.65	ng/Kg	J	0	Tissue	0.65
	TEQ	0.47	0	0	ng/Kg		0	Tissue	0

Compounds were marked with the qualifier “I” when incorrect isotopes were found during analysis. Compounds were marked with the qualifier “J” when concentrations found were below the calibration range and should be considered estimates.

Appendix Table 28: Metal, PCB, Tetrachloro-m-xylene, Decachlorobiphenyl, and Lipid Analysis for *L. variegatus* tissue following the 28-Day Bioaccumulation Test

Field ID	Parameter	Result	LOD	LOQ	EQL	Units	Code	Matrix
BW15ML-004 REP 1	Percent Moisture	88.6	0.10	0.10	0.10	%		Tissue
	Arsenic	0.91	0.012	0.10	0.10	mg/kg		Tissue
	Cadmium	0.034	0.0064	0.10	0.10	mg/kg	J	Tissue
	Chromium	0.12	0.024	0.10	0.10	mg/kg		Tissue
	Copper	2.2	0.023	0.10	0.10	mg/kg		Tissue
	Lead	0.49	0.0025	0.10	0.10	mg/kg		Tissue
	Nickel	0.12	0.030	0.10	0.10	mg/kg		Tissue
	Zinc	26.5	0.64	2.0	2.0	mg/kg		Tissue
	Mercury	0.0091	0.0048	0.0098	0.0098	mg/kg	J	Tissue
BW15ML-004 REP 2	Percent Moisture	87.9	0.10	0.10	0.10	%		Tissue
	Arsenic	0.98	0.012	0.10	0.10	mg/kg		Tissue
	Cadmium	0.035	0.0064	0.10	0.10	mg/kg	J	Tissue
	Chromium	0.25	0.024	0.10	0.10	mg/kg		Tissue
	Copper	2.3	0.023	0.10	0.10	mg/kg		Tissue
	Lead	0.94	0.0025	0.10	0.10	mg/kg		Tissue
	Nickel	0.20	0.030	0.10	0.10	mg/kg		Tissue
	Zinc	27.2	0.64	2.0	2.0	mg/kg		Tissue
	Mercury	0.0089	0.0044	0.0092	0.0092	mg/kg	J	Tissue
BW15ML-004 REP 3	Percent Moisture	87.2	0.10	0.10	0.10	%		Tissue
	Arsenic	1.1	0.012	0.098	0.098	mg/kg		Tissue
	Cadmium	0.031	0.0063	0.098	0.098	mg/kg	J	Tissue
	Chromium	0.21	0.024	0.098	0.098	mg/kg		Tissue
	Copper	2.6	0.023	0.098	0.098	mg/kg		Tissue
	Lead	0.85	0.0025	0.098	0.098	mg/kg		Tissue
	Nickel	0.17	0.029	0.098	0.098	mg/kg		Tissue
	Zinc	29.4	0.63	2.0	2.0	mg/kg		Tissue
	Mercury	0.011	0.0047	0.0098	0.0098	mg/kg		Tissue
BW15ML-004 REP 4	Percent Moisture	88.2	0.10	0.10	0.10	%		Tissue
	Arsenic	1.1	0.012	0.098	0.098	mg/kg		Tissue
	Cadmium	0.026	0.0063	0.098	0.098	mg/kg	J	Tissue
	Chromium	0.038	0.024	0.098	0.098	mg/kg	J	Tissue
	Copper	2.1	0.023	0.098	0.098	mg/kg		Tissue
	Lead	0.25	0.0025	0.098	0.098	mg/kg		Tissue
	Nickel	0.069	0.030	0.098	0.098	mg/kg	J	Tissue
	Zinc	28.0	0.63	2.0	2.0	mg/kg		Tissue
	Mercury	0.0090	0.0047	0.0098	0.0098	mg/kg	J	Tissue
BW15ML-004 REP 5	Percent Moisture	87.5	0.10	0.10	0.10	%		Tissue
	Arsenic	0.97	0.012	0.094	0.094	mg/kg		Tissue
	Cadmium	0.033	0.0060	0.094	0.094	mg/kg	J	Tissue
	Chromium	0.22	0.023	0.094	0.094	mg/kg		Tissue
	Copper	2.4	0.022	0.094	0.094	mg/kg		Tissue
	Lead	0.99	0.0024	0.094	0.094	mg/kg		Tissue
	Nickel	0.22	0.028	0.094	0.094	mg/kg		Tissue
	Zinc	30.5	0.61	1.9	1.9	mg/kg		Tissue
	Mercury	0.0093	0.0047	0.0097	0.0097	mg/kg	J	Tissue
BW15ML-004 COMP	PCB-1016 (Aroclor 1016)	29.4	29.4	58.9	58.9	ug/kg	U	Tissue
	PCB-1221 (Aroclor 1221)	29.4	29.4	58.9	58.9	ug/kg	U	Tissue
	PCB-1232 (Aroclor 1232)	29.4	29.4	58.9	58.9	ug/kg	U	Tissue
	PCB-1242 (Aroclor 1242)	29.4	29.4	58.9	58.9	ug/kg	U	Tissue
	PCB-1248 (Aroclor 1248)	29.4	29.4	58.9	58.9	ug/kg	U	Tissue
	PCB-1254 (Aroclor 1254)	29.4	29.4	58.9	58.9	ug/kg	U	Tissue
	PCB-1260 (Aroclor 1260)	368	29.4	58.9	58.9	ug/kg		Tissue
	PCB-1262 (Aroclor 1262)	29.4	29.4	58.9	58.9	ug/kg	U	Tissue
	PCB-1268 (Aroclor 1268)	29.4	29.4	58.9	58.9	ug/kg	U	Tissue
	PCB, Total	368	29.4	58.9	58.9	ug/kg		Tissue
	Tetrachloro-m-xylene (S)	86				%		Tissue
	Decachlorobiphenyl (S)	84				%		Tissue
	Lipid	1.6				%		Tissue

Field ID	Parameter	Result	LOD	LOQ	EQL	Units	Code	Matrix
BW15ML-032 REP 1	Percent Moisture	87.7	0.10	0.10	0.10	%		Tissue
	Arsenic	1.1	0.012	0.099	0.099	mg/kg		Tissue
	Cadmium	0.041	0.0063	0.099	0.099	mg/kg	J	Tissue
	Chromium	0.45	0.024	0.099	0.099	mg/kg		Tissue
	Copper	3.1	0.023	0.099	0.099	mg/kg		Tissue
	Lead	1.2	0.0025	0.099	0.099	mg/kg		Tissue
	Nickel	0.36	0.030	0.099	0.099	mg/kg		Tissue
	Zinc	29.2	0.63	2.0	2.0	mg/kg		Tissue
	Mercury	0.012	0.0048	0.010	0.010	mg/kg		Tissue
BW15ML-032 REP 2	Percent Moisture	88.1	0.10	0.10	0.10	%		Tissue
	Arsenic	1.2	0.011	0.094	0.094	mg/kg		Tissue
	Cadmium	0.043	0.0060	0.094	0.094	mg/kg	J	Tissue
	Chromium	0.62	0.023	0.094	0.094	mg/kg		Tissue
	Copper	2.7	0.022	0.094	0.094	mg/kg		Tissue
	Lead	1.9	0.0024	0.094	0.094	mg/kg		Tissue
	Nickel	0.51	0.028	0.094	0.094	mg/kg		Tissue
	Zinc	28.7	0.60	1.9	1.9	mg/kg		Tissue
	Mercury	0.012	0.0048	0.0099	0.0099	mg/kg		Tissue
BW15ML-032 REP 3	Percent Moisture	86.8	0.10	0.10	0.10	%		Tissue
	Arsenic	1.3	0.012	0.095	0.095	mg/kg		Tissue
	Cadmium	0.045	0.0060	0.095	0.095	mg/kg	J	Tissue
	Chromium	0.58	0.023	0.095	0.095	mg/kg		Tissue
	Copper	3.0	0.022	0.095	0.095	mg/kg		Tissue
	Lead	1.6	0.0024	0.095	0.095	mg/kg		Tissue
	Nickel	1.8	0.028	0.095	0.095	mg/kg		Tissue
	Zinc	31.2	0.61	1.9	1.9	mg/kg		Tissue
	Mercury	0.013	0.0048	0.0099	0.0099	mg/kg		Tissue
BW15ML-032 REP 4	Percent Moisture	87.8	0.10	0.10	0.10	%		Tissue
	Arsenic	1.2	0.012	0.10	0.10	mg/kg		Tissue
	Cadmium	0.036	0.0064	0.10	0.10	mg/kg	J	Tissue
	Chromium	0.26	0.024	0.10	0.10	mg/kg		Tissue
	Copper	2.4	0.023	0.10	0.10	mg/kg		Tissue
	Lead	0.68	0.0025	0.10	0.10	mg/kg		Tissue
	Nickel	0.21	0.030	0.10	0.10	mg/kg		Tissue
	Zinc	27.0	0.64	2.0	2.0	mg/kg		Tissue
	Mercury	0.012	0.0048	0.0098	0.0098	mg/kg		Tissue
BW15ML-032 REP 5	Percent Moisture	87.5	0.10	0.10	0.10	%		Tissue
	Arsenic	1.2	0.011	0.091	0.091	mg/kg		Tissue
	Cadmium	0.027	0.0058	0.091	0.091	mg/kg	J	Tissue
	Chromium	0.086	0.022	0.091	0.091	mg/kg	J	Tissue
	Copper	2.5	0.021	0.091	0.091	mg/kg		Tissue
	Lead	0.31	0.0023	0.091	0.091	mg/kg		Tissue
	Nickel	0.093	0.027	0.091	0.091	mg/kg		Tissue
	Zinc	27.8	0.58	1.8	1.8	mg/kg		Tissue
	Mercury	0.0084	0.0045	0.0094	0.0094	mg/kg	J	Tissue
BW15ML-032 COMP	PCB-1016 (Aroclor 1016)	60.3	60.3	121	121	ug/kg	U	Tissue
	PCB-1221 (Aroclor 1221)	60.3	60.3	121	121	ug/kg	U	Tissue
	PCB-1232 (Aroclor 1232)	60.3	60.3	121	121	ug/kg	U	Tissue
	PCB-1242 (Aroclor 1242)	60.3	60.3	121	121	ug/kg	U	Tissue
	PCB-1248 (Aroclor 1248)	60.3	60.3	121	121	ug/kg	U	Tissue
	PCB-1254 (Aroclor 1254)	60.3	60.3	121	121	ug/kg	U	Tissue
	PCB-1260 (Aroclor 1260)	1120	60.3	121	121	ug/kg		Tissue
	PCB-1262 (Aroclor 1262)	60.3	60.3	121	121	ug/kg	U	Tissue
	PCB-1268 (Aroclor 1268)	60.3	60.3	121	121	ug/kg	U	Tissue
	PCB, Total	1120	60.3	121	121	ug/kg		Tissue
	Tetrachloro-m-xylene (S)	82				%		Tissue
	Decachlorobiphenyl (S)	86				%		Tissue
	Lipid	1.6				%		Tissue

Field ID	Parameter	Result	LOD	LOQ	EQL	Units	Code	Matrix
BW15ML-034 REP 1	Percent Moisture	86.7	0.10	0.10	0.10	%		Tissue
	Arsenic	1.1	0.012	0.097	0.097	mg/kg		Tissue
	Cadmium	0.030	0.0062	0.097	0.097	mg/kg	J	Tissue
	Chromium	0.20	0.024	0.097	0.097	mg/kg		Tissue
	Copper	2.2	0.022	0.097	0.097	mg/kg		Tissue
	Lead	0.48	0.0024	0.097	0.097	mg/kg		Tissue
	Nickel	0.19	0.029	0.097	0.097	mg/kg		Tissue
	Zinc	26.5	0.62	1.9	1.9	mg/kg		Tissue
	Mercury	0.012	0.0048	0.010	0.010	mg/kg		Tissue
BW15ML-034 REP 2	Percent Moisture	86.8	0.10	0.10	0.10	%		Tissue
	Arsenic	1.2	0.011	0.093	0.093	mg/kg		Tissue
	Cadmium	0.038	0.0059	0.093	0.093	mg/kg	J	Tissue
	Chromium	0.36	0.023	0.093	0.093	mg/kg		Tissue
	Copper	2.5	0.022	0.093	0.093	mg/kg		Tissue
	Lead	0.85	0.0023	0.093	0.093	mg/kg		Tissue
	Nickel	0.29	0.028	0.093	0.093	mg/kg		Tissue
	Zinc	28.0	0.60	1.9	1.9	mg/kg		Tissue
	Mercury	0.012	0.0048	0.0098	0.0098	mg/kg		Tissue
BW15ML-034 REP 3	Percent Moisture	87.2	0.10	0.10	0.10	%		Tissue
	Arsenic	1.2	0.012	0.098	0.098	mg/kg		Tissue
	Cadmium	0.026	0.0063	0.098	0.098	mg/kg	J	Tissue
	Chromium	0.13	0.024	0.098	0.098	mg/kg		Tissue
	Copper	2.4	0.023	0.098	0.098	mg/kg		Tissue
	Lead	0.38	0.0025	0.098	0.098	mg/kg		Tissue
	Nickel	0.13	0.029	0.098	0.098	mg/kg		Tissue
	Zinc	27.1	0.63	2.0	2.0	mg/kg		Tissue
	Mercury	0.0095	0.0046	0.0095	0.0095	mg/kg	J	Tissue
BW15ML-034 REP 4	Percent Moisture	86.3	0.10	0.10	0.10	%		Tissue
	Arsenic	1.3	0.012	0.099	0.099	mg/kg		Tissue
	Cadmium	0.029	0.0063	0.099	0.099	mg/kg	J	Tissue
	Chromium	0.16	0.024	0.099	0.099	mg/kg		Tissue
	Copper	2.4	0.023	0.099	0.099	mg/kg		Tissue
	Lead	0.46	0.0025	0.099	0.099	mg/kg		Tissue
	Nickel	0.16	0.030	0.099	0.099	mg/kg		Tissue
	Zinc	29.5	0.64	2.0	2.0	mg/kg		Tissue
	Mercury	0.011	0.0046	0.0096	0.0096	mg/kg		Tissue
BW15ML-034 REP 5	Percent Moisture	87.2	0.10	0.10	0.10	%		Tissue
	Arsenic	1.3	0.011	0.090	0.090	mg/kg		Tissue
	Cadmium	0.028	0.0058	0.090	0.090	mg/kg	J	Tissue
	Chromium	0.25	0.022	0.090	0.090	mg/kg		Tissue
	Copper	2.5	0.021	0.090	0.090	mg/kg		Tissue
	Lead	0.59	0.0023	0.090	0.090	mg/kg		Tissue
	Nickel	0.22	0.027	0.090	0.090	mg/kg		Tissue
	Zinc	28.9	0.58	1.8	1.8	mg/kg		Tissue
	Mercury	0.011	0.0048	0.0099	0.0099	mg/kg		Tissue
BW15ML-034 COMP	PCB-1016 (Aroclor 1016)	32.0	32.0	63.9	63.9	ug/kg	U	Tissue
	PCB-1221 (Aroclor 1221)	32.0	32.0	63.9	63.9	ug/kg	U	Tissue
	PCB-1232 (Aroclor 1232)	32.0	32.0	63.9	63.9	ug/kg	U	Tissue
	PCB-1242 (Aroclor 1242)	32.0	32.0	63.9	63.9	ug/kg	U	Tissue
	PCB-1248 (Aroclor 1248)	32.0	32.0	63.9	63.9	ug/kg	U	Tissue
	PCB-1254 (Aroclor 1254)	32.0	32.0	63.9	63.9	ug/kg	U	Tissue
	PCB-1260 (Aroclor 1260)	993	32.0	63.9	63.9	ug/kg		Tissue
	PCB-1262 (Aroclor 1262)	32.0	32.0	63.9	63.9	ug/kg	U	Tissue
	PCB-1268 (Aroclor 1268)	32.0	32.0	63.9	63.9	ug/kg	U	Tissue
	PCB, Total	993	32.0	63.9	63.9	ug/kg		Tissue
	Tetrachloro-m-xylene (S)	88				%		Tissue
	Decachlorobiphenyl (S)	91				%		Tissue
	Lipid	1.9				%		Tissue

Field ID	Parameter	Result	LOD	LOQ	EQL	Units	Code	Matrix
BW15ML-010 REP 1	Percent Moisture	88.3	0.10	0.10	0.10	%		Tissue
	Arsenic	1.2	0.011	0.088	0.088	mg/kg		Tissue
	Cadmium	0.015	0.0056	0.088	0.088	mg/kg	J	Tissue
	Chromium	0.086	0.021	0.088	0.088	mg/kg	J	Tissue
	Copper	1.6	0.020	0.088	0.088	mg/kg		Tissue
	Lead	0.18	0.0022	0.088	0.088	mg/kg		Tissue
	Nickel	0.10	0.026	0.088	0.088	mg/kg		Tissue
	Zinc	23.6	0.57	1.8	1.8	mg/kg		Tissue
	Mercury	0.014	0.0044	0.0092	0.0092	mg/kg		Tissue
BW15ML-010 REP 2	Percent Moisture	88.1	0.10	0.10	0.10	%		Tissue
	Arsenic	1.3	0.011	0.093	0.093	mg/kg		Tissue
	Cadmium	0.018	0.0059	0.093	0.093	mg/kg	J	Tissue
	Chromium	0.16	0.023	0.093	0.093	mg/kg		Tissue
	Copper	1.8	0.021	0.093	0.093	mg/kg		Tissue
	Lead	0.39	0.0023	0.093	0.093	mg/kg		Tissue
	Nickel	0.20	0.028	0.093	0.093	mg/kg		Tissue
	Zinc	24.1	0.60	1.9	1.9	mg/kg		Tissue
	Mercury	0.013	0.0047	0.0097	0.0097	mg/kg		Tissue
BW15ML-010 REP 3	Percent Moisture	88.2	0.10	0.10	0.10	%		Tissue
	Arsenic	1.3	0.012	0.096	0.096	mg/kg		Tissue
	Cadmium	0.018	0.0061	0.096	0.096	mg/kg	J	Tissue
	Chromium	0.088	0.023	0.096	0.096	mg/kg	J	Tissue
	Copper	1.8	0.022	0.096	0.096	mg/kg		Tissue
	Lead	0.20	0.0024	0.096	0.096	mg/kg		Tissue
	Nickel	0.13	0.029	0.096	0.096	mg/kg		Tissue
	Zinc	23.1	0.62	1.9	1.9	mg/kg		Tissue
	Mercury	0.014	0.0046	0.0095	0.0095	mg/kg		Tissue
BW15ML-010 REP 4	Percent Moisture	87.8	0.10	0.10	0.10	%		Tissue
	Arsenic	1.3	0.011	0.087	0.087	mg/kg		Tissue
	Cadmium	0.016	0.0056	0.087	0.087	mg/kg	J	Tissue
	Chromium	0.064	0.021	0.087	0.087	mg/kg	J	Tissue
	Copper	1.7	0.020	0.087	0.087	mg/kg		Tissue
	Lead	0.17	0.0022	0.087	0.087	mg/kg		Tissue
	Nickel	0.090	0.026	0.087	0.087	mg/kg		Tissue
	Zinc	25.9	0.56	1.7	1.7	mg/kg		Tissue
	Mercury	0.014	0.0045	0.0093	0.0093	mg/kg		Tissue
BW15ML-010 REP 5	Percent Moisture	88.9	0.10	0.10	0.10	%		Tissue
	Arsenic	1.2	0.012	0.097	0.097	mg/kg		Tissue
	Cadmium	0.014	0.0062	0.097	0.097	mg/kg	J	Tissue
	Chromium	0.061	0.024	0.097	0.097	mg/kg	J	Tissue
	Copper	1.5	0.023	0.097	0.097	mg/kg		Tissue
	Lead	0.15	0.0024	0.097	0.097	mg/kg		Tissue
	Nickel	0.089	0.029	0.097	0.097	mg/kg	J	Tissue
	Zinc	21.6	0.63	1.9	1.9	mg/kg		Tissue
	Mercury	0.013	0.0048	0.010	0.010	mg/kg		Tissue
BW15ML-010 COMP	PCB-1016 (Aroclor 1016)	22.9	22.9	45.8	45.8	ug/kg	U	Tissue
	PCB-1221 (Aroclor 1221)	22.9	22.9	45.8	45.8	ug/kg	U	Tissue
	PCB-1232 (Aroclor 1232)	22.9	22.9	45.8	45.8	ug/kg	U	Tissue
	PCB-1242 (Aroclor 1242)	22.9	22.9	45.8	45.8	ug/kg	U	Tissue
	PCB-1248 (Aroclor 1248)	22.9	22.9	45.8	45.8	ug/kg	U	Tissue
	PCB-1254 (Aroclor 1254)	22.9	22.9	45.8	45.8	ug/kg	U	Tissue
	PCB-1260 (Aroclor 1260)	480	22.9	45.8	45.8	ug/kg		Tissue
	PCB-1262 (Aroclor 1262)	22.9	22.9	45.8	45.8	ug/kg	U	Tissue
	PCB-1268 (Aroclor 1268)	22.9	22.9	45.8	45.8	ug/kg	U	Tissue
	PCB, Total	480	22.9	45.8	45.8	ug/kg		Tissue
	Tetrachloro-m-xylene (S)	90				%		Tissue
	Decachlorobiphenyl (S)	90				%		Tissue
	Lipid	1.5				%		Tissue

Field ID	Parameter	Result	LOD	LOQ	EQL	Units	Code	Matrix
MLS-LV-1 PRE	Percent Moisture	84.2	0.10	0.10	0.10	%		Tissue
	Arsenic	0.16	0.012	0.10	0.10	mg/kg		Tissue
	Cadmium	0.040	0.0064	0.10	0.10	mg/kg	J	Tissue
	Chromium	0.063	0.024	0.10	0.10	mg/kg	J	Tissue
	Copper	2.5	0.023	0.10	0.10	mg/kg		Tissue
	Lead	0.25	0.0025	0.10	0.10	mg/kg		Tissue
	Nickel	0.17	0.030	0.10	0.10	mg/kg		Tissue
	Zinc	28.4	0.64	2.0	2.0	mg/kg		Tissue
	Mercury	0.0048	0.0048	0.010	0.010	mg/kg	U	Tissue
	PCB-1016 (Aroclor 1016)	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	PCB-1221 (Aroclor 1221)	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	PCB-1232 (Aroclor 1232)	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	PCB-1242 (Aroclor 1242)	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	PCB-1248 (Aroclor 1248)	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	PCB-1254 (Aroclor 1254)	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	PCB-1260 (Aroclor 1260)	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	PCB-1262 (Aroclor 1262)	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	PCB-1268 (Aroclor 1268)	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	PCB, Total	16.4	16.4	32.8	32.8	ug/kg	U	Tissue
	Tetrachloro-m-xylene (S)	85				%		Tissue
	Decachlorobiphenyl (S)	87				%		Tissue
	Lipid	2.1				%		Tissue

Compounds were marked with the code “J” when concentrations found were at or above the limit of detection (LOD) and below the limit of quantitation (LOQ). They are considered estimates. Compounds were marked with the code “U” when the compound was analyzed for, but not detected at or above the adjusted LOD.

