GREAT LAKES ARCHITECT ENGINEER SERVICES (GLAES)

CONTRACT

SITE CHARACTERIZATION REPORT

Munger Landing Sediment Characterization,
St. Louis River AOC, Minnesota and Wisconsin
Site Characterization
EPA GLAES Contract
Task Order No. 68HE0518F0693/Contract No. EP-R5-11-09

August 2019

PREPARED FOR

EPA United States Environmental Protection Agency

PREPARED BY

ch2m

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Contents

Appendixes

Tables

Exhibits

Figures

Acronyms and Abbreviations

AOC	area of concern
bss	below sediment surface
BUI	beneficial use impairments
CH2M	CH2M HILL, Inc.
DQO	data quality objective
DRO	diesel range organics
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
IDW	investigation-derived waste
mg/kg	milligrams per kilogram
MPCA	Minnesota Pollution Control Agency
ng/kg	nanograms per kilogram
NOAA	National Oceanic and Atmospheric Administration
Pace Analytical	Pace Analytical Services, LLC
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PID	photoionization detector
QAPP	quality assurance project plan
R/V	Research Vessel
SQT	Sediment Quality Targets
TCLP	toxicity characteristic leaching procedure
TEQ	toxicity equivalence
TOC	total organic carbon
VOC	volatile organic compound
WDNR	Wisconsin Department of Natural Resources

SECTION 1

Introduction

This site characterization report documents the field activities and findings of the investigation conducted at the Munger Landing Sediment Characterization Site within the St. Louis River Area of Concern (AOC) in Minnesota and Wisconsin. The investigation was conducted for the U.S. Environmental Protection Agency (EPA) Great Lakes National Program Office in accordance with Task Order No. 68HE0518F0693, Contract No. EP-R5-11-09. Sampling activities were performed in October 2018. This report also presents data collected during investigations in 2014, 2015, and 2017, and summarizes a sediment investigation performed in 2011 to provide a complete understanding of the sediment characteristics, and upland investigation during 2016-2018.

The site characterization report is organized as follows:

- Section 1 presents the site setting, site history, and previous investigations.
- Section 2 presents the project objectives and description of the 2018 field investigation activities.
- Section 3 presents the investigation results.
- Section 4 provides conclusions, including a summary of the key findings and recommendations.
- Section 5 provides the references cited in this document.

1.1 Site Description

The Munger Landing site located in Duluth, Minnesota, is approximately 7 miles upstream (south) of Lake Superior within the St. Louis River AOC (Figure 1). Munger Landing is a cutoff channel, separated from the navigation channel in the St. Louis River by an island. General flow is from south to north and discharges into Lake Superior. The Munger Landing boat launch is located on the west side of the site and serves as the nearest identifiable landmark. The site extends east across the state line into Wisconsin and across the navigation channel to a marsh on the west shore of Clough Island. Spirit Lake, location of the U.S. Steel Superfund Site, is located directly upstream of the Munger Landing site.

Stewart Creek and Snively Creek, located on the west bank of the channel, flow from west to east into the Stewart Creek Wetlands, which empties into the St. Louis River just south of the Munger Landing boat launch. The creeks flow along the north and south sides of the former Westinghouse Electric Corp. repair facility, currently the site of a townhome development. Municipalities include the State of Minnesota, City of Duluth, Grand Avenue Estates, Burlington Northern Santa Fe Railroad, and private landowners.

The contaminants of concern at the Munger Landing site are polychlorinated biphenyls (PCBs), dioxins and furans, and mercury.

1.1.1 St. Louis River Area of Concern

The St. Louis River AOC, located in Minnesota and Wisconsin, was designated as the second largest U.S.-based AOC under the 1987 Great Lakes Water Quality Agreement, draining 3,634 square miles of watershed and encompassing a 1,020-square-mile area (EPA 2019).

The following are the beneficial use impairments (BUIs) for the St. Louis River AOC:

- Restrictions on fish and wildlife consumption
- Excessive loading of sediment and nutrients
- Degradation of fish and wildlife populations
- Beach closings
- Fish tumors or other deformities—**BUI removed 2019**
- Degradation of aesthetics—**BUI removed 2014**

- Degradation of benthos
- Restrictions on dredging activities
- Loss of fish and wildlife habitat

1.2 Hydrology

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. 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 and can result in reversed flow upstream for 11 miles from the confluence of the St. Louis River. According to the National Oceanic and Atmospheric Administration (NOAA) gauge station data, monthly Lake Superior water level elevations have ranged from 599.0 to 604.4 feet above mean sea level since measurements began in August 1997 (NOAA 2018). Since inception of the staff gauge in August 1997, through December 2018, monthly water levels have been above the ordinary high water mark elevation (603.1 feet) 15 percent of the time during the 21.4-year period, with all ordinary high water mark exceedances during this period occurring between June 2014 and December 2018, 71 percent of the time during the 4.6-year period. Stewart and

Snively Creek flow from west to east into the Stewart Creek Wetland area, which adjoins the river approximately 0.2 mile upstream of Munger Landing. No hydrology data exists for either creek; however, based on observations during the time of sampling, the primary source of water for the creeks seems to be overland flow. During the time of investigation, water levels for Stewart and Snively creeks were a maximum of 2.1 and 0.5 foot, respectively, and channel widths averaged 16 and 9 feet, respectively. A light current was observed in both Stewart and Snively Creeks during the time of sampling. The current did not affect wading in the creeks during sampling activities.