Appendix Table 29: Pace Analytical Results from Sediment Analysis for Metals and PCBs

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-038-0-0.15' **Lab ID: 10334678001** Collected: 12/28/15 13:10 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	85.9	15.0	1	12/29/15 10:29	01/07/16 21:13	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	85.9	35.1	1	12/29/15 10:29	01/07/16 21:13	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	85.9	15.6	1	12/29/15 10:29	01/07/16 21:13	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	85.9	40.1	1	12/29/15 10:29	01/07/16 21:13	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	85.9	25.9	1	12/29/15 10:29	01/07/16 21:13	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	85.9	9.7	1	12/29/15 10:29	01/07/16 21:13	11097-69-1	
PCB-1260 (Aroclor 1260)	**2110**	ug/kg	85.9	10	1	12/29/15 10:29	01/07/16 21:13	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	85.9	13.2	1	12/29/15 10:29	01/07/16 21:13	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	85.9	9.1	1	12/29/15 10:29	01/07/16 21:13	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	80	%.	52-125		1	12/29/15 10:29	01/07/16 21:13	877-09-8	
Decachlorobiphenyl (S)	74	%.	47-125		1	12/29/15 10:29	01/07/16 21:13	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**9.3**	mg/kg	1.0	0.25	20	12/29/15 09:27	12/29/15 21:49	7440-38-2	
Cadmium	**1.8**	mg/kg	0.17	0.056	20	12/29/15 09:27	12/29/15 21:49	7440-43-9	
Chromium	**44.3**	mg/kg	1.0	0.39	20	12/29/15 09:27	12/29/15 21:49	7440-47-3	
Copper	**74.2**	mg/kg	2.1	0.67	20	12/29/15 09:27	12/29/15 21:49	7440-50-8	
Lead	**110**	mg/kg	0.21	0.090	20	12/29/15 09:27	12/29/15 21:49	7439-92-1	
Nickel	**34.6**	mg/kg	1.0	0.31	20	12/29/15 09:27	12/29/15 21:49	7440-02-0	
Zinc	**425**	mg/kg	10.3	2.8	20	12/29/15 09:27	12/29/15 21:49	7440-66-6	
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**1.4**	mg/kg	0.047	0.016	1	12/29/15 09:11	01/03/16 16:18	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**61.6**	%	0.10	0.10	1		01/07/16 11:43		

REPORT OF LABORATORY ANALYSIS

Pace Analytical
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-032-0-0.15' **Lab ID: 10334678002** Collected: 12/28/15 11:48 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	78.4	13.7	1	12/29/15 10:29	01/07/16 21:29	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	78.4	32.1	1	12/29/15 10:29	01/07/16 21:29	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	78.4	14.2	1	12/29/15 10:29	01/07/16 21:29	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	78.4	36.6	1	12/29/15 10:29	01/07/16 21:29	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	78.4	23.6	1	12/29/15 10:29	01/07/16 21:29	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	78.4	8.9	1	12/29/15 10:29	01/07/16 21:29	11097-69-1	
PCB-1260 (Aroclor 1260)	**397**	ug/kg	78.4	9.1	1	12/29/15 10:29	01/07/16 21:29	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	78.4	12.0	1	12/29/15 10:29	01/07/16 21:29	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	78.4	8.3	1	12/29/15 10:29	01/07/16 21:29	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	72	%.	52-125		1	12/29/15 10:29	01/07/16 21:29	877-09-8	
Decachlorobiphenyl (S)	68	%.	47-125		1	12/29/15 10:29	01/07/16 21:29	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**8.5**	mg/kg	0.84	0.20	20	12/29/15 09:27	12/29/15 21:52	7440-38-2	
Cadmium	**1.5**	mg/kg	0.13	0.045	20	12/29/15 09:27	12/29/15 21:52	7440-43-9	
Chromium	**40.6**	mg/kg	0.84	0.32	20	12/29/15 09:27	12/29/15 21:52	7440-47-3	
Copper	**43.5**	mg/kg	1.7	0.54	20	12/29/15 09:27	12/29/15 21:52	7440-50-8	
Lead	**99.8**	mg/kg	0.17	0.073	20	12/29/15 09:27	12/29/15 21:52	7439-92-1	
Nickel	**32.3**	mg/kg	0.84	0.25	20	12/29/15 09:27	12/29/15 21:52	7440-02-0	
Zinc	**375**	mg/kg	8.4	2.2	20	12/29/15 09:27	12/29/15 21:52	7440-66-6	
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**0.41**	mg/kg	0.046	0.016	1	12/29/15 09:11	01/03/16 16:20	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**57.9**	%	0.10	0.10	1		01/07/16 11:43		

Pace Analytical
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-034-0-0.15' **Lab ID: 10334678003** Collected: 12/28/15 09:35 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	74.6	13.1	1	12/29/15 10:29	01/07/16 21:45	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	74.6	30.5	1	12/29/15 10:29	01/07/16 21:45	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	74.6	13.6	1	12/29/15 10:29	01/07/16 21:45	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	74.6	34.8	1	12/29/15 10:29	01/07/16 21:45	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	74.6	22.5	1	12/29/15 10:29	01/07/16 21:45	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	74.6	8.5	1	12/29/15 10:29	01/07/16 21:45	11097-69-1	
PCB-1260 (Aroclor 1260)	**451**	ug/kg	74.6	8.7	1	12/29/15 10:29	01/07/16 21:45	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	74.6	11.5	1	12/29/15 10:29	01/07/16 21:45	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	74.6	7.9	1	12/29/15 10:29	01/07/16 21:45	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	81	%.	52-125		1	12/29/15 10:29	01/07/16 21:45	877-09-8	
Decachlorobiphenyl (S)	72	%.	47-125		1	12/29/15 10:29	01/07/16 21:45	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**7.4**	mg/kg	0.79	0.19	20	12/29/15 09:27	12/29/15 21:55	7440-38-2	
Cadmium	**1.3**	mg/kg	0.13	0.043	20	12/29/15 09:27	12/29/15 21:55	7440-43-9	
Chromium	**38.5**	mg/kg	0.79	0.30	20	12/29/15 09:27	12/29/15 21:55	7440-47-3	
Copper	**42.3**	mg/kg	1.6	0.51	20	12/29/15 09:27	12/29/15 21:55	7440-50-8	
Lead	**81.4**	mg/kg	0.16	0.069	20	12/29/15 09:27	12/29/15 21:55	7439-92-1	
Nickel	**32.0**	mg/kg	0.79	0.24	20	12/29/15 09:27	12/29/15 21:55	7440-02-0	
Zinc	**307**	mg/kg	7.9	2.1	20	12/29/15 09:27	12/29/15 21:55	7440-66-6	
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**0.45**	mg/kg	0.039	0.013	1	12/29/15 09:11	01/03/16 16:22	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**55.7**	%	0.10	0.10	1		01/07/16 11:43		

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-037-0-0.15' **Lab ID: 10334678004** Collected: 12/28/15 11:20 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	**ND**	ug/kg	103	18.1	1	12/29/15 10:29	01/07/16 22:01	12674-11-2	
PCB-1221 (Aroclor 1221)	**ND**	ug/kg	103	42.3	1	12/29/15 10:29	01/07/16 22:01	11104-28-2	
PCB-1232 (Aroclor 1232)	**ND**	ug/kg	103	18.8	1	12/29/15 10:29	01/07/16 22:01	11141-16-5	
PCB-1242 (Aroclor 1242)	**ND**	ug/kg	103	48.3	1	12/29/15 10:29	01/07/16 22:01	53469-21-9	
PCB-1248 (Aroclor 1248)	**ND**	ug/kg	103	31.1	1	12/29/15 10:29	01/07/16 22:01	12672-29-6	
PCB-1254 (Aroclor 1254)	**ND**	ug/kg	103	11.7	1	12/29/15 10:29	01/07/16 22:01	11097-69-1	
PCB-1260 (Aroclor 1260)	**333**	ug/kg	103	12.0	1	12/29/15 10:29	01/07/16 22:01	11096-82-5	
PCB-1262 (Aroclor 1262)	**ND**	ug/kg	103	15.9	1	12/29/15 10:29	01/07/16 22:01	37324-23-5	
PCB-1268 (Aroclor 1268)	**ND**	ug/kg	103	10.9	1	12/29/15 10:29	01/07/16 22:01	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	81	%.	52-125		1	12/29/15 10:29	01/07/16 22:01	877-09-8	
Decachlorobiphenyl (S)	82	%.	47-125		1	12/29/15 10:29	01/07/16 22:01	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**7.2**	mg/kg	1.1	0.28	20	12/29/15 09:27	12/29/15 22:18	7440-38-2	
Cadmium	**0.91**	mg/kg	0.18	0.062	20	12/29/15 09:27	12/29/15 22:18	7440-43-9	
Chromium	**44.6**	mg/kg	1.1	0.43	20	12/29/15 09:27	12/29/15 22:18	7440-47-3	
Copper	**42.3**	mg/kg	2.3	0.74	20	12/29/15 09:27	12/29/15 22:18	7440-50-8	
Lead	**57.5**	mg/kg	0.23	0.099	20	12/29/15 09:27	12/29/15 22:18	7439-92-1	
Nickel	**37.3**	mg/kg	1.1	0.35	20	12/29/15 09:27	12/29/15 22:18	7440-02-0	
Zinc	**237**	mg/kg	11.4	3.1	20	12/29/15 09:27	12/29/15 22:18	7440-66-6	
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**0.20**	mg/kg	0.054	0.019	1	12/29/15 09:11	01/03/16 16:24	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**68.1**	%	0.10	0.10	1		01/07/16 11:44		

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-004-0-0.15' **Lab ID: 10334678005** Collected: 12/28/15 14:40 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	88.6	15.5	1	12/29/15 10:29	01/07/16 22:17	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	88.6	36.3	1	12/29/15 10:29	01/07/16 22:17	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	88.6	16.1	1	12/29/15 10:29	01/07/16 22:17	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	88.6	41.4	1	12/29/15 10:29	01/07/16 22:17	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	88.6	26.7	1	12/29/15 10:29	01/07/16 22:17	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	88.6	10.0	1	12/29/15 10:29	01/07/16 22:17	11097-69-1	
PCB-1260 (Aroclor 1260)	**176**	ug/kg	88.6	10.3	1	12/29/15 10:29	01/07/16 22:17	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	88.6	13.6	1	12/29/15 10:29	01/07/16 22:17	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	88.6	9.4	1	12/29/15 10:29	01/07/16 22:17	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	76	%.	52-125		1	12/29/15 10:29	01/07/16 22:17	877-09-8	
Decachlorobiphenyl (S)	85	%.	47-125		1	12/29/15 10:29	01/07/16 22:17	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**14.0**	mg/kg	1.3	0.31	20	12/29/15 09:27	12/29/15 22:20	7440-38-2	
Cadmium	**1.6**	mg/kg	0.20	0.068	20	12/29/15 09:27	12/29/15 22:20	7440-43-9	
Chromium	**39.6**	mg/kg	1.3	0.47	20	12/29/15 09:27	12/29/15 22:20	7440-47-3	
Copper	**46.4**	mg/kg	2.5	0.81	20	12/29/15 09:27	12/29/15 22:20	7440-50-8	
Lead	**162**	mg/kg	0.25	0.11	20	12/29/15 09:27	12/29/15 22:20	7439-92-1	
Nickel	**30.3**	mg/kg	1.3	0.38	20	12/29/15 09:27	12/29/15 22:20	7440-02-0	
Zinc	**522**	mg/kg	12.5	3.4	20	12/29/15 09:27	12/29/15 22:20	7440-66-6	
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**0.36**	mg/kg	0.046	0.016	1	12/29/15 09:11	01/03/16 16:27	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**62.8**	%	0.10	0.10	1		01/07/16 11:44		

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-018-0-0.15' **Lab ID: 10334678006** Collected: 12/28/15 10:14 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	89.0	15.6	1	12/29/15 10:29	01/07/16 22:33	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	89.0	36.4	1	12/29/15 10:29	01/07/16 22:33	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	89.0	16.2	1	12/29/15 10:29	01/07/16 22:33	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	89.0	41.5	1	12/29/15 10:29	01/07/16 22:33	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	89.0	26.8	1	12/29/15 10:29	01/07/16 22:33	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	89.0	10.1	1	12/29/15 10:29	01/07/16 22:33	11097-69-1	
PCB-1260 (Aroclor 1260)	**289**	ug/kg	89.0	10.4	1	12/29/15 10:29	01/07/16 22:33	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	89.0	13.7	1	12/29/15 10:29	01/07/16 22:33	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	89.0	9.4	1	12/29/15 10:29	01/07/16 22:33	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	74	%.	52-125		1	12/29/15 10:29	01/07/16 22:33	877-09-8	
Decachlorobiphenyl (S)	72	%.	47-125		1	12/29/15 10:29	01/07/16 22:33	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**8.2**	mg/kg	1.1	0.27	20	12/29/15 09:27	12/29/15 22:23	7440-38-2	
Cadmium	**1.1**	mg/kg	0.18	0.060	20	12/29/15 09:27	12/29/15 22:23	7440-43-9	
Chromium	**33.9**	mg/kg	1.1	0.41	20	12/29/15 09:27	12/29/15 22:23	7440-47-3	
Copper	**42.6**	mg/kg	2.2	0.71	20	12/29/15 09:27	12/29/15 22:23	7440-50-8	
Lead	**81.0**	mg/kg	0.22	0.095	20	12/29/15 09:27	12/29/15 22:23	7439-92-1	
Nickel	**28.6**	mg/kg	1.1	0.33	20	12/29/15 09:27	12/29/15 22:23	7440-02-0	
Zinc	**285**	mg/kg	11.0	2.9	20	12/29/15 09:27	12/29/15 22:23	7440-66-6	
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**0.34**	mg/kg	0.049	0.017	1	12/29/15 09:11	01/03/16 16:29	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**62.9**	%	0.10	0.10	1		01/07/16 11:44		

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-010-0-0.15' **Lab ID: 10334678007** Collected: 12/28/15 14:08 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	106	18.6	1	12/29/15 10:29	01/07/16 23:20	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	106	43.5	1	12/29/15 10:29	01/07/16 23:20	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	106	19.3	1	12/29/15 10:29	01/07/16 23:20	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	106	49.6	1	12/29/15 10:29	01/07/16 23:20	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	106	32.0	1	12/29/15 10:29	01/07/16 23:20	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	106	12.0	1	12/29/15 10:29	01/07/16 23:20	11097-69-1	
PCB-1260 (Aroclor 1260)	**307**	ug/kg	106	12.4	1	12/29/15 10:29	01/07/16 23:20	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	106	16.3	1	12/29/15 10:29	01/07/16 23:20	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	106	11.2	1	12/29/15 10:29	01/07/16 23:20	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	81	%.	52-125		1	12/29/15 10:29	01/07/16 23:20	877-09-8	
Decachlorobiphenyl (S)	74	%.	47-125		1	12/29/15 10:29	01/07/16 23:20	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**7.1**	mg/kg	1.2	0.30	20	12/29/15 09:27	12/29/15 21:57	7440-38-2	
Cadmium	**0.96**	mg/kg	0.19	0.066	20	12/29/15 09:27	12/29/15 21:57	7440-43-9	
Chromium	**46.1**	mg/kg	1.2	0.46	20	12/29/15 09:27	12/29/15 21:57	7440-47-3	M6
Copper	**53.9**	mg/kg	2.4	0.78	20	12/29/15 09:27	12/29/15 21:57	7440-50-8	
Lead	**58.1**	mg/kg	0.24	0.11	20	12/29/15 09:27	12/29/15 21:57	7439-92-1	
Nickel	**44.1**	mg/kg	1.2	0.37	20	12/29/15 09:27	12/29/15 21:57	7440-02-0	
Zinc	**234**	mg/kg	12.1	3.2	20	12/29/15 09:27	12/29/15 21:57	7440-66-6	M6
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**0.20**	mg/kg	0.064	0.022	1	12/29/15 09:11	01/03/16 16:39	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**69.0**	%	0.10	0.10	1		01/07/16 11:44		

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-022-0-0.15' **Lab ID: 10334678008** Collected: 12/28/15 10:45 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	50.6	8.9	1	12/29/15 10:29	01/07/16 23:36	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	50.6	20.7	1	12/29/15 10:29	01/07/16 23:36	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	50.6	9.2	1	12/29/15 10:29	01/07/16 23:36	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	50.6	23.6	1	12/29/15 10:29	01/07/16 23:36	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	50.6	15.2	1	12/29/15 10:29	01/07/16 23:36	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	50.6	5.7	1	12/29/15 10:29	01/07/16 23:36	11097-69-1	
PCB-1260 (Aroclor 1260)	**86.9**	ug/kg	50.6	5.9	1	12/29/15 10:29	01/07/16 23:36	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	50.6	7.8	1	12/29/15 10:29	01/07/16 23:36	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	50.6	5.3	1	12/29/15 10:29	01/07/16 23:36	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	75	%.	52-125		1	12/29/15 10:29	01/07/16 23:36	877-09-8	
Decachlorobiphenyl (S)	75	%.	47-125		1	12/29/15 10:29	01/07/16 23:36	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**2.7**	mg/kg	0.63	0.15	20	12/29/15 09:27	12/29/15 22:25	7440-38-2	
Cadmium	**0.21**	mg/kg	0.10	0.034	20	12/29/15 09:27	12/29/15 22:25	7440-43-9	
Chromium	**30.3**	mg/kg	0.63	0.24	20	12/29/15 09:27	12/29/15 22:25	7440-47-3	
Copper	**29.1**	mg/kg	1.3	0.41	20	12/29/15 09:27	12/29/15 22:25	7440-50-8	
Lead	**12.2**	mg/kg	0.13	0.055	20	12/29/15 09:27	12/29/15 22:25	7439-92-1	
Nickel	**64.3**	mg/kg	0.63	0.19	20	12/29/15 09:27	12/29/15 22:25	7440-02-0	
Zinc	**70.5**	mg/kg	6.3	1.7	20	12/29/15 09:27	12/29/15 22:25	7440-66-6	
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**0.029**	mg/kg	0.028	0.0097	1	12/29/15 09:11	01/03/16 16:45	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**34.7**	%	0.10	0.10	1		01/07/16 11:45		