1.3 Background and History

During the late 19th century, the cities of Duluth, Minnesota, and Superior, Wisconsin, grew from the lumber and mineral exploration industries. The lumber industry was one of the first major industries in the area. The cities are proximate to the St. Louis River and Lake Superior, which inspired railroad speculators to construct early railroads here. Northern Pacific Railroad is located in the Munger Landing Project area. (CH2M 2019a)

The largest and busiest port on the Great Lakes, the Port of Duluth-Superior, handles an average of 35 million short tons of cargo and nearly 900 vessel visits each year. There are 20 privately owned and operated docks along 49 miles of waterfront in this harbor, plus one general cargo terminal, a fueling depot, tug/barge services, and a shipyard with two dry docks. Primarily, a natural resources port, docks in the "twin ports" of Duluth, Minnesota, and Superior, Wisconsin, handle a diversified commodities base ranging from coal, iron ore, grain, and limestone to cement, salt, wood pulp, steel coil, wind turbine components, and other heavy equipment (Duluth Seaway Port Authority 2019).

Lake Superior has been impacted by the point-source pollution from industrial discharges, sewage effluent, urban development and sedimentation in urban areas like the St. Louis River corridor (Goldsworthy et al. 2017). The lower 15 miles of the St. Louis River estuary has been impacted by heavy industry since the late 19th century (St. Louis River Citizens Action Committee 2002). Although water quality has improved since the Western Lake Superior Sanitary District began treating industrial and domestic effluent in 1979, contaminated sediments persist, and the International Joint Commission lists the estuary as an AOC (Anderson et al. 2013).

The Munger Landing Project is located in an area that was originally platted as the Ironside Division for the Ironside Steel Plant (Frank 1902). During the turn of the 20th century, the neighborhoods presently known

as Smithville, Riverside, and Morgan Park grew around the industrial subdivision to the south, north, and east, respectively (HNTB 2017).

The western shore of the Munger Landing site was used for railroad transportation. Historical aerials also show the land undeveloped, except for the railroads, Clyde Avenue, and surface parking lots (University of Minnesota 2005). Today, Munger Landing functions as a public boat launch.

Steel mill operations were located to the north and south of the site's western shore, and ship building operations occurred in the slips located directly adjacent to the north (downstream) of the site (Bay West 2018). Directly upstream of the Munger Landing site is the St. Louis River-U.S. Steel Superfund Site, location of the former U.S. Steel Duluth Works mill plant. Between 1916 and 1981, the plant was used for producing coke, iron, and steel and experienced peak production during World War II, producing 715,000 tons of steel a year (Duluth News Tribune 2018). The site, added to the federal Superfund site list in 1979, includes approximately 500 acres of land and a 200-acre part of the St. Louis River that is known as Spirit Lake.

The site of the former Westinghouse Electric Corp. repair facility was undeveloped wooded land through 1953, when a warehouse building was constructed for use by Westinghouse Electric Corp. as an electrical equipment service building. Westinghouse occupied the building through the 1980s. By 1990, Eastern Electric Apparatus Repair Co. occupied the site for similar operations. Eastern Electric occupied the site through the early 2000s. Metals Service, Inc. occupied the site during the early to mid-2000s. The building was demolished in 2005. Prior to remedial actions and development of the site through 2016 and 2017, the site remained vacant and largely undeveloped, wooded land since 2005 (Nova 2018). The 2016 through 2017 remedial actions were conducted under a voluntary program to manage upland subsurface impacts for protection of human health and the environment (Nova 2018). The property is currently the site of a townhome development.

1.4 Previous Investigations

A focused feasibility study (Bay West 2018) was completed by the Minnesota Pollution Control Agency (MPCA) that developed remedial alternatives to address contaminated sediment in the St. Louis River within the Munger Landing site.

The following is a summary of investigation activities that include the Munger Landing site:

2011 MPCA Lower St. Louis River Sediment Investigation

As part of an initial sediment investigation in the Lower St. Louis River, 14 samples from 6 locations were collected within the Munger Landing area. Samples were analyzed for polycyclic aromatic hydrocarbons (PAHs), PCBs, dioxins and furans, and select metals. The investigation was performed by Somat Engineering under contract to the U.S. Army Corps of Engineers, on behalf of MPCA (Somat Engineering 2012).

2014-2015 MPCA Munger Landing Sediment Investigation

A remedial investigation was performed by Bay West LLC for MPCA during summer 2014 and spring 2015. Sampling was conducted to determine the nature and extent of contaminated sediment, estimate volumes, refine the list of contaminants of concern, and develop a conceptual site model. A total of 110 sediment samples were collected from 40 locations within the Munger Landing site in the St. Louis River. Samples were analyzed for select metals and total organic carbon; subsets of samples were analyzed for one or more of the following: PAHs, PCBs, dioxins and furans, grain size, and percent moisture (Bay West 2015).

2017 MPCA Munger Landing Additional Sediment Characterization

Additional sediment characterization was performed in October 2017 by Bay West, for MPCA. Fifty-two sediment samples were collected from 27 locations within the Munger Landing area of the St. Louis River to

fill data gaps and refine the remedial footprint. Samples were analyzed for one or more of the following: total organic carbon (TOC), PCBs, and dioxins and furans (Bay West 2018).

2016-2018 Phase II Site Characterization and Remedial Action at the Former Westinghouse Electric Corp. Facility

Site characterization and remedial action activities were conducted at the former Westinghouse facility under the MPCA Voluntary Investigation and Cleanup Program by Nova Consulting Group, on behalf of Grand Avenue Estates of Duluth, LLP. The Phase II investigation included collection of 74 soil samples, 7 groundwater samples, and 20 soil vapor samples collected from 10 locations. Soil samples were analyzed for PCBs, Resource Conservation and Recovery Act metals, and diesel range organics (DRO); groundwater samples were analyzed for volatile organic compounds (VOCs), PAHs, PCBs, metals, DRO, and gasoline range organics; and soil vapor samples were analyzed for VOCs. Samples collected during remedial activities included 22 stockpile soil and 70 excavation confirmation soil samples. Analyses included one or more of the following: VOCs, semivolatile organic compounds, PCBs, PAHs, metals, DRO, gasoline range organics, and asbestos (Nova 2018).

SECTION 2

Field Investigation Activities

This section provides an overview of the field investigation performed in 2018. The site characterization consisted of site access negotiation, public utility locates, sediment characterization and sampling, as well as investigative-derived waste (IDW) management. Sediment characterization activities were performed in accordance with the site-specific plans prepared by CH2M:

- CH2M HILL (CH2M). 2018a. *Draft Data Quality Objectives, Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin Site Characterization*. October.
- CH2M HILL (CH2M). 2018b. *Health and Safety Plan, Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin.* October.

Prior to field activities, the draft data quality objectives (DQO) plan was conditionally approved by EPA Great Lakes National Program Office on October 11, 2018. Following field activities, comments received on the draft DQO plan were incorporated into the site-specific field sampling and quality assurance project plan (QAPP):

- CH2M HILL (CH2M). 2019b. *Field Sampling and Quality Assurance Project Plan, Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin Site Characterization.* May.

No deviations to the field procedures associated with sediment collection were implemented during the field effort. Minor deviations occurred as a result of field conditions encountered, including an increased number of samples collected due to sediment thickness and sample location repositioning. Data usability was found to be unaffected by these deviations. Specific deviations and a summary of data usability findings are described in the data usability report provided in Appendix A.

2.1 Objectives

The primary objectives for the Munger Landing site characterization were to collect data to determine if either Snively Creek or Stewart Creek may be ongoing contaminant sources to the Munger Landing sediments, and to collect additional data within Munger Landing to fill data gaps at the site. This information will be used to help identify areas that may require further investigation or remedial action.

The following field activities were conducted to achieve the objectives for this investigation:

- Completed a public utility locate to identify and locate underground utilities within the project area.
- Conducted sediment sampling at 40 locations to gain an understanding of the nature and extent of contamination for some or all of the following: dioxin and furan congeners, mercury, methyl mercury, and PCB Aroclors.
- Analyze samples for TOC to assess the cohesion and potential bioavailability of contaminants to receptors.
- Surveyed *x, y* coordinates of each sample location and collected water elevation data.
- Collected field observations, including visual observations, photoionization detector (PID) readings, and photographic documentation of sample processing and field activities.

2.2 Sediment Investigation

Prior to mobilization for the field investigation, CH2M coordinated with Spirit Lake Marina & RV to establish a staging area for sediment core processing and temporary storage of IDW drums. Mobilization, sampling,

and demobilization activities were completed in 7 days from October 14 through 20, 2018. Investigation activities were performed by the following:

- CH2M staff supported or performed poling and core collection onboard the Mudpuppy, petite Ponar sampling, manual coring in the creeks, collection of field data (locational data, depth measurements, and observations), sediment core logging, collecting samples for laboratory analysis, and managing of IDW.
- Cetacean Marine of Bay City, Michigan, using the Research Vessel (R/V) Mudpuppy II vessel under separate contract to EPA, performed vibracore sediment collection activities.
- The Wisconsin Department of Natural Resources (WDNR) staff mobilized a jon boat to the site and supported surface sediment collection by petite Ponar.
- Pace Analytical, under contract to CH2M, provided daily courier service for sample pickup and transportation from the site to the laboratories and performed sample analysis.

Weather conditions during the sediment investigation started out with clear skies and cool temperatures ranging from 30 to 40 degrees Fahrenheit with consistent wind speed from 0 to 20 miles per hour and occasional wind gusts up to 25 miles per hour; and temperatures ranging from 45 to 66 degrees Fahrenheit with wind speed from 0 to 16 miles per hour during the last 2 days of sampling. No delays due to weather occurred.

2.2.1 Utility Locate

Before initiating intrusive subsurface activities, CH2M contacted Minnesota's Gopher One Call and Wisconsin's Digger's Hotline utility locate to identify and locate underground utilities within the project area. Exhibit 1 describes utilities identified that cross the river and creeks within the project area. CH2M reviewed utility maps and navigation charts before sampling activities to determine if proposed locations conflicted with known utilities. Utilities were avoided during sampling. Exhibit 1 and Figure 2 show the underground utilities identified within the project area.

Exhibit 1. Utility-Locate Summary
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

Channel near Munger Landing	No utility owners responded with utility locations within the channel.
Stewart Creek	City of Duluth • Sewer – 3 creek crossings
	Western Lake Superior Sanitary District • Sanitation – 1 creek crossing
Snively Creek	No utility owners responded with utility locations within the creek.