REPORT OF LABORATORY ANALYSIS

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-006-0-0.15' **Lab ID: 10334678009** Collected: 12/28/15 13:35 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	105	18.3	1	12/29/15 10:29	01/07/16 23:52	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	105	42.8	1	12/29/15 10:29	01/07/16 23:52	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	105	19.0	1	12/29/15 10:29	01/07/16 23:52	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	105	48.9	1	12/29/15 10:29	01/07/16 23:52	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	105	31.5	1	12/29/15 10:29	01/07/16 23:52	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	105	11.9	1	12/29/15 10:29	01/07/16 23:52	11097-69-1	
PCB-1260 (Aroclor 1260)	**764**	ug/kg	105	12.2	1	12/29/15 10:29	01/07/16 23:52	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	105	16.1	1	12/29/15 10:29	01/07/16 23:52	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	105	11.1	1	12/29/15 10:29	01/07/16 23:52	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	81	%.	52-125		1	12/29/15 10:29	01/07/16 23:52	877-09-8	
Decachlorobiphenyl (S)	70	%.	47-125		1	12/29/15 10:29	01/07/16 23:52	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**6.9**	mg/kg	1.1	0.27	20	12/29/15 09:27	12/29/15 22:30	7440-38-2	
Cadmium	**1.1**	mg/kg	0.18	0.061	20	12/29/15 09:27	12/29/15 22:30	7440-43-9	
Chromium	**42.7**	mg/kg	1.1	0.43	20	12/29/15 09:27	12/29/15 22:30	7440-47-3	M6
Copper	**61.0**	mg/kg	2.3	0.73	20	12/29/15 09:27	12/29/15 22:30	7440-50-8	M6
Lead	**73.8**	mg/kg	0.23	0.098	20	12/29/15 09:27	12/29/15 22:30	7439-92-1	M6
Nickel	**43.0**	mg/kg	1.1	0.34	20	12/29/15 09:27	12/29/15 22:30	7440-02-0	
Zinc	**261**	mg/kg	11.3	3.0	20	12/29/15 09:27	12/29/15 22:30	7440-66-6	M6
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**0.22**	mg/kg	0.059	0.021	1	12/29/15 09:11	01/03/16 16:47	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**68.5**	%	0.10	0.10	1		01/07/16 11:45		

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: J150329 SLR Sediment AOCs
Pace Project No.: 10334678

Sample: BW15ML-110-0-0.15' **Lab ID: 10334678010** Collected: 12/28/15 14:08 Received: 12/28/15 18:15 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
8082A GCS PCB	Analytical Method: EPA 8082A Preparation Method: EPA 3550								
PCB-1016 (Aroclor 1016)	ND	ug/kg	108	18.9	1	12/29/15 10:29	01/08/16 00:08	12674-11-2	
PCB-1221 (Aroclor 1221)	ND	ug/kg	108	44.2	1	12/29/15 10:29	01/08/16 00:08	11104-28-2	
PCB-1232 (Aroclor 1232)	ND	ug/kg	108	19.6	1	12/29/15 10:29	01/08/16 00:08	11141-16-5	
PCB-1242 (Aroclor 1242)	ND	ug/kg	108	50.4	1	12/29/15 10:29	01/08/16 00:08	53469-21-9	
PCB-1248 (Aroclor 1248)	ND	ug/kg	108	32.5	1	12/29/15 10:29	01/08/16 00:08	12672-29-6	
PCB-1254 (Aroclor 1254)	ND	ug/kg	108	12.2	1	12/29/15 10:29	01/08/16 00:08	11097-69-1	
PCB-1260 (Aroclor 1260)	**285**	ug/kg	108	12.6	1	12/29/15 10:29	01/08/16 00:08	11096-82-5	
PCB-1262 (Aroclor 1262)	ND	ug/kg	108	16.6	1	12/29/15 10:29	01/08/16 00:08	37324-23-5	
PCB-1268 (Aroclor 1268)	ND	ug/kg	108	11.4	1	12/29/15 10:29	01/08/16 00:08	11100-14-4	
Surrogates									
Tetrachloro-m-xylene (S)	75	%.	52-125		1	12/29/15 10:29	01/08/16 00:08	877-09-8	
Decachlorobiphenyl (S)	73	%.	47-125		1	12/29/15 10:29	01/08/16 00:08	2051-24-3	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3050								
Arsenic	**7.0**	mg/kg	1.2	0.28	20	12/29/15 09:27	12/29/15 22:28	7440-38-2	
Cadmium	**0.91**	mg/kg	0.19	0.063	20	12/29/15 09:27	12/29/15 22:28	7440-43-9	
Chromium	**46.5**	mg/kg	1.2	0.44	20	12/29/15 09:27	12/29/15 22:28	7440-47-3	
Copper	**53.0**	mg/kg	2.3	0.75	20	12/29/15 09:27	12/29/15 22:28	7440-50-8	
Lead	**58.7**	mg/kg	0.23	0.10	20	12/29/15 09:27	12/29/15 22:28	7439-92-1	
Nickel	**43.8**	mg/kg	1.2	0.35	20	12/29/15 09:27	12/29/15 22:28	7440-02-0	
Zinc	**230**	mg/kg	11.6	3.1	20	12/29/15 09:27	12/29/15 22:28	7440-66-6	
7471B Mercury	Analytical Method: EPA 7471B Preparation Method: EPA 7471B								
Mercury	**0.21**	mg/kg	0.063	0.022	1	12/29/15 09:11	01/03/16 16:53	7439-97-6	
	Analytical Method: ASTM D2974								
Percent Moisture	**69.4**	%	0.10	0.10	1		01/07/16 11:45		

Appendix 2

Statistical Analysis Data

Appendix Table 30: *H. azteca* Survival Statistics

One Way Analysis of Variance Monday, April 18, 2016, 3:29:33 PM

Data source: Data 1 in HA_Surviv.SNB

Normality Test: Failed (P < 0.050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks Monday, April 18, 2016, 3:29:33 PM

Data source: Data 1 in HA_Surviv.SNB

Group	N	Missing	Median	25%	75%
HB	8	0	9.500	9.000	10.000
HC	8	0	9.000	8.000	10.000
HD	8	0	9.000	8.500	10.000
HE	8	0	10.000	10.000	10.000
HF	8	0	9.000	9.000	10.000
HG	8	0	9.000	8.500	9.000
HH	8	0	8.000	7.500	8.500
HI	8	0	9.500	8.500	10.000
HJ	8	0	10.000	9.500	10.000
HK	8	0	8.000	7.000	9.000

H = 21.998 with 9 degrees of freedom. (P = 0.009)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0.009)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method) :

Comparison	Diff of Ranks	Q	P<0.05
HH vs HB	22.875	1.969	No
HK vs HB	21.438	1.845	Do Not Test
HE vs HB	15.813	1.361	Do Not Test
HG vs HB	10.875	0.936	Do Not Test
HJ vs HB	10.313	0.888	Do Not Test
HC vs HB	5.250	0.452	Do Not Test
HD vs HB	4.250	0.366	Do Not Test
HF vs HB	3.313	0.285	Do Not Test
HI vs HB	1.250	0.108	Do Not Test

Note: The multiple comparisons on ranks do not include an adjustment for ties.

Appendix Table 31: *H. azteca* Dry Weight Statistics

One Way Analysis of Variance Monday, April 18, 2016, 3:43:20 PM

Data source: Data 1 in HA_weights.SNB

Normality Test: Passed (P = 0.415)

Equal Variance Test: Passed (P = 0.899)

Group Name	N	Missing	Mean	Std Dev	SEM
HB	8	0	0.0663	0.0125	0.00443
HC	8	0	0.0501	0.00730	0.00258
HD	8	0	0.0474	0.0172	0.00610
HE	8	0	0.0792	0.0125	0.00443
HF	8	0	0.0465	0.0106	0.00376
HG	8	0	0.0355	0.0146	0.00515
HH	8	0	0.0473	0.0108	0.00381
HI	8	0	0.0723	0.0105	0.00373
HJ	8	0	0.0631	0.00609	0.00215
HK	8	0	0.0554	0.0114	0.00402

Source of Variation	DF	SS	MS	F	P
Between Groups	9	0.0132	0.00147	10.644	<0.001
Residual	70	0.00968	0.000138		
Total	79	0.0229			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

Multiple Comparisons versus Control Group (Bonferroni t-test):

Comparisons for factor:

Comparison	Diff of Means	t	P	P<0.050
HB vs. HG	0.0308	5.246	<0.001	Yes
HB vs. HF	0.0199	3.377	0.011	Yes
HB vs. HH	0.0190	3.234	0.017	Yes
HB vs. HD	0.0190	3.226	0.017	Yes
HB vs. HC	0.0162	2.752	0.068	No
HB vs. HE	0.0129	2.186	0.289	Do Not Test
HB vs. HK	0.0109	1.862	0.602	Do Not Test
HB vs. HI	0.00597	1.014	1.000	Do Not Test
HB vs. HJ	0.00320	0.544	1.000	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Appendix Table 32: *C. dilutus* Survival Statistics

One Way Analysis of Variance Tuesday, April 19, 2016, 8:30:09 AM

Data source: Data 1 in Chiro_Surv_19Aor2016.SNB

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks Tuesday, April 19, 2016, 8:30:09 AM

Data source: Data 1 in Chiro_Surv_19Aor2016.SNB

Group	N	Missing	Median	25%	75%
CB	8	0	10.000	10.000	10.000
CC	8	0	9.000	8.000	10.000
CD	8	0	10.000	9.500	10.000
CE	8	0	9.500	9.000	10.000
CF	8	0	9.500	9.000	10.000
CG	8	0	7.500	7.000	9.000
CH	8	0	9.500	8.500	10.000
CI	8	0	10.000	9.000	10.000
CJ	8	0	10.000	10.000	10.000
CK	8	0	10.000	9.000	10.000

H = 27.258 with 9 degrees of freedom. ($P = 0.001$)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference ($P = 0.001$)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method) :

Comparison	Diff of Ranks	Q	P<0.05
CG vs CB	44.500	3.830	Yes
CC vs CB	22.750	1.958	No
CH vs CB	20.563	1.770	Do Not Test
CF vs CB	18.188	1.565	Do Not Test
CE vs CB	16.500	1.420	Do Not Test
CK vs CB	15.188	1.307	Do Not Test
CI vs CB	14.063	1.210	Do Not Test
CD vs CB	8.250	0.710	Do Not Test
CJ vs CB	0.000	0.000	Do Not Test

Note: The multiple comparisons on ranks do not include an adjustment for ties.

Appendix Table 33: *C. dilutus* Ash Free Dry Weight Statistics

One Way Analysis of Variance Tuesday, April 19, 2016, 8:37:21 AM

Data source: Data 1 in Chiro_weights_19Apr2016.SNB

Normality Test: Failed ($P < 0.050$)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks Tuesday, April 19, 2016, 8:37:21 AM

Data source: Data 1 in Chiro_weights_19Apr2016.SNB

Group	N	Missing	Median	25%	75%
CB	8	0	0.660	0.605	0.712
CC	8	0	0.700	0.652	0.765
CD	8	0	0.686	0.671	0.708
CE	8	0	0.848	0.786	0.888
CF	8	0	0.649	0.633	0.712
CG	8	0	0.685	0.603	0.768
CH	8	0	0.646	0.583	0.707
CI	8	0	0.793	0.761	0.862
CJ	8	0	0.736	0.705	0.780
CK	8	0	0.619	0.612	0.648

$H = 32.354$ with 9 degrees of freedom. ($P = <0.001$)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference ($P = <0.001$)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method) :

Comparison	Diff of Ranks	Q	P<0.05
CE vs CB	40.750	3.507	Yes
CI vs CB	34.000	2.926	Yes
CJ vs CB	18.625	1.603	No
CC vs CB	11.500	0.990	Do Not Test
CD vs CB	9.750	0.839	Do Not Test
CG vs CB	6.500	0.559	Do Not Test
CK vs CB	5.875	0.506	Do Not Test
CH vs CB	2.875	0.247	Do Not Test
CF vs CB	1.375	0.118	Do Not Test

Note: The multiple comparisons on ranks do not include an adjustment for ties.

Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Laboratory Data Review Checklist

Doc Type: Data Review

Instructions: The following is the Minnesota Pollution Control Agency's (MPCA) informal checklist that may be used to review data. The information follows the general format of the National Functional Guidelines which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. This checklist should be used in conjunction with the *Laboratory Data Checklist Guidance* (p-eao-11a): http://www.pca.state.mn.us/index.php/view-document.html?gid=16113. Also see the MPCA Laboratory Quality Control (QC) and Data Policy: http://www.pca.state.mn.us/index.php/view-document.html?gid=16288.

Project Information

Project name: J170470 SLR Sediment AOCs

Laboratory: Pace - 10407134

Work order number: 3000019769

Report date (mm/dd/yyyy): 10/31/2017

1. Preservation

For help with this section on holding times, containers and preservatives, refer to the Minnesota Department of Health's website at: http://www.health.state.mn.us/divs/phl/environmental/handbook/internet/envhandbook.html.

Questions			Yes	No	N/A	Comments
a.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
b.	Is there a sample condition form with the report?		☒	☐	☐	
c.	Were there samples requiring preservation?		☐	☒	☐	
	i.	If so, were they properly preserved?	☐	☐	☒	
	ii.	Were they received on ice?	☒	☐	☐	
d.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough extra sample collected to complete method required batch QC?	☒	☐	☐	
e.	Were samples received with adequate holding time for sample prep for all requested analyses?		☒	☐	☐	
f.	Are there notes about sample condition or holding time issues on the COC? Explain impact.		☒	☐	☐	
g.	Is there narration or data qualifiers within the report about sample condition or holding time issues? Explain impact.		☒	☐	☐	

2. Calibration

Question		Yes	No	N/A	Comments
a.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☐	☒	☐	

3. Blanks

Question			Yes	No	N/A	Comments
a.	Do any of the analyses contain samples for field or trip blanks?		☒	☐	☐	One rinsate blank was collected with the samples this SDG.
	i.	If yes, are there target analytes present above the reporting limit?	☐	☒	☐	
	ii.	If yes, are the same compounds also present in the samples? Explain possible impact.	☐	☐	☒	
b.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	
	i.	If yes, are the same compounds present in the samples?	☐	☐	☒	
	ii.	Is the amount of target analyte in the blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☐	☐	☒	

4. Surrogates

Question			Yes	No	N/A	Comments
a.	Are there organic analyses that contain surrogate compounds?		☒	☐	☐	
b.	Are the lab recovery limits specified on the report?		☒	☐	☐	
	i.	Do the lab limits seem reasonable when compared with the suggested guidelines in the MPCA QC Policy?	☒	☐	☐	
c.	Are there surrogates outside lab limits? (These should have a data qualifier)		☒	☐	☐	
	i.	If yes, are the surrogates above the lab limits?	☐	☒	☐	
	ii.	Below the lab limits?	☐	☐	☒	The recovery for tetrachloro-m-xylene of 29% was biased low and outside acceptance criteria of 30-125% in the method blank for associated with batch 2735256.
	iii.	Explain what this could mean for the affected samples.	☐	☐	☒	All surrogate recoveries for the field samples were within acceptance criteria so no qualifiers were applied.

5. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
a.	Are there LCS/LCSD samples present for the reported analyses? (An LCS alone is acceptable if there is an Matrix Spike/Matrix Spike Duplicate [MS/MSD] or sample/sample dup for precision.)		☒	☐	☐	
	i.	If so, do the lab limits seem reasonable compared to the suggested guidelines in the MPCA QC Policy?	☒	☐	☐	
b.	Are there LCS/LCSD compounds outside lab limits? (These should have a data qualifier.)		☐	☒	☐	
	i.	If yes, are the analytes above the lab limits?	☐	☐	☒	

	ii.	Below the lab limits?	☐	☐	☒	
	iii.	Are all samples in the preparation batch also flagged for the same analyte(s)?	☐	☐	☒	
	iv.	Explain what this could mean for the affected samples.	☐	☐	☒	

6. Matrix Spike/Matrix Spike Duplicate/Sample Duplicate (MS/MSD/Dup)

Question				Yes	No	N/A	Comments
a.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.b.			☒	☐	☐	MS/MSDs were performed on samples BW17-42-0.0-0.15, BW17-163-0.15-0.42, and BW17-056-0.0-0.15.
	i.	Have the required matrix spikes been prepared and reported?		☒	☐	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☐	☒	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☐	☐	☒	
	iv.	Are the lab limits specified on the report?		☒	☐	☐	
	v.	Do the limits seem reasonable when compared to the suggested guidelines in the MPCA QC Policy?		☒	☐	☐	
	vi.	Are there compounds outside the lab limits?		☐	☒	☐	
		1.	If yes, are the analytes above the lab limits?	☐	☐	☒	
		2.	Below the lab limits?	☐	☐	☒	
		3.	Is the source sample also flagged for compounds outside lab limits?	☐	☐	☒	
b.	Is a sample duplicate reported for the analytical method(s)? If no, skip to 6.c.			☐	☒	☐	RPDs discussed apply to MS/MSDs.
	i.	Is the RPD for the duplicate pair within the lab limits?		☒	☐	☐	All RPDs were within the acceptance criterion for the MS/MSDs performed.
	ii.	If no, has the associated source sample been flagged?		☐	☐	☒	
c.	What is the impact of failed QC on this project?			☐	☐	☒	

7. Method Detection Limits/Report Limits

Question		Yes	No	N/A	Comments
a.	Are reporting and/or method detection limits clearly listed on the report for all analyses? (may also be called quantitation limits)	☒	☐	☐	

Additional comments on report:

(1) The following samples were collected as blind field duplicates: (a) BW17ML-67-0.15-0.39 and BW17ML-167-0.15-0.39, (b) BW17ML-043-0.15-0.46 and BW17ML-143-0.15-0.46, (c) BW17ML-063-0,15-0.42 and BW17ML-163-0,15-0.42, (d) BW17ML-060-0.15-0.41 and BW17ML-160-015-0.41, (d) BW17ML-049-0.15-0.39 and BW17ML-149-0.15-0.39, (e) BW17ML-050-0.15-0.44 and BW17ML-150-0.15-0.44. Only field duplicate pairs BW17ML-060-0.15-0.41 and BW17ML-160-015-0.41 and BW17ML-049-0.15-0.39 and BW17ML-149-0.15-0.39 had detections. All RPDs were ≤ the QC guideline of 50%. RPDs were calculated only when both results were > the reporting limit.

(2) PCB sample BW17ML-052-0.0-0.15 was analyzed at a 5-fold duilution due to a high concentration of PCB-1260. The reporting limits and method detection limits were adjusted accordingly. Level II reports were reviewed, so calibrations and raw data were not reviewed.

(3) Level 2 lab reports were reviewed so calibrations and raw data were not reviewed.

Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Laboratory Data Review Checklist

Doc Type: Data Review

Instructions: The following is the Minnesota Pollution Control Agency's (MPCA) informal checklist that may be used to review data. The information follows the general format of the National Functional Guidelines which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. This checklist should be used in conjunction with the *Laboratory Data Checklist Guidance* (p-eao-11a): http://www.pca.state.mn.us/index.php/view-document.html?gid=16113. Also see the MPCA Laboratory Quality Control (QC) and Data Policy: http://www.pca.state.mn.us/index.php/view-document.html?gid=16288.

Project Information

Project name: J170470 SLR Sediment AOCs   Laboratory: Pace - 10409348

Work order number: 3000019769   Report date (mm/dd/yyyy): 11/08/2017

1. Preservation

For help with this section on holding times, containers and preservatives, refer to the Minnesota Department of Health's website at: http://www.health.state.mn.us/divs/phl/environmental/handbook/internet/envhandbook.html.

Questions			Yes	No	N/A	Comments
a.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
b.	Is there a sample condition form with the report?		☒	☐	☐	
c.	Were there samples requiring preservation?		☐	☒	☐	
	i.	If so, were they properly preserved?	☐	☐	☒	
	ii.	Were they received on ice?	☒	☐	☐	
d.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough extra sample collected to complete method required batch QC?	☒	☐	☐	
e.	Were samples received with adequate holding time for sample prep for all requested analyses?		☒	☐	☐	
f.	Are there notes about sample condition or holding time issues on the COC? Explain impact.		☐	☒	☐	
g.	Is there narration or data qualifiers within the report about sample condition or holding time issues? Explain impact.		☐	☒	☐	

2. Calibration

Question		Yes	No	N/A	Comments
a.	Do the report narrative or data qualifiers indicate calibration problems for any analyses? If yes, explain the data impact.	☐	☒	☐	

3. Blanks

Question			Yes	No	N/A	Comments
a.	Do any of the analyses contain samples for field or trip blanks?		☐	☒	☐	Trip blanks are not required for TOC analysis.
	i.	If yes, are there target analytes present above the reporting limit?	☐	☐	☒	
	ii.	If yes, are the same compounds also present in the samples? Explain possible impact.	☐	☐	☒	
b.	Do method blanks for any analyses contain target analytes above the reporting limit?		☐	☒	☐	
	i.	If yes, are the same compounds present in the samples?	☐	☐	☒	
	ii.	Is the amount of target analyte in the blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☐	☐	☒	

4. Surrogates

Question			Yes	No	N/A	Comments
a.	Are there organic analyses that contain surrogate compounds?		☐	☒	☐	
b.	Are the lab recovery limits specified on the report?		☐	☐	☒	
	i.	Do the lab limits seem reasonable when compared with the suggested guidelines in the MPCA QC Policy?	☐	☐	☒	
c.	Are there surrogates outside lab limits? (These should have a data qualifier)		☐	☐	☒	
	i.	If yes, are the surrogates above the lab limits?	☐	☐	☒	
	ii.	Below the lab limits?	☐	☐	☒	
	iii.	Explain what this could mean for the affected samples.	☐	☐	☒	

5. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
a.	Are there LCS/LCSD samples present for the reported analyses? (An LCS alone is acceptable if there is an Matrix Spike/Matrix Spike Duplicate [MS/MSD] or sample/sample dup for precision.)		☒	☐	☐	
	i.	If so, do the lab limits seem reasonable compared to the suggested guidelines in the MPCA QC Policy?	☒	☐	☐	
b.	Are there LCS/LCSD compounds outside lab limits? (These should have a data qualifier.)		☐	☒	☐	
	i.	If yes, are the analytes above the lab limits?	☐	☐	☒	
	ii.	Below the lab limits?	☐	☐	☒	
	iii.	Are all samples in the preparation batch also flagged for the same analyte(s)?	☐	☐	☒	

		Question	Yes	No	N/A	Comments
	iv.	Explain what this could mean for the affected samples.	☐	☐	☒	

6. Matrix Spike/Matrix Spike Duplicate/Sample Duplicate (MS/MSD/Dup)

Question				Yes	No	N/A	Comments
a.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.b.			☒	☐	☐	MS/MSDs were performed on samples BW17ML-42-0.0-0.15, BW17ML-043-015-0.46, BW17ML-046-0.0-0.15, BW17ML-052-015-0.44, BW17ML-058-0.0-0.15, and BW17ML-052-0.0-0.15 for TOC.
	i.	Have the required matrix spikes been prepared and reported?		☒	☐	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☐	☒	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☐	☐	☒	
	iv.	Are the lab limits specified on the report?		☒	☐	☐	
	v.	Do the limits seem reasonable when compared to the suggested guidelines in the MPCA QC Policy?		☒	☐	☐	
	vi.	Are there compounds outside the lab limits?		☒	☐	☐	
		1.	If yes, are the analytes above the lab limits?	☒	☐	☐	The MSD recovery for TOC in sample BW17ML-052-015-0.44 and the MS recovery for sample BW17ML-058-0.0-0.15 was biased high and outside acceptance criteria.
		2.	Below the lab limits?	☐	☐	☒	
		3.	Is the source sample also flagged for compounds outside lab limits?	☒	☐	☐	
b.	Is a sample duplicate reported for the analytical method(s)? If no, skip to 6.c.			☒	☐	☐	RPDs discussed apply to MS/MSDs.
	i.	Is the RPD for the duplicate pair within the lab limits?		☒	☐	☐	All RPDs were within the acceptance criterion for the MS/MSDs performed except for the following. The RPD was high for TOC in the MS/MSD performed on samples BW17ML-043-015-0.46 and BW17ML-052-015-0.44.
	ii.	If no, has the associated source sample been flagged?		☒	☐	☐	
c.	What is the impact of failed QC on this project?			☐	☐	☐	Results for the mean TOC were qualified “J” in samples BW17ML-043-015-0.46 and BW17ML-052-015-0.44 due to high MS or MSD recoveries. The mean TOC results were qualified “J” as estimated in these two samples. In addition, results for mean TOC were qualified “J” as estimated due to high RPDs in samples BW17ML-043-015-0.46 and BW17ML-052-015-0.44. Mean TOC results were qualified “J” as estimated.

7. Method Detection Limits/Report Limits

Question		Yes	No	N/A	Comments
a.	Are reporting and/or method detection limits clearly listed on the report for all analyses? (may also be called quantitation limits)	☒	☐	☐	

Additional comments on report:

(1) No blind field duplicates were collected for the samples in this SDG. Field duplicates were not required for TOC analysis.

(2) Level 2 lab reports were reviewed so calibrations, tunes, and raw data were not reviewed.

Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Laboratory Data Review Checklist

Doc Type: Data Review

Instructions: The following is the Minnesota Pollution Control Agency's (MPCA) informal checklist that may be used to review data. The information follows the general format of the National Functional Guidelines which is the primary data review tool used in the U.S. Environmental Protection Agency's Contract Laboratory Program for Superfund analytical work. This checklist should be used in conjunction with the *Laboratory Data Checklist Guidance* (p-eao-11a): http://www.pca.state.mn.us/index.php/view-document.html?gid=16113. Also see the MPCA Laboratory Quality Control (QC) and Data Policy: http://www.pca.state.mn.us/index.php/view-document.html?gid=16288.

Project Information

Project name: J170470 SLR Sediment AOCs   Laboratory: AXYS – DPWG62496

Work order number: 3000019769   Report date (mm/dd/yyyy): 1/5/2018

1. Preservation

For help with this section on holding times, containers and preservatives, refer to the Minnesota Department of Health's website at: http://www.health.state.mn.us/divs/phl/environmental/handbook/internet/envhandbook.html.

Questions			Yes	No	N/A	Comments
a.	Is there a chain of custody (COC) with the report?		☒	☐	☐	
b.	Is there a sample condition form with the report?		☒	☐	☐	
c.	Were there samples requiring preservation?		☐	☒	☐	
	i.	If so, were they properly preserved?	☐	☐	☒	
	ii.	Were they received on ice?	☒	☐	☐	
d.	Were samples received in the correct containers?		☒	☐	☐	
	i.	Was there enough sample volume/weight to complete all requested analyses?	☒	☐	☐	
	ii.	Was there enough extra sample collected to complete method required batch QC?	☒	☐	☐	
e.	Were samples received with adequate holding time for sample prep for all requested analyses?		☒	☐	☐	
f.	Are there notes about sample condition or holding time issues on the COC? Explain impact.		☒	☐	☐	Samples were received at a temperature of 9.1 °C above 0-4°C. The samples were stored at -20°C prior to extraction and analysis. These samples were analyzed by modified EPA Method 1613B.
g.	Is there narration or data qualifiers within the report about sample condition or holding time issues? Explain impact.		☒	☐	☐	The elevated temperature upon receipt was judged to have minimal impact on the results, therefore; no data were qualified.

2. Calibration

Question		Yes	No	N/A	Comments
a.	Do the report narrative or data qualifiers indicate	☐	☒	☐	

	calibration problems for any analyses? If yes, explain the data impact.				

3. Blanks

Question		Yes	No	N/A	Comments
a.	Do any of the analyses contain samples for field or trip blanks?	☐	☒	☐	
	i. If yes, are there target analytes present above the reporting limit?	☐	☐	☐	
	ii. If yes, are the same compounds also present in the samples? Explain possible impact.	☐	☐	☒	
b.	Do method blanks for any analyses contain target analytes above the reporting limit?	☒	☐	☐	The following analytes were detected in the method blanks: 1,2,3,4,6,7,8-HPCDD (0.0726 pg/g), OCDD (0.364 pg/g), 1,2,3,4,6,7,8-HPCDF (0.169 pg/g), OCDF (0.0738 pg/g), total hepta-dioxins (0.105 pg/g), and total hepta-furans (0.329 pg/g), and 1,2,3,4,6,7,8-HPCDF (0.169 pg/g).
	i. If yes, are the same compounds present in the samples?	☒	☐	☐	
	ii. Is the amount of target analyte in the blank more than 1/10th of that in the sample(s)? Explain the possible impact on sample results.	☐	☐	☒	No impact on sample results, because all sample results were > 10x the blank concentrations.

4. Surrogates

Question		Yes	No	N/A	Comments
a.	Are there organic analyses that contain surrogate compounds?	☒	☐	☐	Called labelled compounds for EPA Method 1613B.
b.	Are the lab recovery limits specified on the report?	☒	☐	☐	
	i. Do the lab limits seem reasonable when compared with the suggested guidelines in the MPCA QC Policy?	☒	☐	☐	
c.	Are there surrogates outside lab limits? (These should have a data qualifier)	☒	☐	☐	
	i. If yes, are the surrogates above the lab limits?	☒	☐	☐	An interference causing the recovery of ^{13}C-1,2,3,7,8-PeCDD to be slightly elevated, identified as a phthalate ester was observed to elute near the retention time corresponding to the native and labeled 1,2,3,7,8-PeCDD in all samples. The phthalate ester interference affected the response of the native and labeled 1,2,3,7,8-PeCDD equally, resulting in a calculated over-over-recovery of ^{13}C1,2,3,7,8-PeCDD, but not affecting the accuracy of the 1,2,3,7,8-PeCDD result. Due to the over-recovery of the surrogate, the total PeCDD result would have been under-reported and some samples required a correction factor to be applied based on the ration of ^{13}C-1,2,3,7,8-PeCDD to ^{13}C-1,2,3,7,8- and ^{13}C2,3,4,7,8-PeCDF in the sample compared to the opening calibration verification.

	ii.	Below the lab limits?	☐	☒	☐	
	iii.	Explain what this could mean for the affected samples.	☐	☐	☒	The quantification of 1,2,3,7,8-PeCDD was not affected. For samples requiring the correction factor, the total PeCDD result has been recalculated and flagged with a "T".

5. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

Question			Yes	No	N/A	Comments
a.	Are there LCS/LCSD samples present for the reported analyses? (An LCS alone is acceptable if there is an Matrix Spike/Matrix Spike Duplicate [MS/MSD] or sample/sample dup for precision.)		☒	☐	☐	Ongoing Precision and Recovery (OCP) Standard
	i.	If so, do the lab limits seem reasonable compared to the suggested guidelines in the MPCA QC Policy?	☒	☐	☐	
b.	Are there LCS/LCSD compounds outside lab limits? (These should have a data qualifier.)		☐	☒	☐	
	i.	If yes, are the analytes above the lab limits?	☐	☐	☒	
	ii.	Below the lab limits?	☐	☐	☒	
	iii.	Are all samples in the preparation batch also flagged for the same analyte(s)?	☐	☐	☒	
	iv.	Explain what this could mean for the affected samples.	☐	☐	☒	

6. Matrix Spike/Matrix Spike Duplicate/Sample Duplicate (MS/MSD/Dup)

Question				Yes	No	N/A	Comments
a.	Do the analytical methods used require an MS and/or MSD? If no, skip to 6.b.			☒	☐	☐	MS/MSDs were performed on sample BW17ML-052-0.15-044.
	i.	Have the required matrix spikes been prepared and reported?		☒	☐	☐	
	ii.	If no, is there and explanation in the report as to why?		☐	☐	☒	
	iii.	Did the lab process an alternate spiked sample (such as LCSD) instead?		☐	☐	☒	
	iv.	Are the lab limits specified on the report?		☒	☐	☐	
	v.	Do the limits seem reasonable when compared to the suggested guidelines in the MPCA QC Policy?		☒	☐	☐	
	vi.	Are there compounds outside the lab limits?		☒	☐	☐	
		1.	If yes, are the analytes above the lab limits?	☒	☐	☐	MS/MSD recoveries for 1,2,3,4,6,7,8-HPCDF, 1,2,3,4,7,8,9-HPCDF, and OCDF were biased high and outside acceptance criteria.
		2.	Below the lab limits?	☐	☒	☐	
		3.	Is the source sample also flagged for compounds outside lab limits?	☒	☐	☐	
b.	Is a sample duplicate reported for the analytical method(s)? If no, skip to 6.c.			☒	☒	☐	RPDs discussed apply to MS/MSDs.
	i.	Is the RPD for the duplicate pair within the lab limits?		☐	☒	☐	RPDs for 1,2,3,4,6,7,8-HPCDF, 1,2,3,4,7,8,9-HPCDF, and OCDF were biased high and outside acceptance criteria.

	ii.	If no, has the associated source sample been flagged?	☒	☐	☐	
c.		What is the impact of failed QC on this project?	☐	☒	☐	Results for 1,2,3,4,6,7,8-HPCDF, 1,2,3,4,7,8,9-HPCDF, and OCDF were qualified “J” as estimated and may be biased high in parent sample BW17ML-052-0.15-044.

7. Method Detection Limits/Report Limits

Question		Yes	No	N/A	Comments
a.	Are reporting and/or method detection limits clearly listed on the report for all analyses? (may also be called quantitation limits)	☒	☐	☐	MDLs are not applicable to dioxins and furans; however; report limits were listed on the reports for all samples.

Additional comments on report:

(1) Blind field duplicates were not required for dioxins and furans.

(2) To bring responses of congeners to concentrations within the instrument calibration range, samples BW17ML-047-0.15-0.36, BW17ML-048-0.15-0.26, BW17ML-049-0.15-0.39, BW17ML-050-0.0-0.15, BW17ML-051-0.0-0.15, BW17ML-051-0.15-0.36, BW17ML-054-0.0-0.15, BW17ML-056-0.15-0.34 were analyzed at dilutions. Some of the diluted and cleaned-up samples required more than one GC/MS acquisition before all instrumental method specifications were met. The sample extractions were instrumentally reanalyzed and method specifications were met. Sample concentrations are reported from these re-injections (indicated by suffix Wi or LFWi on the AXYS ID. The reporting limits were adjusted accordingly.

(3) Level 2 lab reports were reviewed so calibrations and raw data were not reviewed.

Appendix B

Munger Landing PCB Human Health SDCV Technical Memorandum

Munger Landing – Polychlorinated Biphenyl (PCBs) in Sediment
April 2018

Background

The Munger Landing site is part of the St. Louis River located in Duluth, Minnesota. It consists of a channel between the shoreline and a long, narrow island that is water covered part of the year. It is located north of Spirit Lake and the Morgan Park neighborhood and west of Clough Island in Wisconsin (Figure 1). Munger Landing which contains a parking area, boat launch and fishing pier, is located to the west of the site along the shoreline (Figure 2). Residential housing surrounds the site past Munger Landing to the west and is directly adjacent to the site in the northern portion of the site. Spirit Lake Marina is located outside the northern end of the site. Adjacent areas at the southern end of the site are undeveloped. A rail road track runs adjacent to the site along the shoreline and through Munger Landing to the west of the boat launch and fishing pier. Some residences to the north contain trails leading to the shoreline and some personal watercrafts are stored on the shoreline (Figures 3 and 4). This area is used for boating, including kayaks and larger personal watercraft, fishing, swimming and wading. The long, narrow island is owned by the Bureau of Land Management and is open to camping. As part of the development of the Western Waterfront Trail, the city of Duluth is proposing to install a kayak launch area north of Munger Landing in the future (indicated by red arrow on Figures 1 and 2).

At the southern end the channel, it is approximately 1000 feet wide; at the northern end, it is approximately 300 to 400 feet wide. Shallower areas of water with depths between 1 and 3 feet are located to the east and west along the shoreline and the long, narrow island. The middle of the channel ranges from 6 to 10 feet deep. Water flows from south to north towards Lake Superior (Bay West 2016).

Polychlorinated biphenyl (PCBs) have been detected in sediments at the site. Sediment sampling results that were provided by Erin Endsley are in the attached Excel Spreadsheet titled "Munger Landing PCBs Sediment SDCV Summary", worksheet "Data". Maximum concentrations observed were 43.7 mg/kg and 12.6 mg/kg located adjacent to the Munger Landing boat launch (Figure 5). Other higher PCB concentrations observed were 5.77 mg/kg and 2.89 mg/kg, adjacent to the Munger Landing boat launch, and 1.59 mk/kg near the southern end of the long, narrow island (Figure 6). All other detections were below 0.956 mg/kg.

Purpose

The purpose of this evaluation is to provide a recommendation regarding the potential risks to people from PCBs in sediments that use the Munger Landing site for recreational purposes. *This assessment evaluates potential risks to people from the following exposure pathways: ingestion, dermal contact and inhalation. It does NOT include the fish consumption pathway. The Minnesota Department of Health does have fish consumption advisory for this area for PBCs.*

Site Specific Risk Assessment

Sediment depth

The depth of sediment that a person may be exposed to depends on the depth that the sediment is disturbed from both natural and unnatural sediment disturbances. Per Angus Vaughan's email dated March 15, 2018, a conservative estimate of scouring for this area based on natural disturbances from modeling conducted by Barr Engineering in nearby areas is 1 to 2 feet (30 to 60 cm). This depth is also likely to account for any unnatural sediment disturbances including a person disturbing the sediment with their body, boats being launched, boat oars, propellers, prop wash or power loading.

To ensure adequate protection, it is recommended that sediment samples down to 2 feet depth be included in the evaluation of potential risks to people. This recommendation is site specific and is NOT applicable to all sites in Minnesota.

Water depth
A conservative estimate of a height that most people will be under is 6.5 feet (US Census 2012).
If an assumption is made that a person's head and upper body will stick out of the water by 1 foot when wading, a reasonable maximum estimate of water depth that someone could wade in is 5.5 feet.

To ensure adequate protection, it is recommended that sediments under 5.5 feet of water or less be included in the evaluation of potential risks to people. This recommendation is applicable to all sites in Minnesota.

Site specific sediment cleanup value (SDCV)

Current site conditions

The two site specific scenarios when people may be exposed to PCBs in sediment under the current site conditions are:

- Exposure to *water covered* sediments while wading or swimming – most likely to occur in all areas of site
  - People have been observed playing and swimming in the water near the boat launch. People also use the area to launch both small and large watercraft. Although some watercraft travel further into the river after launching, some smaller watercraft spend time exploring the channel, especially the areas around the long, narrow island.
- Exposure to *intertidal sediments* while wading or playing – may occur on the shores of the long, narrow island when it is not water covered but are much less likely to occur in all other areas of the site
  - Areas near the shoreline are heavily vegetated and contain no beach or sandy areas. Rail road tracks are located near the shoreline running through the entire site. As a result, it is NOT likely children will be playing in intertidal sediments with any frequency if at all. There is a visible grass covered trail that leads from a residence to the shoreline in the north end of the site, but the area is heavily vegetated and does not appear to be suitable for children to play in sediments (Figure 3).

Site specific sediment cleanup values were derived for both exposure scenarios to provide a range of potential risks that could be used in site decision making. Table 1 provides a range of site specific sediment cleanup values (SDCVs) representing different exposure scenarios.

Exposure parameters

Exposure parameters used to derive SDCVs are shown in Table 1. It is appropriate to use a child ages 6 to 16 years to represent the maximum risk present from the two recreational scenarios described above: water covered sediments and intertidal sediments.

Exposure frequencies were based on the five months when it is warm enough to expect someone to swim or wade: May, June, July, August and September. Four different exposure frequencies were used (Table 1).