2.2.2 Surveying

The survey activities were performed following the procedures outlined in the QAPP (CH2M 2019b). The following summarizes survey activities performed during the sampling event:

- Sediment vibracore sample location coordinates were surveyed by the EPA R/V Mudpuppy II using differential global positioning system receivers capable of submeter accuracy. Samples were collected in latitude and longitude, North American Datum of 1983. Water depth *x, y* coordinate measurements were collected before sediment coring to the nearest 0.1 foot at each location using a surveyor's rod

outfitted with a 6-inch-diameter plate or a surveyor's tape outfitted with a sounding disc per U.S. Army Corps of Engineers guidance (2013).

- Manual sediment cores and Ponar samples were surveyed by CH2M using a differential global positioning system receiver capable of submeter accuracy. *X, y* coordinates were collected in latitude and longitude, North American Datum of 1983. Water-depth measurements were collected before sediment coring to the nearest 0.1 foot at each location using a surveyor's rod.
- Water elevation data was collected for vibracore sediment locations and Ponar samples from the National Oceanic and Atmospheric Administration gauge station #9099064. Elevations are reported in International Great Lakes Datum 1985 US Survey feet.
- Sediment elevation was calculated by subtracting water depth from the water surface elevation reported from National Oceanic and Atmospheric Administration gauge station #9099064. If refusal was encountered, refusal elevation was calculated by subtracting the refusal depth from the sediment elevation.

There are no known staff gauges within Snively Creek and Stewart Creek; therefore, water elevation data were not available for the manual core locations located in the creeks.

2.2.3 Sediment Collection Field Procedures

Sediment cores or surface grab samples were collected from 40 locations within the investigation area and are shown in Figure 2. Table 1 shows field-collected data for each location.

Prior to sample collection, manual sediment poling was conducted at each proposed sample location in order to gauge available sediment thickness to aid in selecting an appropriate length of vibracore liner for sediment coring. At each location, field staff recorded the location identifier, location coordinates, water depth, sediment thickness, sample type (vibracore, manual, Ponar), penetration, and measured recovery.

2.2.3.1 Vibracore Collection

Under separate contract with EPA, three staff from Cetacean Marine collected sediment core samples from 28 locations (ML-SD-01 through ML-SD-28) in the river channel using vibracore methods aboard the EPA's R/V Mudpuppy II. CH2M and EPA staff performed oversite of sample collection operations onboard the R/V Mudpuppy II. Sediment cores were collected using 4-inch polycarbonate core tubes outfitted to a Rossfelder P3C vibracore unit. The vibracore unit was advanced to refusal or a maximum depth of 10 feet. Upon sediment core retrieval, the core bottom was capped, labeled, and stored upright in preparation for transfer to the onshore staging area for processing.

2.2.3.2 Ponar Surface Sediment Collection

Surface sediment, representative of 0- to 0.25-foot below sediment surface, was collected within the river channel by WDNR and CH2M personnel from four locations west of Clough Island (ML-SD-29 though ML-SD-32) using a petite Ponar sampler. The sediment was placed into disposable aluminum pans upon collection, excess water decanted, and transferred to 2-gallon airtight resealable plastic bags for transport to shore for processing.

2.2.3.3 Manual Core Collection

Sediment cores from 8 locations in Stewart and Snively creeks (SD-33 through SD-40) were collected by CH2M staff using manual coring methods. Inaccessible by boat, CH2M walked to the locations, waded into the creek, and performed manual sediment coring using 3-inch-diameter polycarbonate tubing. The core tubes were driven with a 10-pound post hammer to advance the core continuously until refusal was reached.

2.2.4 Sediment Processing and Characterization

Sediment cores retrieved from manual coring and vibracore collection and Ponar surface grabs were transported to the processing area. Before processing sediment cores, the top core cap was removed, and free water decanted by slowly tipping the core at the minimum angle needed, with care given not to pour out fine-grained soil or sediments at the interface. The sediment cores were placed on a decontaminated table and split lengthwise for visual characterization and sampling by the field team.

Sediment cores and Ponar samples were photographed and visually characterized and logged according to textural class, color, odor, moisture content, particle size and shape, consistency, and other notable characteristics, such as visible evidence of staining or contaminant impacts. A PID was used to screen every 1-foot interval of the sediment cores.

Appendix B contains the sediment core logs. Appendix C contains photographs of sediment cores. Table 1 summarizes the sediment sample locations, core penetration and refusal depths, water depths, latitude, longitude, and the observations noted during logging activities.

2.2.5 Sample Collection and Analysis

Following sediment core characterization, the sediment cores were divided into sample intervals for chemical analysis. The material from each sample interval was transferred to disposable aluminum pans and homogenized until uniform texture and color were achieved. The homogenate was then transferred to analyte-specific bottleware and labeled. The laboratory samples and respective analysis were recorded in the Scribe database, and chain-of-custody forms were generated. Following collection, samples were held on ice until they were picked up by the laboratory courier.

Two-hundred and forty-two sediment samples and 24 field duplicate samples were collected from 40 locations. In accordance with the QAPP (CH2M 2019b), the sediment samples were collected for one or more of the following analyses: PCB Aroclors, dioxin and furan congeners, mercury, methyl mercury, and TOC. The top one or two intervals per location were submitted for laboratory analysis (71 samples and 7 field duplicates), and remaining sample intervals were collected and placed on hold at the laboratory (171 samples and 17 field duplicates). Upon review of the preliminary data by EPA, MPCA, and WDNR, 15 samples and 2 field duplicates originally placed on hold were selected for laboratory analysis, resulting in 86 samples and 9 field duplicates analyzed.