Ingestion rates vary based on the exposure scenario being evaluated. An ingestion rate of 4.45 mg per day was used for wading in water covered sediments and 44.5 mg per day for swimming in water covered sediments (Table 1). EPA provides a swimming ingestion rate of 120 mL/hr for children (EPA 2011). Results from a step down test (provides the amount of sediment in water) conducted for the St. Louis River Interlake-Duluth Tar Site provided a 75% upper confidence limit of the mean of 371 mg/L (MDH 2013). Children are assumed to ingest 1/10th of their surface water ingestion rate while wading per MDH recommendations in the US Steel Health Consultation (MDH 2103). Children are assumed to spend one hour swimming or wading on site each day they visit the site based on the site specific scenario.

Sediment ingestion while swimming

$$Surface\ water\ ingestion\ rate * sediment\ in\ water * conversion\ factor$$

$$\frac{120\ mL}{hr} * \frac{371\ mg}{1\ L} * \frac{1\ L}{1000\ mL} = 44.5\ mg/hr$$

Sediment ingestion while wading

$$Surface\ water\ ingestion\ rate * \frac{1}{10} th$$

$$120\ mL * \frac{1}{10} = 12\ mL$$

$$Surface\ water\ ingestion\ rate * sediment\ in\ water * conversion\ factor$$

$$\frac{12\ mL}{hr} * \frac{371\ mg}{1\ L} * \frac{1\ L}{1000\ mL} = 4.45\ mg/hr$$

An ingestion rate of 200 mg per day was used for intertidal sediments based on the EPA's recommendation to use this value to evaluate potential ingestion of soil and the site specific exposure scenario (EPA 2014).

For wading and swimming in water covered sediment an adherence factor of 1 mg/cm^2 was used as recommended in the MDH US Steel Health Consultation per the Massachusetts Department of Environmental Protection (MDH 2013, MADEP 2002). For intertidal sediment two different adherence factors were used to calculate two different sets of SDCVs: 1 mg/cm^2 and 5 mg/cm^2 based on data from EPA's Exposure Factor Handbook, information from MDH's US Steel Health Consultation and Massachusetts Department of Environmental Protection and the site specific exposure scenario (EPA 2011, MDH 2013, MADEP 2002).

Surface area for a child of 4498 cm^2 and body weight of 44 kg were calculated using data from EPA's 2011 Exposure Factors Handbook (EPA 2011).

Potential future site conditions
If the City of Duluth installs a kayak launch area north of Munger Landing as shown in Figures 1 and 2, this would significantly increase the possibility that people will be exposed to intertidal sediments in this area. It will not change the possibility that people will be exposed to intertidal sediment in other areas of the site.

Results and recommendation

Current site conditions
As shown in Table 1, the most significant potential risks to people using the site for recreational purposes is from cancer risks due to the dermal exposure pathway.

Table 2 compares the different SDCVs to the highest site concentrations. All other site concentrations are below 0.956 mg/kg and do NOT exceed any of the SDCVs.

The water covered - wading and water covered - swimming exposure scenarios are the most likely exposure scenarios to occur in most areas of the site. The intertidal exposure scenario may occur on the shores of the long, narrow island when it is not water covered but are much less likely to occur in all other areas of the site. It is NOT likely a child will visit the site 7 days a week for the entire 5 month period of potential exposure. It is more likely a child will visit the site between 1 and 5 days a week.

For water covered sediments, potential risks may be present at concentrations exceeding 7.8 mg/kg which is a conservative SDCV to be protective for this site specific scenario only and is NOT applicable to other sites. A more reasonable approach to estimating potential risks might be to use a range of SDCVs from 7.8 mg/kg to 39 mg/kg based on the potential exposures of 5 days per week to 1 day per week for the most conservative exposure scenario, swimming (Table 2).

For intertidal sediments on the shores of the long, narrow island, potential risks may be present at concentrations exceeding 1.6 mg/kg SDCV which is a conservative SDCV to be protective for this site specific scenario only and is NOT applicable to other sites. A more reasonable approach to estimating *potential risks might be to use a range of SDCVs from 1.6 to 32 mg/kg based on the potential exposures of 5 days per week to 1 day per week and adherence factors of 1 and 5 (Table 2).*

For intertidal sediments located in other areas of the site, based on the results in Table 2 and the exposure to intertidal sediment not being likely to occur if at all at this site, the water covered sediment SDCVs provided above are likely to be adequately protective of this scenario if it were to occur.

Potential future site conditions
For intertidal sediments that may be accessed at the potential future kayak launch north of Munger Landing, potential risks may be present at concentrations exceeding 1.6 mg/kg SDCV which is a conservative SDCV to be protective for this site specific scenario only and is NOT applicable to other sites. A more reasonable approach to estimating potential risks might be to use a range of SDCVs from 1.6 to 32 mg/kg based on the potential exposures of 5 days per week to 1 day per week and adherence factors of 1 and 5 (Table 2).

Bonnie Brooks, MS, Environmental Research Scientist
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155
651 331 6173
bonnie.brooks@state.mn.us

References

Bay West 2016. Bay West LLC. Final Focused Feasibility Study, SR# 1015. June 2016.

EPA 2011. U.S. Environmental Protection Agency. Exposure Factor Handbook. September 2011. http://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252.

EPA 2014. U.S. Environmental Protection Agency. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. February, 2014. https://rais.ornl.gov/documents/OSWER-Directive-9200-1-120-Exposure-Factors_corrected.pdf.

MADEP 2002. Massachusetts Department of Environmental Protection. Technical Update - Weighted Skin-Soil Adherence Factors. April 2002. http://www.mass.gov/eea/docs/dep/cleanup/laws/dermadhe.pdf.

MDH 2013. Minnesota Department of Health. Updated Human Health Screening Values for St. Louis River Sediments: US Steel Site. April 2013. http://www.health.state.mn.us/divs/eh/hazardous/sites/stlouis/ussteel.html.

U.S. Census 2012. U.S. Census Bureau. Statistical Abstract of the United States 2012. https://www.census.gov/library/publications/2011/compendia/statab/131ed.html.

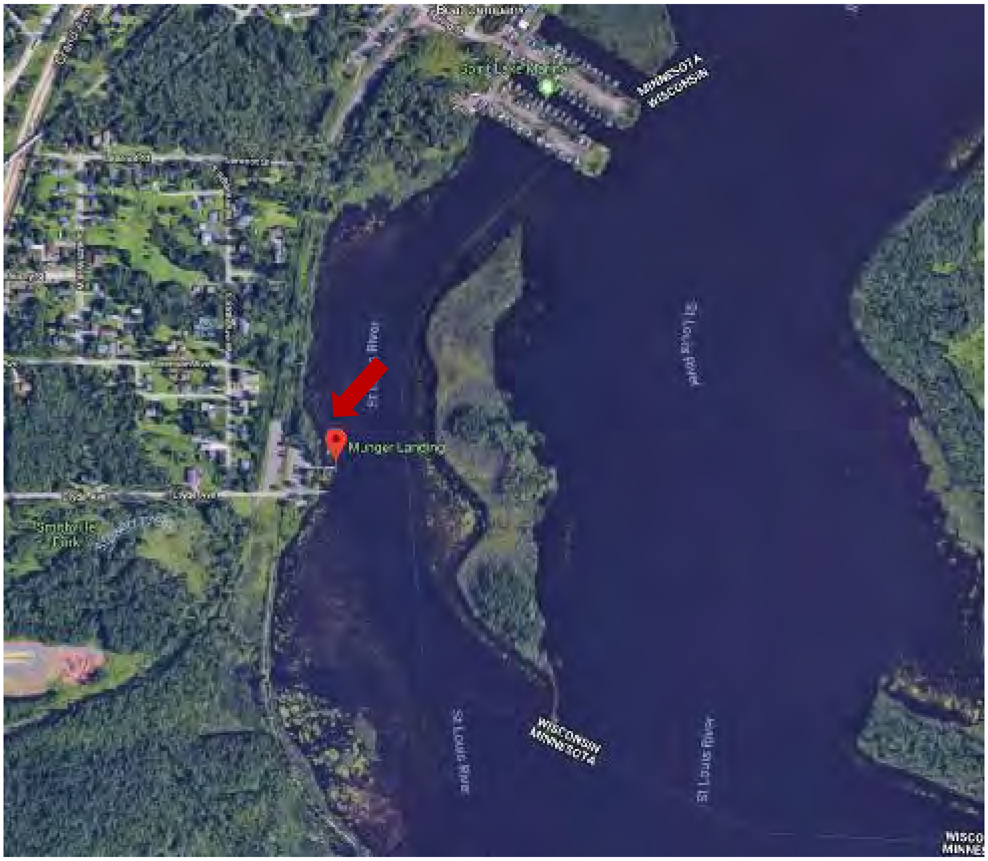


Figure 1: Munger Landing site location.

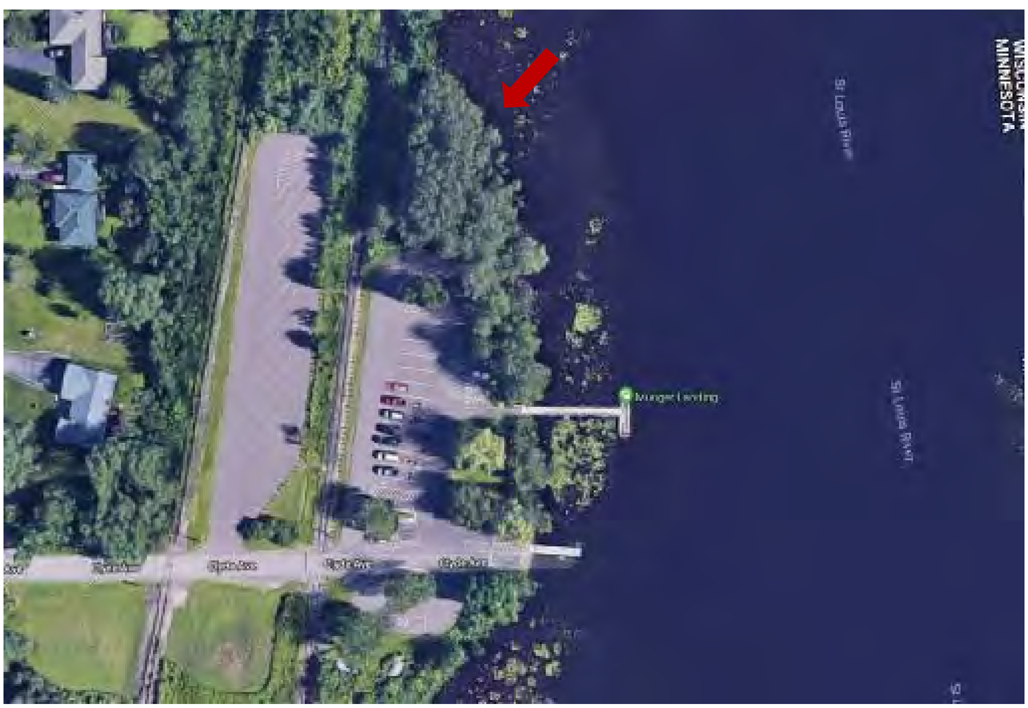


Figure 2: Munger Landing boat launch and fishing pier.


Figure 3: Northern end of site. Trail leading from residence to shoreline.


Figure 4: Northern end of site. Personal watercraft stored on shoreline.

Figure 5: Maximum PCB concentrations and depths.

Munger Landing – Polychlorinated Biphenyl (PCBs) in Sediment
April 2018

Figure 6: Other higher PCB concentrations and depths.

Sediment Type	Exposure Duration years	Exposure Frequency days/year	Exposure Frequency days per week	Ingestion Rate Child [1] mg/day	Adherence Factor Child [2] mg/cm^2	*Surface Area Child 6-16 years[3] cm^2*	*Body Weight Child 6-16 years[3] cm^2*	SDCV Site Specific Sediment Screening Value mg/kg	Basis	Additional Information	Significant Pathway
Water covered - wading											
Water covered	10	150	7	4.45	1	4498	44	5.8	Cancer	Noncancer = 8.5	Dermal
Water covered	10	105	5	4.45	1	4498	44	8.2	Cancer	Noncancer = 12	Dermal
Water covered	10	42	2	4.45	1	4498	44	21	Cancer	Noncancer = 30	Dermal
Water covered	10	21	1	4.45	1	4498	44	41	Cancer	Noncancer = 60	Dermal
Water covered - swimming											
Water covered	10	150	7	44.5	1	4498	44	5.4	Cancer	Noncancer = 8	Dermal
Water covered	10	105	5	44.5	1	4498	44	7.8	Cancer	Noncancer = 11	Dermal
Water covered	10	42	2	44.5	1	4498	44	19	Cancer	Noncancer = 29	Dermal
Water covered	10	21	1	44.5	1	4498	44	39	Cancer	Noncancer = 57	Dermal
Intertidal											
Intertidal	10	150	7	200	1	4498	44	4.4	Cancer	Noncancer = 6.5	Dermal
Intertidal	10	105	5	200	1	4498	44	6.3	Cancer	Noncancer = 9.3	Dermal
Intertidal	10	42	2	200	1	4498	44	16	Cancer	Noncancer = 23	Dermal
Intertidal	10	21	1	200	1	4498	44	32	Cancer	Noncancer = 46	Dermal
Intertidal	10	150	7	200	5	4498	44	1.1	Cancer	Noncancer = 1.6	Dermal
Intertidal	10	105	5	200	5	4498	44	1.6	Cancer	Noncancer = 2.3	Dermal
Intertidal	10	42	2	200	5	4498	44	4	Cancer	Noncancer = 5.8	Dermal
Intertidal	10	21	1	200	5	4498	44	8	Cancer	Noncancer = 15	Dermal

SDCV - Site Specific Sediment Cleanup Values

Parameter changes

Parameter does NOT change

1 - MDH U.S. Steel Public Health Consultation, Apr 2013

2 - MDH US Steel Public Health Consultation, MA DEP Apr 2002, Apr 2013, EPA Exposure Factors Handbook, Sept 2011

3 - Includes head, arms, hands, legs and feet from EPA Exposure Factors Handbook Sept 2011

Table 1. Site specific sediment cleanup values (SDCVs)

Munger Landing – Polychlorinated Biphenyl (PCBs) in Sediment
April 2018

Sediment Type	Exposure Duration years	Exposure Frequency days/year	Exposure Frequency days per week	Ingestion Rate Child [1] mg/day	Adherence Factor Child [2] mg/cm^2	*Surface Area Child 6-16 years[3] cm^2*	*Body Weight Child 6-16 years[3] cm^2*	SDCV Site Specific Sediment Screening Value mg/kg	Site Detect mg/kg	Site Detect mg/kg	Site Detect mg/kg	Site Detect mg/kg	Site Detect mg/kg
Water covered - wading													
Water covered	10	150	7	4.45	1	4498	44	5.8	43.7	12.6	5.77	2.89	1.59
Water covered	10	105	5	4.45	1	4498	44	8.2	43.7	12.6	5.77	2.89	1.59
Water covered	10	42	2	4.45	1	4498	44	21	43.7	12.6	5.77	2.89	1.59
Water covered	10	21	1	4.45	1	4498	44	41	43.7	12.6	5.77	2.89	1.59
Water covered - swimming													
Water covered	10	150	7	44.5	1	4498	44	5.4	43.7	12.6	5.77	2.89	1.59
Water covered	10	105	5	44.5	1	4498	44	7.8	43.7	12.6	5.77	2.89	1.59
Water covered	10	42	2	44.5	1	4498	44	19	43.7	12.6	5.77	2.89	1.59
Water covered	10	21	1	44.5	1	4498	44	39	43.7	12.6	5.77	2.89	1.59
Intertidal													
Intertidal	10	150	7	200	1	4498	44	4.4	43.7	12.6	5.77	2.89	1.59
Intertidal	10	105	5	200	1	4498	44	6.3	43.7	12.6	5.77	2.89	1.59
Intertidal	10	42	2	200	1	4498	44	16	43.7	12.6	5.77	2.89	1.59
Intertidal	10	21	1	200	1	4498	44	32	43.7	12.6	5.77	2.89	1.59
Intertidal	10	150	7	200	5	4498	44	1.1	43.7	12.6	5.77	2.89	1.59
Intertidal	10	105	5	200	5	4498	44	1.6	43.7	12.6	5.77	2.89	1.59
Intertidal	10	42	2	200	5	4498	44	4	43.7	12.6	5.77	2.89	1.59
Intertidal	10	21	1	200	5	4498	44	8	43.7	12.6	5.77	2.89	1.59

SDCV - Site Specific Sediment Cleanup Values

Parameter changes

Parameter does NOT change

Exceeds SDCV

Does NOT exceed SDCV

1 - MDH U.S. Steel Public Health Consultation, Apr 2013

2 - MDH US Steel Public Health Consultation, MA DEP Apr 2002, Apr 2013, EPA Exposure Factors Handbook, Sept 2011

3 - Includes head, arms, hands, legs and feet from EPA Exposure Factors Handbook Sept 2011

Table 2. Site specific sediment cleanup values (SDCVs) vs. highest detections.

Appendix C

Technical Analysis

Two remedial alternatives involving construction activities, one alternative involving monitoring only, and one alternative involving a no action approach were developed and evaluated as part of the Munger Landing Focused Feasibility Study (FFS) and include the following:

Alternative 1 – No Action

Alternative 2 – Monitored Natural Recovery

Alternative 3 – Enhanced Monitored Natural Recovery with Broadcasted Amendment

Alternative 4 – Enhanced Monitored Natural Recovery with Thin-Layer Amended Cover

Alternative 5 – Excavate with Offsite Disposal

Alternative 6 – Hotspot Dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment

Class 4 rough order of magnitude cost analyses (+50/-30) were developed for each of these alternatives and are summarized within **Section 3** of the FFS document. This Technical Analysis serves to provide the calculations and outline the assumptions used to compile each of the alternative cost analyses.

Cost estimates were compiled using a variety of sources. These sources include construction cost data from RSMeans estimating software for open shop pricing in Duluth, Minnesota; current Bay West LLC (Bay West) and state contract rates for labor, equipment, and sample analysis; personal communication with vendors; historic cost data from projects similar in size and scope; other FFS documents, presentations, or technical papers that provided estimated or real construction cost data; and available online vendor pricing of materials.

The selection of construction equipment, production rates, remedial volumes, remedial action areas, and other "design-type" elements used as a starting point to develop alternative costs are based on a current understanding of Site conditions at this early feasibility study-level stage.

This document is divided into the following sections:

Section 1: Remedial Areas and Volumes
Section 2: Construction Implementation Assumptions and Production Rates
Section 3: Material Staging Area
Section 4: Environmental Controls and Construction Monitoring
Section 5: Cover/Cap Materials and Volumes

The following tables were used to calculate values incorporated into each alternative cost analysis and are included within this Technical Analysis:

Appendix C Table 1: Volume, Rate, and Time Frame Calculations
Appendix C Table 2: Unit Rate Calculations
Appendix C Table 3: Lump Sum Costs
Appendix C Table 4: Monitoring and Evaluation Costs
Appendix C Table 5: Present Value Calculations

Many of the assumptions used to compile the cost analyses for the alternatives are included within the tables. Those aspects of alternative development not readily apparent within the tables and the Munger Landing FFS text are described in the following sections.

Section 1: Remedial Areas and Volumes

Areas targeted for remedial action (remedial areas) generally include those with lead, nickel, zinc, PCBs and/or dioxins/furans concentrations in sediments exceeding the Midpoint Sediment Quality Target (SQT), also referred to as the preliminary cleanup level (CUL), with an emphasis on area with high PCB and dioxin/furan concentrations. These compounds are considered contaminants of concern (COCs) for the Site. Remedial areas are presented in **Figure 6** of the FFS document. Remedial areas were developed based on sample results obtained during the 2015 Remedial Investigation (RI), 2017 PCB and dioxin/furan characterization, bathymetric data, and professional judgement. Remedial areas total approximately 38 acres in size. It is anticipated that these areas would be further defined during the design phase.

Data collected during the 2015 RI and 2017 PCB and dioxin/furan characterization indicates that sediment contamination in exceedance of the CULs exists within the upper 0.5 meter to 1.0 meter of sediment across the remedial areas. However, there is some evidence that contamination may extend to depths greater than 1.0 meter below the sediment surface (bss) within some areas of the Site:

1) A single sample was collected from depths greater than 1.0 meter bss and contained sediments in exceedance of the CULs.
2) Core shortening observed during the 2015 RI resulted in an average sediment recovery of 50 percent (%); therefore, sediments may have originated from deeper in situ sediment depths than represented by their location/interval within core samples.