Table 2 presents the parameters collected for each sample. PCB Aroclors, mercury, and TOC were analyzed by Pace Analytical's laboratory in Green Bay, Wisconsin; dioxin and furan congeners were analyzed by Pace Analytical's laboratory in Minneapolis, Minnesota; and methyl mercury was analyzed by the Duluth, Minnesota, laboratory.

2.2.6 Quality Assurance/Quality Control Samples

Quality assurance/quality control sediment samples were collected as described in the QAPP (CH2M 2019b), except for TOC, where field duplicate samples were inadvertently not collected at the 10 percent frequency. Quality assurance/quality control samples included field duplicates, matrix spikes/matrix spike duplicates, and two equipment blank samples. Two equipment blanks were collected from nondisposable equipment (stainless-steel spoons and petite Ponar) used to collect surface grab samples. The equipment blank samples were analyzed for dioxin and furan congeners, PCB Aroclors, mercury, and methyl mercury. The data usability report summarizes the field duplicate and matrix spike/matrix spike duplicate sample results (Appendix A).

2.2.7 Field Equipment Decontamination

Equipment used for the project, including sampling vessels and sampling equipment, was decontaminated for residual sediments, as well as invasive and exotic vegetation prior to and after use in accordance with the QAPP (CH2M 2019b). Nondisposable sampling equipment aboard the sampling vessels (such as vibracore equipment, ponar sampler, and power shears) was decontaminated before sampling activities and between sample locations. Disposable sampling equipment (such as mixing utensils and aluminum pans) used during sample processing were containerized in 55-gallon drums with secure lids and disposed of as IDW.

2.2.8 Investigation-Derived Waste

Sediment remaining after processing and sampling was placed in 55-gallon drums. One composite sample of sediment representative of the project area was collected and analyzed for toxicity characteristic leaching procedure (TCLP) VOCs, TCLP semivolatile organic compounds, TCLP pesticides, TCLP herbicides, TCLP metals, total PCBs, dioxin and furan congeners, flashpoint, and pH.

The composite and in situ sediment sample results were used to characterize the waste. The waste was determined to be classified and disposed of as non-TSCA regulated, Resource Conservation and Recovery Act nonhazardous. Six IDW drums containing solid waste and personal protective equipment were removed from the staging facility and disposed of on November 30, 2018. Appendix D contains the waste characterization sample results and copy of the signed manifest.

SECTION 3

Investigation Results

The observations and analytical results from the Munger Landing investigation are summarized and discussed within this section. Within the following subsections, exhibits are used within the text to present high-level summary data that support the accompanying narrative. More detailed tables and figures are provided at the end of the report.

The results have been grouped relative to three spatial areas for purposes of discussion and presentation:

- Munger Landing Cutoff Channel and Stewart Creek Wetland
- Clough Island (where applicable)
- Stewart and Snively Creeks

The data have also been evaluated with respect to surface sediment and subsurface sediment. Surface sediment represents samples collected from the sediment surface to depths of 0.25 to 1.3 feet below sediment surface. All other sampling intervals are grouped together representing subsurface sediment, including sample intervals starting from 0.5 foot below sediment surface and extending deeper into the sediment column.

3.1 Physical Characteristics

3.1.1 Water Depth

Water depths observed during the 2018 investigation are summarized in this section.

Based on observations at the sample locations within the Munger Landing cutoff channel (ML-SD-01 through ML-SD-28), water depths ranged from 2.4 feet at ML-SD-20 to 18.7 feet at ML-SD-02, with an average water depth of 6.3 feet. The deepest water depths were observed just south of the Munger Landing Boat launch at locations ML-SD-01 and ML-SD-02, where the depths exceeded 18 feet.

At the four shoreline locations by Clough Island (ML-SD-29 through ML-SD-32), water depths ranged from 1.0 to 4.1 feet, with an average of 3.1 feet.

Water depths observed at sample locations within Stewart and Snively Creeks (ML-SD-33 though ML-SD-40) ranged from 0.2 to 0.5 foot, except for location ML-SD-36, which had a water depth of 2.1 feet.

3.1.2 Sediment Type and Distribution

Sediment characteristics from the 2018 investigation are summarized and discussed within this section.

Sediment in the Munger Landing cutoff channel consists largely of silt and sandy silt. Several locations throughout the channel exhibited a subsurface sand layer typically from around 5 to 8 feet below the sediment surface. Of the 28 cores collected in the channel during the 2018 investigation (locations ML-SD-01 through ML-SD-28), refusal was reached at 11 locations (39 percent). Refusal depth exceeded the maximum core tube length of 10 feet at the remaining 17 core locations (61 percent) within the channel. Native clay material was not recovered at any core locations in the river channel. Sediment thickness observed in the Munger Landing cutoff channel ranged from 3 feet at location ML-SD-17 to greater than 10 feet where the maximum core length was met. Thicker deposits were observed on the east side of the Munger Landing Channel near the shore of a small island (7- to 10-foot refusal point).

Surface sediment collected at the four sample locations near the west shore of Clough Island (ML-SD-29, ML-SD-30, ML-SD-31, and ML-SD-32) consisted of silt and organics. Poling data collected at the time of sampling showed that sediment thickness ranged from 1.8 to 2.5 feet.

The sediment in Snively and Stewart creeks consists mostly of a sand and silt combination with some organic material. Refusal was reached at all core locations collected in the creeks (locations ML-SD-33 though ML-SD-40); no native clay material was covered. Based on sampling observations at Snively and Stewart creeks, the sediment thickness ranges from 1.9 to 2.2 feet in Stewart Creek and from 1.4 to 3.5 feet in Snively Creek.

Table 1 shows sediment thickness results, water depths, calculated sediment elevation, and the visual observations at each location collected during the 2018 sediment investigation. Appendix B contains the core logs for the 2018 investigation.

3.1.3 Physical Observations

Physical observations from the 2018 investigation are summarized and discussed within this section.

Faint to light sheen was observed during processing at locations ML-SD-07 and ML-SD-39 within the project area. Sheen and odor were observed during sediment processing at ML-SD-07 located in the Munger Landing cutoff channel, and at ML-SD-39 located in Snively Creek.

Table 1 summarizes observations for potentially impacted material at each core location, along with the associated maximum PID readings measured. Individual sample interval PID readings and descriptions of potentially impacted material are recorded within sediment core and photograph logs (Appendixes B and C, respectively).

3.1.4 Physical Parameters

This section summarizes physical parameters from the 2014-2015 MPCA Munger Landing Sediment Investigation, 2017 MPCA Munger Landing Additional Sediment Characterization, and 2018 Munger Landing Sediment Characterization.

The 263 unique samples collected between 2014 and 2018 and submitted for chemical analysis were also analyzed for TOC and percent moisture. Table 3 shows TOC and percent moisture sample results.

- Range of TOC in surface sediment (0.0 to 1.3 feet below sediment surface [bss]): 672 to 287,000 milligrams per kilogram (mg/kg)
- Range of TOC in subsurface sediment (0.5 foot bss to refusal): 629 to 189,000 mg/kg
- Range of percent moisture: 8.47 to 90.23 percent (average 42.94 percent)

3.2 Sediment Contaminant Analysis Summary

Analytical results from the following investigations are summarized and discussed within this section:

- 2014-2015 MPCA Munger Landing Sediment Investigation
- 2017 MPCA Munger Landing Additional Sediment Characterization
- 2018 Munger Landing Sediment Characterization

In accordance with the QAPP, analytical results were screened against applicable Minnesota Sediment Quality Targets (SQT) for the Protection of Sediment-Dwelling Organisms in Minnesota (MPCA 2007):

- "Level I SQTs are intended to identify contaminant concentrations below which harmful effects on sediment-dwelling organisms (i.e., benthic invertebrates) are unlikely to be observed" (MPCA 2007).
- "Level II SQTs are intended to identify contaminant concentrations above which harmful effects on sediment-dwelling organisms are likely to be observed" (MPCA 2007).

Level I and Level II SQTs for dioxin and furan toxicity equivalence were adopted for the protection of fish, as toxicity equivalency factors are not available for sediment-dwelling organisms (MPCA 2007).

- Midpoint SQTs, midway between the Level I and Level II SQTs, are used as a qualitative comparison to identify, rank, and prioritize site contaminants of concern (Bay West 2018).

Table 3 summarizes analytical results, screening criteria, and screening results, and Appendix B contains full analytical results from the 2018 sediment investigation. Figures 3 and 4 present results for mercury, Figures 5 and 6 present results for total PCB concentrations, and Figures 7 and 8 present results for dioxin and furan toxicity equivalency for fish.

3.2.1 Mercury

This section summarizes analytical results from the 2014-2015 MPCA Munger Landing Sediment Investigation and 2018 Munger Landing Sediment Characterization. Mercury data was not collected as part of the 2017 MPCA Munger Landing Additional Sediment Characterization.

One-hundred and sixty-five samples were collected throughout the project area between 2014 and 2018 and analyzed for total mercury and screened against Minnesota SQTs. Twenty of those samples were also analyzed for methyl mercury. Table 3 shows methyl mercury results and screened total mercury results. Figure 3 shows screened mercury results for surface sediment, and Figure 4 shows maximum mercury concentrations. Exhibit 2 shows summary statistics and results of the screening against the SQT values.

Methyl mercury was detected in 1 of the 20 samples analyzed, location ML-SD-02, with a concentration of 0.003 mg/kg at 1.0 to 2.0 feet bss. ML-SD-02 is located at the downstream extent of the project area near Spirit Lake Marina. Total mercury in this sample was detected at 0.89 mg/kg, which exceeds the midpoint SQT of 0.64 mg/kg for mercury.

Level I SQT exceedances for mercury were observed within the cutoff channel, with 45 percent of surface sediment and 29 percent of subsurface sediment samples exceeding the Level I SQT for mercury. Mercury exceeded the SQT midpoint at locations ML-SD-02 and BW15ML-001D, both located near the downstream extent of the project area near Spirit Lake Marina (Figure 4). Three percent of sediment samples within the channel were above the Level II SQT screening criteria for mercury. Level II SQT exceedances were found at 3 locations, BW14ML-011, located in the middle of the cutoff channel, between the Munger Landing boat launch (upstream) and Spirit Lake Marina (downstream); and co-located sample locations BW14ML-038 and BW15ML-038D, located approximately 225 feet east of the Munger Landing boat launch.

Mercury concentrations in the creeks (locations ML-SD-33 through ML-SD-40) were lower than in the river channel, ranging from nondetect to 0.054 J mg/kg. SQT exceedances for mercury were not observed in the creeks.