An estimated 130,000 cubic yards of sediment exists within the remedial footprint.

Section 2: Construction Implementation Assumptions and Production Rates

Unit rate costs were developed for amendment placement and cover construction activities by summing labor and equipment costs and dividing by an assumed production rate; therefore, the production rate has a substantial impact on the unit rate cost of these activities and the overall project cost. The following sections detail the construction methods developed for remedy implementation and their associated production rates. It is important to note that these methods were developed solely to assist in developing cost estimates for each alternative, and final construction methods would be determined during the design and/or construction bidding phase.

Amendment Placement

A general order of operations was assumed in order to facilitate costing of Alternative 3, which incorporates broadcasting of an amendment material over remedial areas of the Site. This order of operations was used to assist in selecting construction equipment, labor, production rates, time frames, etc.

The general order of placement is described as follows:

- Amendment materials would be purchased from a supplier, shipped to the staging area at Hallett Dock #7, and stockpiled.
- Amendment materials would be loaded into a large material transport barge moored at the staging area at Hallett Dock #7 during non-placement (e.g., late evening or early morning) hours. The loaded barge would travel upriver to the Site in time for commencement of daily work activities. The transport barge would spud down or moor to dolphin pilings driven into the river.
- An excavator with clamshell bucket would be staged on the material transport barge. The excavator would be used to load two small 12-cubic yard placement barges with amendment material on a periodic basis.
- Two 12-cubic yard placement barges, each equipped with a sand slinger or equivalent broadcasting device, would be used to broadcast amendment material over the remedial areas. A push boat attached to each hopper barge would be used to transport the hopper barges from the loading area (transport barge with onboard excavator) to the active placement areas.
- Once the material transport barge was emptied, cover construction would cease for the day. The material transport barge would return to the staging area at Hallett Dock #7 where it would again be loaded during overnight hours.

- These activities would be conducted until amendment placement is complete.

The production rate for broadcasting of amendment material was estimated at 168 cubic yards per day. This estimate assumes that each 12 cubic yard placement barge would require 72 minutes to empty (6 minutes per cubic yard), and that two placement barges would operate for approximately 11 hours each day. Ten minutes of travel time to and from the loading area and a 5-minute load time for each cycle were also incorporated into the production rate.

Thin-Layer Amended Sand Cover Construction

A general order of operations was assumed in order to facilitate costing of Alternative 4, which incorporates construction of a thin-layer amended sand cover over remedial areas of the Site. This order of operations was used to assist in selecting construction equipment, labor, production rates, time frames, etc.

The general order of cover construction is described as follows:

- Clean washed sand meeting project specifications would be purchased from a local upland borrow source and imported to the staging area located at Hallett Dock #7. Amendment materials would be purchased from a supplier, shipped to the staging area, and stockpiled. Mixing of amendment materials would be conducted mechanically using an end loader, excavator, or similar equipment.
- Cover materials would be loaded into a large material transport barge moored at the staging area at Hallett Dock #7 during non-construction (e.g., late evening or early morning) hours. The loaded barge would travel upriver to the Site in time for commencement of daily work activities. The transport barge would spud down or moor to dolphin pilings driven into the river.
- An excavator with clamshell bucket would be staged on the material transport barge. The excavator would be used to load two small 25-cubic yard hopper barges with cover material on a periodic basis.
- A single work boat or small tug would be used to manage the two hopper barges. The work boat would transfer the hopper barges between the material loading area and a cover placement barge on a regular basis. A full hopper barge would be delivered to the placement barge by the time the second hopper barge had been emptied. The emptied hopper barge would then be returned to the loading area and filled again with cover material.
- Once the material transport barge was emptied, cover construction would cease for the day. The material transport barge would return to the staging area at Hallett Dock #7 where it would again be loaded during overnight hours.
- These activities would be conducted until cover construction is complete.

The production rate for thin-layer sand cover construction was estimated using a bucket size of 2 cubic yards, a 70% fill rate, and 2 minutes per cycle. The bucket size was selected at 2 cubic yards to allow for ease of placement within the small 25-cubic yard hopper barges. A placement time frame of 11 hours per day equates to a total daily production for a single excavator of 462 cubic yards.

Placement of amendment/cover materials via the methods detailed above assumes that sufficient draft is available across the Site to float the smaller hopper and amendment/cover placement barges. Areas with insufficient draft may require placement via other methods. Based on available bathymetry, it is assumed that sufficient water depth is available for amendment/cover placement via the method outlined above.

Dredging Operation

Alternatives 5 and 6 involve dredging of sediments assume that sediments would be slurried with water and pumped as low solids content slurry (e.g., less than 5% solids) to a nearby dewatering area. This assumption was made to avoid passing of contaminated sediments over the railroad embankment into a transport barge and subsequent barging of sediments to Hallett Dock #7 for dewatering. Equipment was assumed to consist of a barge-mounted mechanical excavator with environmental clamshell bucket and slurry tank (i.e., hopper) or hydraulic dredge; costs for this equipment were assumed to be similar enough for FFS-level cost analyses.

The dredging production rate was estimated partially based on U.S. Environmental Protection Agency (USEPA) sediment remediation guidance (USEPA, 2005), which provides production rates for various sizes of mechanical buckets based on an 80% fill and cycle time of 2 minutes. These rates range from 63 cubic yards per hour for smaller buckets to 252 cubic yards per hour for larger buckets. Another source used to determine the dredge production rate was the St. Louis River/Interlake/Duluth Tar (SLRIDT) Data Gap Report (Service, 2002), in which a review of previous projects and discussions with interested parties resulted in a recommended dredge production rate of 50 cubic yards per hour. Based on these two sources the dredge production rate for the Site was conservatively estimated at 72 cubic yards per hour. This rate assumes a 3-cubic yard bucket filled 80%, a 2-minute cycle time, and an active dredging time frame of 10 hours per day. Dredging downtime is estimated at 2 hours per day to account for morning meetings/safety briefings, startup times, shutdown times, and periods of down time throughout the day. These factors equate to a daily production rate of 720 cubic yards per day.

Sediment Dewatering Area

In Alternatives 5 and 6, dredged sediments would require dewatering prior to transport and disposal at an off-site landfill. The only location identified as a possible sediment dewatering area for the purposes of this FFS is the U.S. Steel property located north of the Site. As stated previously, land-based access to the Site and access between the Site and U.S. Steel property is limited due to wetland areas and steep gradients present at the Site's perimeter. These limitations require that sediments are slurried and pumped to the conceptual dewatering area located at the U.S. Steel site. Slurrying of sediments would result in a large volume of slurry requiring dewatering and a large volume of dredge contact water requiring treatment.

It should be noted that the U.S. Steel site is currently serving as a dewatering area for sediments dredged from Radio Tower Bay. Based on aerial imagery it appears that sediments are being slurried and pumped to U.S. Steel property and exit into a large in-ground dewatering pond. It was assumed that a new above ground dewatering pad would be constructed for implementation of dredging alternatives for the purposes of this FFS. The dewatering pad would be lined and paved to contain dredge contact water and would be sufficiently sized to contain geotextile tubes stacked three layers high, a large sump, and space for a water treatment plant.

Another scenario for handling of dredged sediments involves mechanically dredging sediments and transferring sediments over the railroad embankment into a large transport barge. At the end of each day, the transport barge would return to an off-site dewatering area such as Hallett Dock #7, where sediments would be dewatered and subsequently transported to an off-site landfill for disposal. This scenario was not included in this FFS due to the perceived complexities of transferring contaminated sediments over the railroad embankment. Additionally, transfer of sediments over the railroad embankment would require additional handling of sediments and could increase project costs due to increased labor and equipment demands, and decrease productivity rates.

Section 3: Material Staging Area

The Munger Landing Site may not be suitable for use as an upland material staging area due to widespread public use of the boat launch facilities, multiple train tracks routed along the shoreline, and presence of nearby residences. It was, therefore, assumed that materials would be barged to the Site from an off-site location along the SLR. Hallett Dock #7 has been identified as a potential staging area through conversations between Bay West, the Minnesota Pollution Control Agency (MPCA), and Duluth Seaway Port Authority. Satellite imagery indicates the presence of a large paved area at the end of Hallett Dock #7, which is appropriately sized for stockpiling materials. The dock end is nearly 500 feet in length and was assumed to be useable for barge mooring and material onloading/offloading in its current condition. Staging area upgrades would likely include installation of site fencing to protect construction equipment and prevent unauthorized personnel from entering the staging area while the remedy is being implemented.

Section 4: Environmental Controls and Construction Monitoring

Environmental controls and construction monitoring are important elements in mitigating environmental impacts occurring as a direct result from construction activities and also in ensuring remedial/construction goals are achieved. Environmental controls can include surface water control structures (e.g., silt curtains, sheet piling, and absorbent boom), lined sediment dewatering pads, tire washes, stormwater controls, and site fencing (for protection of human health). Construction monitoring can include turbidity monitoring during dredging activities, air monitoring during intrusive site activities, treated dredge contact water sampling, post-dredge verification sampling, cap thickness verification coring, bathymetric surveys, imported materials sampling, dewatered sediment sampling, and collection of pre- and post-construction upland soil samples within the staging area footprint. Alternatives involving amendment application or thin-layer cover construction as a remedy would likely require less controls and monitoring than alternatives incorporating dredging.

For the purposes of this FFS, it was assumed that alternatives consisting of amendment placement or cover construction would incorporate the following control and monitoring elements:

- Fencing at the Hallett Dock #7 staging area;
- Chemical and physical sampling of imported cover materials to ensure that they are suitable for use; and
- Cover thickness verification coring to ensure that project specifications are achieved.

Section 5: Amendment/Cover Materials and Volumes

Purchasing and shipping of amendment materials can have a large impact on total project cost. For the purposes of this FFS, it was assumed that 31 tons of amendment product (Sedimite™) per acre would be applied to the Site, resulting in a 0.010-meter layer of amendment material to be broadcasted across the remedial area. This thickness was selected for inclusion in the cost analysis to provide a conservative cost scenario and to account for the following factors that could result in a loss of material during or following placement:

1) If broadcasted, amendment materials would be placed within a river channel without further armoring or mixing with a bulking material such as sand; therefore, the amendment material would be susceptible to scour or other erosive forces until bioturbation mixed amendment materials into in situ sediments.

2) Amendment materials often have low densities and can be difficult to place in high energy environments; therefore, placement within a river channel could result in migration of amendment material downstream during placement or difficulty in placing material to the designed thickness.
3) Realistic placement tolerances during broadcasting of amendment material is unknown. Placement of additional amendment material may be required to ensure that the designed thickness is achieved.

Potential sources of cover materials include materials from an upland borrow location (e.g., sand and gravel pit), sediments previously dredged for navigational purposes, and common earth upland soil. Natural materials such as dredged sediments and common earth upland soils often contain fine-grained components that make placement more difficult (Interstate Technology and Regulatory Council [ITRC], 2014). It was assumed for the purposes of the cost analyses that upland borrow materials would be used as no apparent source of dredged materials is readily available near the Site. Upland borrow material consisting of clean, washed sand was assumed for alternatives incorporating construction of a sand cover. The exact grain size specifications would be developed during the design phase but would likely consist of medium to coarse grain sands that would withstand mild erosive forces.

Appendix C: Table 1
Volume, Rate, and Time Frame Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Remedial Areas			
Total Remedial Area (acres)			
Total wetland areas for remediation (acres) in MN	1.65	4%	
Total open water areas for remediation (acres) in MN	31.4	81%	
Total wetland areas for remediation (acres) in WI	0.0	0%	
Total open water areas for remediation (acres) in WI	5.9	15%	
Total remedial area (acres)	38.95		
Hotspot Remedial Area (acres)			
Total hotspot area for remeidation in MN	4.12	56%	
Total hotspot area for remeidation in WI	3.24	44%	
Total hotspot area for remediation	7.4		
Contaminated Sediment			
Volume and Mass of Contaminated Sediment in Wetland Areas in MN			
Wetland areas (acres)	1.65		
Estimated depth of contamination (feet)	2.132	0.65	(meter)
Volume of contamination (cubic yards)	5675		
Mass of contaminated sediment	7946	1.4	ton per CY
Volume and Mass of Contaminated Sediment in Open Water Areas in MN			
Open water area (acres)	31.4		
Estimated depth of contamination (feet)	2.132	0.65	(meter)
Volume of contamination (cubic yards)	108004		
Mass of contaminated sediment	151206	1.4	ton per CY
Total Volume and Mass of Contaminated Sediment in MN			
Wetland areas (cubic yards)	5675		
Open water areas (cubic yards)	108004		
Total volume of contaminated sediment (cubic yards)	113680		
Mass of contaminated sediment	159152	1.4	ton per CY
Volume and Mass of Contaminated Sediment in Wetland Areas in WI			
Wetland areas (acres)	0.0		
Estimated depth of contamination (feet)	2.132	0.65	(meter)
Volume of contamination (cubic yards)	0		
Mass of contaminated sediment	0	1.4	ton per CY
Volume and Mass of Contaminated Sediment in Open Water Areas in WI			
Open water area (acres)	5.9		
Estimated depth of contamination (feet)	2.13	0.65	(meter)
Volume of contamination (cubic yards)	20294		
Mass of contaminated sediment	28411	1.4	ton per CY
Total Volume and Mass of Contaminated Sediment in WI			
Wetland areas (cubic yards)	0		
Open water areas (cubic yards)	20294		
Total volume of contaminated sediment (cubic yards)	20294		
Mass of contaminated sediment	28411	1.4	ton per CY
Total Volume and Mass of Contaminated Sediment			
Wetland areas (cubic yards)	5675.4		
Open water areas (cubic yards)	128298.1		
Total volume of contaminated sediment (cubic yards)	133973		
Mass of contaminated sediment	187562	1.4	ton per CY
Total Volume and Mass of Contaminated Sediment in Hotspot Remedial Area			
Estimated depth of contamination (feet)	2.132	0.65	(meter)
Total hotspot area for remeidation in MN (acres)	4.12		
Volume of contamination in MN (cubic yards)	14171		
Total hotspot area for remeidation in WI (acres)	3.24		
Volume of contamination in WI (cubic yards)	11144		
Total Volume of hotspot contamination (cubic yards)	25316		
Total hotspot area for remeidation in MN (tons)	19839.77	1.4	tons per cubic yard
Total hotspot area for remeidation in WI (tons)	15602.15	1.4	tons per cubic yard
Totla hotspont area for remediation (tons)	35442	1.4	tons per cubic yard

Appendix C: Table 1
Volume, Rate, and Time Frame Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

	Amendment/Cover Volumes		
Alternative 3: EMNR with Broadcasted Amendment (Apatite or Similar for Sequestration of Metals)			<--- Do we still need this?
Wetland areas (acres)	1.7		
Amendment thickness (inches)	2	0.05	(meter)
Amendment required (cubic yards)	444		
Open water areas (acres)	37.3		
Amendment thickness (inches)	2	0.05	(meter)
Amendment required (cubic yards)	10030		
Total volume of amendment required for Alternative 3 (cubic yards)	10474		
Alternative 3: EMNR with Broadcasted Amendment (Activated Carbon for Dioxins/PCBS - Incoporated into Text but not Costs)			
Amendment in cubic yards			
Application areas (acres)	38.95		
Amendment thickness required per acre (inches)	0.38	0.010	(meter)
Amendment required (cubic yards)	2012		
Amendment in tons			
Contaminated areas (acres)	38.95		
Amendment tons per acre	31		metric tons per acre
Amendment required (tons)	1207		
Sedimite dry bulk density (pounds per cubic foot)	45		
Sedimite required based on dry bulk density (cubic yards)	1988		
Alternative 4: EMNR with Thin-Layer Amended Cover			
Wetland areas (acres)	1.7		
Cover thickness (inches)	6	0.15	(meter)
Sand content by volume (percent)	100		
Sand required (cubic yards)	1331		
Amendment required (cubic yards)	85.25		
Total materials required (cubic yards)	1416.25		
Open water areas (acres)	37.3		
Cover thickness (inches)	6	0.15	(meter)
Sand content by volume (percent)	100		
Sand required (cubic yards)	30089		
Amendment required (cubic yards)	1927		
Total materials required (cubic yards)	32016.167		
Total volume of sand required for Alternative 4 (cubic yards)	31420		
Total volume of amendment required for Alternative 4 (cubic yards)	2012		
Total volume of materials required for Alternative 4 (cubic yards)	33432		
Alternative 5: Excavate, Offsite Disposal			
Vegetated Wetland areas (acres)	1.7		
Cover thickness (feet)	0.50		
Sand required (cubic yards)	1,331		
Total materials required (cubic yards)	1,331		
Open water areas (acres)	37.30		
Sand layer thickness (feet)	0.50		
Sand required (cubic yards)	30,089		
Total amount of sand required for Alternative 5 (cubic yards)	31,420		

Appendix C: Table 1
Volume, Rate, and Time Frame Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Alternative 6: Hotpsot dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment

Sand in cubic yards (dredge cover)			
Hotspot area (acres)	7.40		
Sand layer thickness (feet)	0.50		
Sand required (cubic yards)	5,969		
Amendment in cubic yards			
Application areas (acres)	31.55		
Amendment thickness required per acre (inches)	0.38	0.010	(meter)
Amendment required (cubic yards)	1630		
Amendment in tons			
Contaminated areas (acres)	31.55		
Amendment tons per acre	31		metric tons per acre
Amendment required (tons)	978		
Sedimite dry bulk density (pounds per cubic foot)	45		
Sedimite required based on dry bulk density (cubic yards)	1610		

Production Rates

Stone Slinger Barge Production Rate (Alternative 3)

Cycle Time			
Hopper capacity (cubic yards)	12		
Application time per cubic yard placed (minutes)	6		
Application time per load (minutes)	72	1.2	hours
Load time (minutes)	5	0.083	hours
Add in time for travel (minutes)	10	0.17	hours
Total cycle time (hours)	1.45		
Production Rate			
Active placement time per day (hours)	11		
Number of cycles per day per barge	7		
Number of barges	2		
Total volume of amendment applied per day (cubic yards)	168		

Thin-Layer Cover or Dredge Cover Placement Production Rate (Alternative 4, 5, 6)

Bucket size (cubic yards)	2
Percent fill	70
Material per bucket (cubic yards)	1.4
Minutes per cycle	2
Active placement duration per day (hours)	11
Daily production (cubic yards)	462

Dredge Sediment (Alternative 5)

Dredge production (cubic yards per hour)	33.6	Assume 2, 25-cubic yard transport barges are filled per hour
Active dredging duration per day (hours)	22	work day
Daily production (cubic yards)	739.2	

Dredge Sediment (Alternative 6)

Dredge production (cubic yards per hour)	33.6	Assume 2, 25-cubic yard transport barges are filled per hour
Active dredging duration per day (hours)	10.5	work day
Daily production (cubic yards)	352.8	

Construction Timeframe

Alternative 3: Enhanced MNR with Broadcasted Amendment		
Construct staging area and mobilize/setup equipment (days)	5	
Place amendment (days)	63	
Breakdown equipment/demobilize and site restoration (days)	5	
Total time on-site (days)	73	15 weeks
Alternative 4: Enhanced MNR with Thin-Layer Amended Cover		
Construct staging area and mobilize/setup equipment (days)	5	
Place amendment (days)	73	
Breakdown equipment/demobilize and site restoration (days)	5	
Total time on-site (days)	83	17 weeks
Alternative 5: Excavate, Offsite Disposal		
Construction Season #1		
Construct staging area and mobilize/setup equipment (days)	35	Accouns for 2 Mobs
Excavation sediments in open water areas (days)	181	Assumes 24 hours per day
Place cover in open water and wetland areas (days)	68	Conducted concurrently with excavation
Breakdown equipment/demob and site restoration (days)	10	
Total Construction Time (days)	226	
Total Construction Time (weeks)	46	
Construction Season 1	26	
Costruction Season 2	20	
Alternative 6: Hotpsot dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment		
Construction Season #1		
Construct staging area and mobilize/setup equipment (days)	21	
Excavation sediments in Hotspot (days)	72	Assumes 12 hours per day, 5 days per week
Place cover in open water and wetland areas (days)	13	Conducted concurrently with excavation
Place amendment (days)	63	
Breakdown equipment/demob and site restoration (days)	10	
Total Construction Time (days)	166	
Total Construction Time (weeks)	34	