Exhibit 2. MDEQ SQT Screening Value Exceedance Frequencies for Mercury
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

	Minimum (mg/kg)	Maximum (mg/kg)	Median (mg/kg)	Average (mg/kg)	Exceedance of Level I SQT	Exceedance of Midpoint SQT	Exceedance of Level II SQT
Munger Landing Channel							
Surface	0.0067 J	8.0	0.17	0.32	26/58 (45%)	2/58 (3%)	2/58 (3%)
Subsurface	0.0071 J	6.3	0.063	0.24	27/94 (29%)	5/94 (5%)	3/94 (3%)
Stewart and Snively Creeks							
Surface	0.034 U	0.048 J	0.041 U	0.041	0/8 (0%)	0/8 (0%)	0/8 (0%)
Subsurface	0.041 U	0.054 J	0.042 U	0.046	0/5 (0%)	0/5 (0%)	0/5 (0%)

This exhibit includes data from the following investigations: 2014-2015 MPCA Munger Landing Sediment Investigation and 2018 Munger Landing Sediment Characterization. Mercury data was not collected as part of the 2017 MPCA Munger Landing Additional Sediment Characterization.

J = Estimated; U = Not detected

Level I SQT = 0.18 mg/kg mercury
Midpoint SQT = 0.64 mg/kg mercury
Level II SQT = 1.1 mg/kg mercury

3.2.2 Polychlorinated Biphenyls

This section summarizes analytical results from the 2014-2015 MPCA Munger Landing Sediment Investigation, 2017 MPCA Munger Landing Additional Sediment Characterization, and 2018 Munger Landing Sediment Characterization.

One-hundred and thirty-five samples were collected throughout the project area between 2014 and 2018 and analyzed for PCB Aroclors and screened against Minnesota SQTs. Table 3 presents screened total PCB results, and Appendix E contains the full analytical results for individual PCB Aroclors from the 2018 sediment investigation. Figure 5 shows screened total PCB results for surface sediment, and Figure 6 shows maximum total PCB concentrations. Exhibit 3 shows summary statistics and results of the screening against the SQT values.

Total PCBs were calculated by summing the detected results for PCB Aroclors. If all Aroclors were reported as nondetected, the value of one-half the highest individual quantitation limit was used and qualified "U" as nondetect.

Level I SQT exceedances for total PCBs were observed in 57 percent of surface sediment samples and 27 percent of subsurface sediment samples in the channel and wetland. The midpoint SQT was exceeded in 16 percent of surface samples and in 9 percent of subsurface samples. Eleven percent of surface sediment and 8 percent of subsurface sediment samples within the river were above Level II SQT screening criteria for total PCBs. The highest total PCB concentrations were observed in the top 1.4 feet bss collected within the river near the Munger Landing boat launch, with total PCB concentrations exceeding 4 times the Level II SQT for PCBs (BW14ML-013, co-located locations BW14ML-038 and BW15ML-038D, and BW17ML-052). The highest concentration of total PCBs was observed in surface sediment (0.0 to 0.5 foot bss) at location BW14ML-013, with a result of 43.7 mg/kg total PCBs.

Detectable concentrations of PCBs in the creeks were generally lower than concentrations in the channel. Six of the 7 samples, from 3 of the 4 locations collected in Snively Creek exceeded the Level I SQT for PCBs; and 4 samples from 3 locations exceeded the SQT midpoint for PCBs (locations ML-SD-38 through ML-SD-40,

Figure 6). PCBs were not detected at the 4 sample locations in Stewart Creek (ML-SD-33 through ML-SD-36) or at the furthest upstream location in Snively Creek (ML-SD-37).

Exhibit 3. MDEQ SQT Screening Value Exceedance Frequencies for Total PCBs
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

	Minimum (mg/kg)	Maximum (mg/kg)	Median (mg/kg)	Average (mg/kg)	Exceedance of Level I SQT	Exceedance of Midpoint SQT	Exceedance of Level II SQT
Munger Landing Channel and Stewart Creek Wetland							
Surface	0.0164 U	43.7	0.0788	1.099	32/56 (57%)	9/56 (16%)	6/56 (11%)
Subsurface	0.0154 U	12.6 J	0.0252 U	0.322	18/66 (27%)	6/66 (9%)	5/66 (8%)
Stewart and Snively Creeks							
Surface	0.0137 U	0.505	0.0178 U	0.167	3/8 (38%)	2/8 (25%)	0/8 (0%)
Subsurface	0.0166 U	0.554	0.186	0.236	3/5 (60%)	2/5 (40%)	0/5 (0%)

This exhibit includes data from the following investigations: 2014-2015 MPCA Munger Landing Sediment Investigation, 2017 MPCA Munger Landing Additional Sediment Characterization, and 2018 Munger Landing Sediment Characterization.

J = Estimated; U = Not detected

Level I SQT = 0.060 mg/kg PCB
Midpoint SQT = 0.370 mg/kg PCB
Level II SQT = 0.680 mg/kg PCB

3.2.3 Dioxin and Furan Congeners

This section summarizes analytical results from the 2014-2015 MPCA Munger Landing Sediment Investigation, 2017 MPCA Munger Landing Additional Sediment Characterization, and 2018 Munger Landing Sediment Characterization.