Appendix C: Table 2
Unit Rate Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Description	Unit	Unit Cost	Quantity	Extended	Comments
Surface Broadcast Amendment (Alternative 3)					
Equipment					
End loader	Day	580.00	1	$580.00	Manage imported materials at Hallett Dock #7
Staging area Derrick crane with clamshell bucket	Day	536.00	1	$536.00	Load transport hopper barges
Material transport barge	Day	684.00	1	$684.00	400 ton barge for material transport; on-barge excavator for loading smaller transport barges on-site
Material transport barge tug	Day	551.00	1	$551.00	Transport material barge between staging area and Site
Material transport barge excavator with clamshell bucket	Day	1335.00	1	$1,335.00	Onboard excavator to load stone slinger hopper barges
Hopper barge with stone slinger	Day	637.00	2	$1,274.00	12 cubic yard capacity hopper; stone slinger to broadcast amendment
Push boats	Day	373.00	2	$746.00	Move stone slinger hopper barges for placement and loading
Pickup trucks	Day	97.00	3	$291.00	Site supervisor, foreman, mechanic
			SUBTOTAL	$5,997.00	
Labor					
On-site project management	Day	1200.00	1	$1,200.00	
Foreman	Day	854.00	1	$854.00	
Mechanic	Day	980.00	1	$980.00	
Operator at staging area	Day	1106.00	1	$1,106.00	Manage and load incoming materials
Laborer at staging area	Day	812.00	1	$812.00	Manage and load incoming materials
Material transport barge operator	Day	1106.00	1	$1,106.00	Transport materials between staging area and Site; load hopper barges
Stone slinger operators	Day	1036.00	2	$2,072.00	
Push boat operators	Day	1036.00	2	$2,072.00	
Lodging and Per-Diem	Day	146.00	10	$1,460.00	
			SUBTOTAL	$11,662.00	
			TOTAL	$17,659.00	
			DAILY PRODUCTION (CY)	168.00	
			UNIT RATE (CY)	$105.11	

Appendix C: Table 2
Unit Rate Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Place Materials via Barge-Mounted Excavator (Alternative 4)

Description	Unit	Unit Cost	Quantity	Extended	Comments
Equipment					
End loader	Day	$580.00	1	$580.00	Manage imported materials at Hallett Dock #7
Staging area Derrick crane with clamshell bucket	Day	$536.00	1	$536.00	Load transport hopper barges
Material transport barge	Day	$827.00	1	$827.00	800 ton barge for material transport; on-barge excavator for loading smaller transport barges on-site
Material transport barge tug	Day	$551.00	1	$551.00	Transport material barge between staging area and Site
Onboard skid steer	Day	$366.00	1	$366.00	Manage materials onboard dredge
Material transport barge excavator with clamshell bucket	Day	$1,335.00	1	$1,335.00	Onboard excavator to load hopper barges
Transport hopper barges	Day	$129.00	2	$258.00	25 cubic yard capacity hopper barges
Transport tug/boat	Day	$373.00	1	$373.00	Small tug/work boat to transport hopper barges
Excavator barge	Day	$355.00	1	$355.00	With spuds and winches
Barge-mounted excavator with clamshell bucket	Day	$1,335.00	1	$1,335.00	Place amendment
RTK DGPS for dredge	Day	$190.00	1	$190.00	
Survey boat with multibeam survey equipment	Day	$1,500.00	1	$1,500.00	
Pickup trucks	Day	$97.00	3	$291.00	Site supervisor, foreman, mechanic
			SUBTOTAL	$8,497.00	
Labor					
On-site project management	Day	$1,200.00	1	$1,200.00	
Foreman	Day	$854.00	1	$854.00	
Mechanic	Day	$980.00	1	$980.00	
Operator at staging area	Day	$1,106.00	1	$1,106.00	Manage and load incoming materials
Laborer at staging area	Day	$812.00	1	$812.00	Manage and load incoming materials
Material transport barge operator	Day	$1,106.00	1	$1,106.00	Transport materials between staging area and Site; load hopper barges
Placement excavator operator	Day	$1,106.00	1	$1,106.00	Place cover material
Tug/workboat operator	Day	$1,036.00	1	$1,036.00	Transport hopper barges between material barge and placement area
Skid steer operator/bargehand	Day	$1,036.00	1	$1,036.00	
Lodging and Per-Diem	Day	$146.00	9	$1,314.00	
			SUBTOTAL	$10,550.00	
			TOTAL	$19,047.00	
			DAILY PRODUCTION (CY)	462	
			UNIT RATE (CY)	$41.23	

Appendix C: Table 2
Unit Rate Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Alternative 5: Dredge Offsite Disposal

Dredge Unit Rates

Description	Unit	Unit Cost	Quantity	Extended	Comments
Equipment					
Telehandler	Day	$567.00	1	$567.00	Move equipment around Site
Dredge excavator	Day	$2,079.00	1	$2,079.00	Dredge sediments
Clamshell bucket	Day	$102.00	1	$102.00	
RTK GPS equipment for dredge	Day	$350.00	1	$350.00	
Dredge barge	Day	$355.00	1	$355.00	With spuds and winches
Dredge tug	Day	$1,011.18	3	$3,033.54	To transport hopper barges
Material transport barges	Day	$129.00	4	$516.00	25 cubic yard capacity hopper barges
Work boat	Day	$373.00	1	$373.00	
Survey vessel with equipment	Day	$1,500.00	1	$1,500.00	Track progress and QA/QC data
Upland crane	Day	$2,449.32	1	$2,449.32	Unload dredged sediments
End loader	Day	$985.00	1	$985.00	Stabilize sediments and load into trucks
Work trucks	Day	$97.00	3	$291.00	Site supervisor, foreman, mechanic
Storage silo	Day	$100.00	1	$100.00	Storage of Portland cement
Portland cement	Day	$120.00	62.0928	$7,451.14	6 percent by weight; sediment 1.4 tons per cubic yard
			SUBTOTAL	$20,152.00	
Labor					Assumes 2 shifts per day for 24 hr work cycle
On-site project management	Day	1200.00	2	$2,400.00	
Foreman	Day	854	2	$1,708.00	
Dredge operator	Day	$1,106.00	2	$2,212.00	
Boat operator	Day	$1,036.00	6	$6,216.00	
Derrick crane operator	Day	$1,106.00	2	$2,212.00	
End loader operator	Day	$1,106.00	2	$2,212.00	
Laborers (2)	Day	$812.00	4	$3,248.00	
Lodging and Per-Diem	Day	$146.00	27	$3,942.00	
			SUBTOTAL	$24,150.00	
			TOTAL	$44,302.00	
			DAILY PRODUCTION (CY)	739.2	4 25-cubic yard hopper barges filled per hour
			UNIT RATE (CY)	$59.93	

Cover Material Placement Unit Rates	UNIT RATE (CY)	$41.23	Same as Alt 4

Appendix C: Table 2
Unit Rate Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Alternative 6: Hotpsot Dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment					
Dredge Unit Rates					
Equipment					
Telehandler	Day	$567.00	1	$567.00	Move equipment around Site
Dredge excavator	Day	$1,265.00	1	$1,265.00	Dredge sediments
Clamshell bucket	Day	$70.00	1	$70.00	
RTK GPS equipment for dredge	Day	$350.00	1	$350.00	
Dredge barge	Day	$355.00	1	$355.00	With spuds and winches
Dredge tug	Day	$551.00	1	$551.00	To transport hopper barges
Material transport barges (2)	Day	$129.00	2	$258.00	25 cubic yard capacity hopper barges
Work boat	Day	$373.00	1	$373.00	
Survey vessel with equipment	Day	$1,500.00	1	$1,500.00	Track progress and QA/QC data
Upland crane	Day	$1,545.24	1	$1,545.24	Unload dredged sediments
End loader	Day	$580.00	1	$580.00	Stabilize sediments and load into trucks
Work trucks	Day	$97.00	3	$291.00	Site supervisor, foreman, mechanic
Storage silo	Day	$100.00	1	$100.00	Storage of Portland cement
Portland cement	Day	$120.00	29.6352	$3,556.22	6 percent by weight; sediment 1.4 tons per cubic yard
			SUBTOTAL	$11,361.46	
Labor					
On-site project management	Day	1200.00	1	$1,200.00	
Foreman	Day	854	1	$854.00	
Dredge operator	Day	$1,106.00	1	$1,106.00	
Boat operator	Day	$1,036.00	1	$1,036.00	
Derrick crane operator	Day	$1,106.00	1	$1,106.00	
End loader operator	Day	$1,106.00	1	$1,106.00	
Laborers (2)	Day	$812.00	2	$1,624.00	
Lodging and Per-Diem	Day	$146.00	9	$1,314.00	
			SUBTOTAL	$9,346.00	
			TOTAL	$20,707.46	
			DAILY PRODUCTION (CY)	352.8	2 25-cubic yard hopper barges filled per hour
			UNIT RATE (CY)	$58.69	
Cover Material Placement Unit Rates			UNIT RATE (CY)	$41.23	Same as Alt 4
Broadcast ammendment application			UNIT RATE (CY)	$105.11	Same as Alternavie 3
Sediment Hauling and Landfill Disposal					
Transport sediments to landfill	Ton	$4.93	1	$4.93	
Dispose of sediments at landfill					Vonco V Landfill in Duluth
Disposal	Ton	$12.00	1	$12.00	
Environmental Fee	Ton	$0.27	1	$0.27	
Industrial Solid Waste Tax	Ton	$0.46	1	$0.46	
			UNIT RATE (TON)	$17.66	
Purchase and Import Amendment					
Purchase amendment material	Ton	$4,000.00	1	$4,000.00	Estimated Cost for Sedimite
Import amendment material to staging area	Ton	$63.00	1	$63.00	20 tons per trailer; $2.52/mile; 500 miles shipping
			UNIT RATE (TON)	$4,063.00	
			UNIT RATE (CY)	$2,477.00	Assume 1.64 tons per CY

Appendix C: Table 2
Unit Rate Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Purchase and Import Sand					
Purchase sand from upland borrow source	CY	$6.90	1	$6.90	
Import sand to staging area	CY	$13.90	1	$13.90	40 mile cycle; 15 minute wait
			UNIT RATE (CY)	$20.80	

Construction Quality Assurance and Oversight

Description	Unit	Unit Cost	Quantity	Extended	Comments
QA/QC and federal oversight personnel	Week	$10,200.00	1	$10,200	Two staff
Lodging and per-diem	Week	$1,460.00	1	$1,460	Two staff
Truck and mileage	Week	$1,142.00	1	$1,142	Includes mileage
			UNIT RATE (WEEK)	$13,000	

Monthly Operating Expenses and Site Security

Description	Unit	Unit Cost	Quantity	Extended	Comments
Field Offices					
Office trailers and storage boxes (3)	Month	$942.00	3	$2,826.00	Includes utilities, equipment, and supplies for three units
Security Guard	Month	$17,280.00	1	$17,280.00	$40 per hour; 108 hours per week
			UNIT RATE (MONTH)	$20,000	Rounded

Appendix C: Table 3
Lump Sum Costs
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Lump Sum Costs - Alternative 1: No Action

No lump sum costs associated with Alternative 1.

Lump Sum Costs - Alternative 2: Monitored Natural Recovery

No lump sum costs associated with Alternative 2.

Lump Sum Costs - Alternative 3: Enhanced MNR with Broadcasted Amendment

Description	Unit	Unit Cost	Quantity	Extended	Comments
Mobilization/Demobilization					
Office trailers (3) and connex boxes to staging area	Mile	$12.26	240	$2,942.40	To staging area; within 20 miles of site
End loader	Each	$5,592.00	1	$5,592.00	To staging area
Staging area Derrick crane with clamshell bucket	Each	$5,592.00	1	$5,592.00	To staging area
Material transport barge	Hour	$1,634.00	8	$13,072.00	To staging area; sourced from Duluth Harbor
Material transport barge tug	Hour	$1,634.00	0	$0.00	To staging area; sourced from Duluth Harbor
Material transport barge excavator with clamshell bucket	Each	$1,914.00	1	$1,914.00	To staging area
Hopper barge with stone slinger	Each	$1,914.00	2	$3,828.00	To staging area
Push boats (2)	Each	$1,914.00	1	$1,914.00	To staging area; 1 load
Pickup trucks (3)	Mile	$0.56	1500	$840.00	To staging area; 250 miles each way
Additional mileage for non-local equipment	Mile	$2.52	1500	$3,780.00	Assume 3 loads non-local; 250 miles away
Install staging area fencing	LF	$5.39	1500	$8,085.00	Install fencing around staging area perimeter
Assemble and launch equipment; setup staging area	Day	$17,659.00	4	$70,636.00	
Remove and load equipment; disassemble staging area	Day	$17,659.00	4	$70,636.00	
				$189,000.00	Rounded
Site Work					
Clear and grub staging area	Acre	$10,489.00	2	$20,978.00	Assume 4 acres for laydown and 1 acre total along roadways
Construct laydown areas	SY	$8.52	14520	$123,710.40	4-inch crushed concrete; assume 3 acres
Construct site fencing	LF	$5.39	1000	$5,390.00	Assume 1000 feet
Site supervision during site work	Day	$2,540.00	5	$12,700.00	Assume 10 days for staging area construction
			TOTAL	$163,000.00	Rounded
Install and Remove Dolphin Pilings					
Equipment and Labor					
Work barge	Day	$855.00	1	$855.00	Monthly rate times 1.25
Tug	Day	$2,985.30	1	$2,985.30	Monthly rate times 1.25
Crane	Day	$2,150.10	1	$2,150.10	Monthly rate times 1.25
Hammer	Day	$143.48	1	$143.48	Monthly rate times 1.25
Tug captain/crane operator	Day	$1,106.00	1	$1,106.00	12-hour workday with overtime
Laborers	Day	$812.00	2	$1,624.00	12-hour workday with overtime
		TOTAL DAILY COST		$8,863.88	
Installation Work Activities					
Prep/"de-prep" equipment	Day	$8,863.88	1	$8,863.88	
Travel to/from Duluth; launch/pull equipment	Day	$8,863.88	3	$26,591.63	
Travel to/from Site; drive pilings	Day	$8,863.88	1	$8,863.88	
Removal Work Activities	Lump Sum	$44,319.38	1	$44,319.38	Same costs as installation
Materials	Lump Sum	$6,000.00	1	$6,000.00	
		TOTAL PROJECT COST		$95,000.00	Rounded

Lump Sum Costs - Alternative 4: Enhanced MNR with Thin-Layer Amended Cover

Description	Unit	Unit Cost	Quantity	Extended	Comments
Mobilization/Demobilization					
Office trailers (3) and connex boxes to staging area	Mile	$12.26	240	$2,942.40	To staging area; within 20 miles of site
End loader	Each	$5,592.00	1	$5,592.00	To staging area
Staging area Derrick crane with clamshell bucket	Each	$5,592.00	1	$5,592.00	To staging area
Material transport barge	Hour	$1,634.00	8	$13,072.00	To staging area; sourced from Duluth Harbor
Material transport barge tug	Hour	$1,634.00	0	$0.00	To staging area; sourced from Duluth Harbor
Excavators	Each	$1,914.00	3	$5,742.00	To staging area
Transport hopper barges	Each	$1,914.00	2	$3,828.00	To staging area
Transport tug/boat; survey boat	Each	$1,914.00	1	$1,914.00	To staging area
Onboard skid steer	Each	$1,578.00	1	$1,578.00	To staging area
Pickup trucks (3)	Mile	$0.56	1500	$840.00	To staging area; 250 miles each way
Additional mileage for non-local equipment	Mile	$2.52	1500	$3,780.00	Assume 3 loads non-local; 250 miles away
Install staging area fencing	LF	$5.39	1500	$8,085.00	Install fencing around staging area perimeter
Assemble and launch equipment; setup staging area	Day	$19,047.00	4	$76,188.00	
Remove and load equipment; disassemble staging area	Day	$19,047.00	4	$76,188.00	
				$205,000.00	Rounded
Site Work					
Clear and grub staging area	Acre	$10,489.00	2	$20,978.00	Assumes 2 acres for laydown area
Construct laydown areas	SY	$8.52	14520	$123,710.40	4-inch crushed concrete; assume 3 acres
Construct site fencing	LF	$5.39	1000	$5,390.00	Assume 1000 feet
Site supervision during site work	Day	$2,540.00	5	$12,700.00	Assume 10 days for staging area construction
			TOTAL	$163,000.00	Rounded
Install Dolphin Pilings	Lump Sum	$95,000.00	1	$95,000	Same cost as Alternative 3

Appendix C: Table 3
Lump Sum Costs
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Lump Sum Costs - Alternative 5: Dredge Offsite Disposal					
Description	**Unit**	**Unit Cost**	**Quantity**	**Extended**	**Comments**
Mobilization/Demobilization					
Office trailers (3) and connex boxes to staging area	Mile	$12.26	240	$2,942	
Telehandler	Each	$1,914.00	1	$1,914	
Dredge excavator	Each	$1,914.00	1	$1,914	
Dredge barge	Each	$1,914.00	1	$1,914	
Clamshell buckets	Each	$1,578.00	1	$1,578	Two per load
Work boats (2)	Each	$1,914.00	1	$1,914	Two per load
Material transport barges (2)	Each	$1,914.00	2	$3,828	One per load
Derrick crane	Each	$5,592.00	1	$5,592	
End loader	Each	$1,914.00	1	$1,914	
Storage silo	Each	$1,578.00	1	$1,578	
Pickup trucks (3)	Mile	$0.56	1500	$840	500 miles round trip per truck
Additional mileage for non-local equipment	Mile	$2.52	2000	$5,040	Assume 4 items; 250 miles away
Receive, assemble, and launch equipment	Day	$44,302.00	3	$132,906	Includes travel time, assume 2.5 days
Demobilization activities	Day	$44,302.00	3	$132,906	Includes travel time, assume 2.5 days
			TOTAL	$593,560	Assumes 2 construction seasons
Site Work					
Construct site fencing	LF	$5.39	1000	$5,390.00	Assume 1000 feet
Construct dewatering pad	Lump Sum	$100,000.00	1	$100,000.00	150' by 150'
Site supervision during site work	Day	$2,540.00	10	$25,400.00	Assume 10 days for staging area construction
			TOTAL	$131,000.00	Rounded
Debris Removal					
Description	**Unit**	**Unit Cost**	**Quantity**	**Extended**	**Comments**
Cost of labor and equipment for sediment excavation	Day	44302.00	3	$132,906.00	Assume three days for debris removal
Turbidity Controls					
Turbidity controls during sediment dredging	SF	7.6	10280	$78,128.00	50' radius around dredge; 200' section downstream, 20' deep
Construction Quality Assurance Monitoring					
Oversight staff	Week	$6,000	36	$217,488.64	Full-time oversight during day shift
Oversight staff lodging and per-diem	Week	$1,022	36	$37,045.56	
Air Monitoring Equipment	Week	$800.00	36	$28,998.48	Sediment excavation and stabilization area; active excavation timeframe only
Turbidity Monitoring Equipment	Week	$500.00	36	$18,124.05	Two buoys and software; dredging duration
Construction Quality Assurance Sample Analysis					
Pre- and Post-Construction Soil Sampling					
Dioxins/Furans (EPA 8290A)	Per Sample	$595.00	39	$23,175.25	One composite sample per acre, 4 grabs/composite
Mercury* (EPA 7471B)	Per Sample	$28.00	39	$1,090.60	One composite sample per acre, 4 grabs/composite
Treated Discharge Water Sampling					
TSS (SM 2540 D)	Per Sample	$14.00	46	$644.00	1 sample per week
Dioxins/Furans (EPA 8290A)	Per Sample	$595.00	46	$27,370.00	1 sample per week
Mercury* (EPA 7471B)	Per Sample	$32.00	46	$1,472.00	1 sample per week
Low-level Mercury	Per Sample	$85.00	46	$3,910.00	1 sample per week
Post-Dredge Verification Sampling					
Dioxins/Furans (EPA 8290A)	Per Sample	$595.00	39	$23,175.25	One sample per acre
Mercury* (EPA 7471B)	Per Sample	$32.00	39	$1,246.40	One sample per acre
Dewatered Sediment Sampling					
TCLP Metals* (EPA 6020A/7471B)	Per Sample	$110.00	38	$4,126.36	One sample per 5,000 CY
Flash Point	Per Sample	$10.00	38	$380.00	One sample per 5,000 CY
pH (EPA 9045)	Per Sample	$10.00	38	$375.12	One sample per 5,000 CY
Paint Filter	Per Sample	$10.00	38	$375.12	One sample per 5,000 CY
			TOTAL	$389,000.00	Rounded

Lump Sum Costs - Alternative 6: Hotpsot Dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment					
				Extended	
Dredge Construction Equipment				$296,780.00	Same costs as Alternative 5, only 1 construction season
Site Work				$131,000.00	Same costs as Alternative 5
Broadcast Ammendment Construction Equipment				$186,000.00	Same as Alternative 3, without duplicated connex costs
Install Dolphin Pilings				$95,000.00	Same cost as shown for Alternative 3
Turbidity Controls				$78,128.00	Same costs as Alternative 5
Construction Monitoring and Sample Analysis					
Air Monitoring	Week	$800.00	14	$11,481.02	Sediment excavation and stabilization area; active excavation timeframe only
Turbidity Monitoring	Week	$500.00	14	$7,175.64	Two buoys and software; dredging duration
Pre- and Post-Construction Soil Sampling					
Dioxins/Furans (EPA 8290A)	Per Sample	$595.00	7	$4,403.00	One composite sample per acre, 4 grabs/composite
Mercury* (EPA 7471B)	Per Sample	$28.00	7	$207.20	One composite sample per acre, 4 grabs/composite
Treated Discharge Water Sampling					
TSS (SM 2540 D)	Per Sample	$14.00	34	$476.00	1 sample per week
Dioxins/Furans (EPA 8290A)	Per Sample	$595.00	34	$20,230.00	1 sample per week
Mercury* (EPA 7471B)	Per Sample	$32.00	34	$1,088.00	1 sample per week
Low-level Mercury	Per Sample	$85.00	34	$2,890.00	1 sample per week
Post-Dredge Verification Sampling					
Dioxins/Furans (EPA 8290A)	Per Sample	$595.00	7	$4,403.00	One sample per acre
Mercury* (EPA 7471B)	Per Sample	$32.00	7	$236.80	One sample per acre
Dewatered Sediment Sampling					
TCLP Metals* (EPA 6020A/7471B)	Per Sample	$110.00	7	$779.72	One sample per 5,000 CY
Flash Point	Per Sample	$10.00	8	$80.00	One sample per 5,000 CY
pH (EPA 9045)	Per Sample	$10.00	7	$70.88	One sample per 5,000 CY
Paint Filter	Per Sample	$10.00	7	$70.88	One sample per 5,000 CY
			TOTAL	$54,000.00	Rounded

Appendix C: Table 4
Monitoring Elements
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Monitoring and Evaluation Costs - Alternative 1: No Action

No monitoring and evaluation costs associated with Alternative 1.

Monitoring and Evaluation Costs - Alternative 2: MNR

Monitoring Elements	Unit	Cost	Extended	Total	Comment
Monitoring and Evaluation Report	Each	$4,000.00	6	$24,000	Every 5 years for 30 years
Field Sampling	Event	$34,000.00	6	$204,000	Every 5 years for 30 years
Sample Analysis	Event	$35,920.00	6	$215,520	Every 5 years for 30 years
Lead, Nickel, and Zinc (EPA 6020A)	*Sample*	*$48.00*	*25*	*$1,200.00*	*11 locations; 2 intervals; QA/QC samples*
Grain Size (ASTM D422 w/ Hydrometer)	*Sample*	*$375.00*	*5*	*$1,875.00*	*Needed for tox/bio; 5 locations*
TOC Quad Burn (EPA 9060A)	*Sample*	*$105.00*	*5*	*$525.00*	*Needed for tox/bio; 5 locations*
10-d toxicity C. tentans	*Sample*	*$1,638.00*	*5*	*$8,190.00*	*5 locations*
28-d toxicity H. azteca	*Sample*	*$2,013.00*	*5*	*$10,065.00*	*5 locations*
28-d bioaccumulation	*Sample*	*$2,013.00*	*5*	*$10,065.00*	*5 locations*
Lead, Nickel, and Zinc (Benthic Tissue)	*Sample*	*$100.00*	*25*	*$2,500.00*	*Individual replicate analysis*
Lipids content (Pace SOP)	*Sample*	*$100.00*	*10*	*$1,000.00*	*One composite per sample; benthics and fish*
Lead, Nickel, and Zinc (Benthic Tissue)	*Sample*	*$100.00*	*5*	*$500.00*	*Five composite samples from five species*
				$35,920.00	
				$444,000	Rounded

Monitoring and Evaluation Costs - Alternative 3 and Alternative 6

Monitoring Elements	Unit	Cost	Extended	Total	Comment
Monitoring and Evaluation Report	Each	$4,000.00	6	$24,000	Every 5 years for 30 years
Field Sampling	Event	$34,000.00	6	$204,000	Every 5 years for 30 years
Sample Analysis	Event	$35,920.00	6	$215,520	Every 5 years for 30 years
Lead, Nickel, and Zinc (EPA 6020A)	*Sample*	*$48.00*	*25*	*$1,200.00*	*11 locations; 2 intervals; QA/QC samples*
Grain Size (ASTM D422 w/ Hydrometer)	*Sample*	*$375.00*	*5*	*$1,875.00*	*Needed for tox/bio; 5 locations*
TOC Quad Burn (EPA 9060A)	*Sample*	*$105.00*	*5*	*$525.00*	*Needed for tox/bio; 5 locations*
10-d toxicity C. tentans	*Sample*	*$1,638.00*	*5*	*$8,190.00*	*5 locations*
28-d toxicity H. azteca	*Sample*	*$2,013.00*	*5*	*$10,065.00*	*5 locations*
28-d bioaccumulation	*Sample*	*$2,013.00*	*5*	*$10,065.00*	*5 locations*
Lead, Nickel, and Zinc (Benthic Tissue)	*Sample*	*$100.00*	*25*	*$2,500.00*	*Individual replicate analysis*
Lipids content (Pace SOP)	*Sample*	*$100.00*	*10*	*$1,000.00*	*One composite per sample; benthics and fish*
Lead, Nickel, and Zinc (Benthic Tissue)	*Sample*	*$100.00*	*5*	*$500.00*	*Five composite samples from five species*
				$35,920.00	

Monitoring and Evaluation Costs - Alternative 4: Enhanced MNR with Thin-Layer Amended Cover

Monitoring Elements	Unit	Cost	Extended	Total	Comment
Monitoring and Evaluation Report	Each	$4,000.00	6	$24,000	Every 5 years for 30 years
Field Sampling	Event	$34,000.00	6	$204,000	Every 5 years for 30 years
Sample Analysis	Event	$35,920.00	6	$215,520	Every 5 years for 30 years
Lead, Nickel, and Zinc (EPA 6020A)	*Sample*	*$48.00*	*25*	*$1,200.00*	*11 locations; 2 intervals; QA/QC samples*
Grain Size (ASTM D422 w/ Hydrometer)	*Sample*	*$375.00*	*5*	*$1,875.00*	*Needed for tox/bio; 5 locations*
TOC Quad Burn (EPA 9060A)	*Sample*	*$105.00*	*5*	*$525.00*	*Needed for tox/bio; 5 locations*
10-d toxicity C. tentans	*Sample*	*$1,638.00*	*5*	*$8,190.00*	*5 locations*
28-d toxicity H. azteca	*Sample*	*$2,013.00*	*5*	*$10,065.00*	*5 locations*
28-d bioaccumulation	*Sample*	*$2,013.00*	*5*	*$10,065.00*	*5 locations*
Lead, Nickel, and Zinc (Benthic Tissue)	*Sample*	*$100.00*	*25*	*$2,500.00*	*Individual replicate analysis*
Lipids content (Pace SOP)	*Sample*	*$100.00*	*10*	*$1,000.00*	*One composite per sample; benthics and fish*
Lead, Nickel, and Zinc (Benthic Tissue)	*Sample*	*$100.00*	*5*	*$500.00*	*Five composite samples from five species*
				$35,920.00	
				$444,000	Rounded

Field Sampling Event

Description	Unit	Cost	Extended	Total	Comment
Project Management	Hour	$115.00	30	$3,450.00	Project coordination
Scientist II	Hour	$84.00	10	$840.00	Field event planning and coordination
QA/QC	Hour	$94.00	20	$1,880.00	Chemical, tox/bio, tissue results
Field Sampling					
Field Labor	Person	$4,452.00	4	$17,808.00	5 hours meetings; 40 sampling; 8 mob/demob
Truck	Day	$75.00	10	$750.00	2 trucks; boat and office trailer
Mileage	Mile	$0.57	750	$423.75	
Pontoon	Day	$200.00	5	$1,000.00	
Vibracore rental	Lump Sum	$2,500.00	1	$2,500.00	Includes freight
Disposables	Lump Sum	$1,500.00	1	$1,500.00	Vibracore tubing
Office trailer	Day	$75.00	5	$375.00	
GPS	Day	$75.00	5	$375.00	
Generator	Day	$45.00	5	$225.00	
Drum	Each	$105.00	2	$210.00	
Sediment bundle	Day	$65.00	5	$325.00	
Fuel	Lump Sum	$50.00	1	$50.00	
IDW Disposal	Lump Sum	$250.00	1	$250.00	
Lodging	Night	$100.00	16	$1,600.00	
Per-Diem	Day	$35.00	20	$700.00	
			TOTAL	$34,000.00	Rounded

Bathymetric Survey Break-Down

Parameter	Unit	Cost	Extended	Total Cost	
Daily labor cost					
Scientist III	Hour	$109	16	$1,744	Prep equipment; mob/demob; perform survey
Field Tech II	Hour	$64	16	$1,024	Prep equipment; mob/demob; perform survey
Lodging	Night	$100	2	$200	1 night each
Per-diem	Day	$36	4	$144	2 days each
Daily equipment cost					
Boat	Day	$200	2	$400	
Fuel	Day	$25	1	$25	
Multi-beam survey equipment	Day	$1,500	2	$3,000	
GPS	Day	$75	2	$150	
Truck	Day	$75	2	$150	
Mileage	Mile	$0.56	350	$196	
Data reduction/mapping	Hour	$109	20	$2,180	
GIS	Hour	$64	10	$640	
			TOTAL	$10,000	Rounded

Monitoring and Evaluation Costs - Alternative 5: Dredge Offsite Disposal

No monitoring and evaluation costs associated with Alternative 5: Dredge Offsite Disposal

Monitoring and Evaluation Costs - Alternative 6: Hotpsot Dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendment

Monitoring Elements	Unit	Cost	Extended	Total	Comment
Monitoring and Evaluation Report	Each	$4,000.00	6	$24,000	Every 5 years for 30 years
Field Sampling	Event	$34,000.00	6	$204,000	Every 5 years for 30 years
Sample Analysis	Event	$35,920.00	6	$215,520	Every 5 years for 30 years
Lead, Nickel, and Zinc (EPA 6020A)	*Sample*	*$48.00*	*25*	*$1,200.00*	*11 locations; 2 intervals; QA/QC samples*
Grain Size (ASTM D422 w/ Hydrometer)	*Sample*	*$375.00*	*5*	*$1,875.00*	*Needed for tox/bio; 5 locations*
TOC Quad Burn (EPA 9060A)	*Sample*	*$105.00*	*5*	*$525.00*	*Needed for tox/bio; 5 locations*
10-d toxicity C. tentans	*Sample*	*$1,638.00*	*5*	*$8,190.00*	*5 locations*
28-d toxicity H. azteca	*Sample*	*$2,013.00*	*5*	*$10,065.00*	*5 locations*
28-d bioaccumulation	*Sample*	*$2,013.00*	*5*	*$10,065.00*	*5 locations*
Lead, Nickel, and Zinc (Benthic Tissue)	*Sample*	*$100.00*	*25*	*$2,500.00*	*Individual replicate analysis*
Lipids content (Pace SOP)	*Sample*	*$100.00*	*10*	*$1,000.00*	*One composite per sample; benthics and fish*
Lead, Nickel, and Zinc (Benthic Tissue)	*Sample*	*$100.00*	*5*	*$500.00*	*Five composite samples from five species*
				$35,920.00	
				$444,000	Rounded

Field Sampling Event

Description	Unit	Cost	Extended	Total	Comment
Project Management	Hour	$115.00	30	$3,450.00	Project coordination
Scientist II	Hour	$84.00	10	$840.00	Field event planning and coordination
QA/QC	Hour	$94.00	20	$1,880.00	Chemical, tox/bio, tissue results
Field Sampling					
Field Labor	Person	$4,452.00	4	$17,808.00	5 hours meetings; 40 sampling; 8 mob/demob
Truck	Day	$75.00	10	$750.00	2 trucks; boat and office trailer
Mileage	Mile	$0.57	750	$423.75	
Pontoon	Day	$200.00	5	$1,000.00	
Vibracore rental	Lump Sum	$2,500.00	1	$2,500.00	Includes freight
Disposables	Lump Sum	$1,500.00	1	$1,500.00	Vibracore tubing
Office trailer	Day	$75.00	5	$375.00	
GPS	Day	$75.00	5	$375.00	
Generator	Day	$45.00	5	$225.00	
Drum	Each	$105.00	2	$210.00	
Sediment bundle	Day	$65.00	5	$325.00	
Fuel	Lump Sum	$50.00	1	$50.00	
IDW Disposal	Lump Sum	$250.00	1	$250.00	
Lodging	Night	$100.00	16	$1,600.00	
Per-Diem	Day	$35.00	20	$700.00	
			TOTAL	$34,000.00	Rounded

Appendix C: Table 5
Present Value Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Discount rate used for present worth calculations:	7.00%
Present worth calculation is: [(2016 Cost)/(1.07^Event Year 1)]+[(2016 Cost)/(1.07^Event Year 2)]+…	
Year 0 is 2016.	

Alternative 1: No Action	**2016 Costs**	**Years**						**Total Present Worth**	**Note**
No Costs Associated with this Alternative									

Alternative 2: MNR	**2016 Costs**	**Years**						**Total Present Worth**	**Note**
Construction Costs									
No construction costs associated with this alternative									
Long-Term Monitoring									
Implementation Plan Report	$11,000	0						$11,000	
Monitoring and Evaluation Report	$4,000	5	10	15	20	25	30	$8,631	
Field Sampling	$34,000	5	10	15	20	25	30	$73,366	
Sample Analysis	$35,920	5	10	15	20	25	30	$77,509	
Bathymetric Survey	$10,000	5	10	15	20	25	30	$21,578	
Institutional Control Review	$1,500	5	10	15	20	25	30	$3,237	
Professional and Technical Services									
No professional and technical services associated with this alternative									

Alternative 3: Enhanced MNR with Broadcasted Amendment	**2016 Costs**	**Years**						**Total Present Worth**	**Note**
Construction Costs									
Mobilization/Demobilization	$189,000	1						$176,636	
Rent Hallett Dock #7 for Staging Area	$40,000	1						$37,383	
Install and Remove Dolphin Pilings	$95,000	1						$88,785	
Purchase Amendment Materials and Stockpile at Staging Area	$4,983,724	1						$4,657,686	
Broadcast Amendment	$211,488	1						$197,652	
Construction Monitoring/CQA and Oversight	$195,000	1						$182,243	
Monthly Operating Expenses and Site Security	$80,000	1						$74,766	
Implement Institutional Controls	$10,000	1						$9,346	
Long-Term Monitoring									
Monitoring and Evaluation Report	$4,000	5	10	15	20	25	30	$8,631	
Field Sampling	$34,000	5	10	15	20	25	30	$73,366	
Sample Analysis	$35,920	5	10	15	20	25	30	$77,509	
Professional and Technical Services									
Remedial Design (6%)	$469,000	0						$469,000	
Project Management and Permitting (5%)	$390,000	1						$364,486	
Construction Management (6%)	$469,000	1						$438,318	

Appendix C: Table 5
Present Value Calculations
Focused Feasibility Study
Munger Landing
Minnesota Pollution Control Agency

Alternative 4: Enhanced MNR with Thin-Layer Amended Cover	2016 Costs	Years						Total Present Worth	Note
Construction Costs									
Mobilization/Demobilization	$205,000	1						$191,589	
Rent Hallett Dock #7 for Staging Area	$50,000	1						$46,729	
Install and Remove Dolphin Pilings	$95,000	1						$88,785	
Purchase Amendment Materials and Stockpile at Staging Area	$4,983,724	1						$4,657,686	
Purchase Sand and Stockpile at Staging Area	$653,536	1						$610,781	
Construct Thin-Layer Cover	$1,295,361	1						$1,210,618	
Construction Monitoring/CQA and Oversight	$221,000	1						$206,542	
Monthly Operating Expenses and Site Security	$100,000	1						$93,458	
Implement Institutional Controls	$10,000	1						$9,346	
Long-Term Monitoring									
Monitoring and Evaluation Report	$4,000	5	10	15	20	25	30	$8,631	
Field Sampling	$34,000	5	10	15	20	25	30	$73,366	
Sample Analysis	$35,920	5	10	15	20	25	30	$77,509	
Professional and Technical Services									
Remedial Design (6%)	$ 604,000	0						$604,000	
Project Management and Permitting (5%)	$ 504,000	1						$471,028	
Construction Management (6%)	$ 604,000	1						$564,486	

Alternative 5: Dredge Offsite Disposal	2016 Costs	Years						Total Present Worth	Note
Construction Costs									
Mobilization/Demobilization	$593,560	1						$554,729	
Rent Hallett Dock #7 for Staging Area	$50,000	1						$46,729	
Install and Remove Dolphin Pilings	$95,000	1						$88,785	
Turbidity Controls	$78,128	1						$73,017	
Debris Removal	$132,906	1						$124,211	
Dredge Sediments	$8,029,317	1						$7,504,035	
Sediment Hauling and Landfill Disposal	$3,311,452	1						$3,094,815	
Purchase Sand and Stockpile at Staging Area	$653,536	1						$610,781	
Construct Thin-Layer Cover	$1,295,361	1						$1,210,618	
Construction Monitoring/CQA and Oversight	$598,000	1						$558,879	
Construction Monitoring and Sample Analysis	$389,000	1						$363,551	
Monthly Operating Expenses and Site Security	$230,000	1						$214,953	
Implement Institutional Controls	$10,000	1						$9,346	
Professional and Technical Services									
Remedial Design (6%)	$1,160,000	0						$1,160,000	
Project Management and Permitting (5%)	$967,000	1						$903,738	
Construction Management (6%)	$1,160,000	1						$1,084,112	

Alternative 6: Hotpsot Dredge Offsite Disposal & Enhanced MNR with Broadcasted Amendmental	2016 Costs	Years						Total Present Worth	Note
Construction Costs									
Mobilization/Demobilization	$296,780	1						$277,364	
Rent Hallett Dock #7 for Staging Area	$50,000	1						$46,729	
Install and Remove Dolphin Pilings	$95,000	1						$88,785	
Turbidity Controls	$78,128	1						$73,017	
Debris Removal	$88,604	1						$82,807	
Dredge Sediments	$1,517,227	1						$1,417,969	
Sediment Hauling and Landfill Disposal	$2,365,325	1						$2,210,584	
Purchase Sand and Stockpile at Staging Area	$124,155	1						$116,033	
Construct Dredge Cover	$246,086	1						$229,987	
Purchase Amendment Materials and Stockpile at Staging Area	$4,037,510	1						$3,773,374	
Broadcast Amendment	$171,334	1						$160,126	
Construction Monitoring/CQA and Oversight	$442,000	1						$413,084	
Construction Monitoring and Sample Analysis	$54,000	1						$50,467	
Monthly Operating Expenses and Site Security	$170,000	1						$158,879	
Implement Institutional Controls	$10,000	1						$9,346	
Long-Term Monitoring									
Monitoring and Evaluation Report	$4,000	5	10	15	20	25	30	$8,631	
Field Sampling	$34,000	5	10	15	20	25	30	$73,366	
Sample Analysis	$35,920	5	10	15	20	25	30	$77,509	
Professional and Technical Services									
Remedial Design (6%)	$738,000	0						$738,000	
Project Management and Permitting (5%)	$615,000	1						$574,766	
Construction Management (6%)	$738,000	1						$689,720	