One-hundred and thirty-six samples were collected throughout the project area between 2014 and 2018 and analyzed for dioxin and furan congeners. Dioxin and furan toxicity equivalency (TEQ) values were calculated using the EPA Advanced Kaplan Meier TEQ Calculator and 1998 toxic equivalency factors (Van den Berg et al. 1998). The TEQ value is qualified "J" as estimated if more than 50 percent of the TEQ value comes from nondetect, qualified, or rejected data. When fewer than 3 individual congeners were reported as detected, there is insufficient data to calculate the TEQ value using the Kaplan Meier approach. In these cases, one-half of the detection limit was used to calculate the TEQ value. TEQ results for samples with only 1 or 2 detected congeners are qualified "J", and samples with no detectable congeners were qualified "UJ".

Table 3 presents the dioxin and furan TEQ values for fish that were screened against Minnesota SQTs. Appendix E contains the full analytical results for individual dioxin and furan congeners collected during the 2018 investigation. Figure 7 shows screened TEQ results for surface sediment, and Figure 8 shows maximum TEQ values. Exhibit 4 shows summary statistics and results of the screening against the SQT values.

Widespread exceedances of the SQT screening levels for fish TEQ were observed within the cutoff channel and adjacent wetland, with 72 percent of surface sediment and 51 percent of subsurface sediment samples exceeding the Level I SQT, 50 percent of surface sediment and 30 percent of subsurface sediment exceeding the midpoint SQT, and 36 percent surface sediment and 23 percent subsurface sediment samples exceeding the Level II SQT. The highest TEQ values, ranging from 21.5 to 292 nanograms per kilogram (ng/kg) TEQ, were primarily observed in samples located from the center to the west side of the cutoff channel, extending from the upstream end to the downstream end of the small island. Comparatively low TEQ values were exhibited at the upstream extent of the investigation area, on the east side of the cutoff channel

(along the western shore of the small island that separates the cutoff channel from the main channel), and on the north (downstream) side of the small island.

Of the 4 surface samples collected near the west shore of Clough Island, dioxin and furan TEQ values for fish exceeded the midpoint SQT at ML-SD-30 and exceeded the Level II SQT at 3 locations (ML-SD-29, ML-SD-31, and ML-SD-32).

Fish TEQ values exceeded Level I SQTs in the subsurface sediment at locations ML-SD-38 and ML-SD-40 within Snively Creek. Fish TEQs in the creeks did not exceed midpoint or Level II SQTs.

Exhibit 4. MDEQ SQT Screening Value Exceedance Frequencies for Dioxin and Furan Toxicity Equivalency for Fish
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

	Minimum (ng/kg)	Maximum (ng/kg)	Median (ng/kg)	Average (ng/kg)	Exceedance of Level I SQT	Exceedance of Midpoint SQT	Exceedance of Level II SQT
Munger Landing Channel and Stewart Creek Wetland							
Surface	0.318 J	292	12.3	28.7	42/58 (72%)	29/58 (50%)	21/58 (36%)
Subsurface	0.18	249	0.920 J	25.1	31/61 (51%)	18/61 (30%)	14/61 (23%)
Clough Island							
Surface	18.2 J	42.8 J	31.5	31.0	4/4 (100%)	4/4 (100%)	3/4 (75%)
Stewart and Snively Creeks							
Surface	0.344 J	0.722 J	0.405 J	0.487	0/8 (0%)	0/8 (0%)	0/8 (0%)
Subsurface	0.421 J	1.12 J	0.493 J	0.706	2/5 (40%)	0/5 (0%)	0/5 (0%)

This exhibit includes data from the following investigations: 2014-2015 MPCA Munger Landing Sediment Investigation, 2017 MPCA Munger Landing Additional Sediment Characterization, and 2018 Munger Landing Sediment Characterization.

J = Estimated; ND = Insufficient detectable concentrations to calculate TEQ

Level I SQT = 0.85 ng/kg Fish TEQ
Midpoint SQT = 11.2 ng/kg Fish TEQ
Level II SQT = 21.5 ng/kg Fish TEQ

SECTION 4

Conclusions

Analytical results from the following investigations are summarized and discussed within this section:

- 2014-2015 MPCA Munger Landing Sediment Investigation
- 2017 MPCA Munger Landing Additional Sediment Characterization
- 2018 Munger Landing Sediment Characterization

4.1 Nature and Extent of Contamination

Analytical results from the 263 unique field samples were screened against applicable Minnesota SQTs. The following subsections summarize the results relative to the midpoint and Level II SQT values for each subarea.

4.1.1 Munger Landing Cutoff Channel and Stewart Creek Wetland

The following bullets summarize the contaminants observed in the Munger Landing cutoff channel:

- Total mercury in surface samples ranged from 0.0067 to 8.0 mg/kg, with an average of 0.32 mg/kg. Two samples exceeded the midpoint SQT (0.64 mg/kg); these samples also exceeded the Level II SQT (1.1 mg/kg). In subsurface samples, total mercury ranged from 0.0071 to 6.3 mg/kg with an average of 0.24 mg/kg. Five samples exceeded the midpoint SQT, of which 3 samples exceeded the Level II SQT.
- Of the 20 samples selected for analysis of methyl mercury, 1 sample was reported as detected with a result of 0.003 mg/kg.
- Total PCBs in surface samples ranged from 0.0164 U to 43.7 mg/kg, with an average of 1.099 mg/kg. Nine samples exceeded the midpoint SQT (0.37 mg/kg), and 6 of these samples also exceeded the Level II SQT (0.68 mg/kg). In subsurface samples, total PCBs ranged from 0.0154 U to 12.6 mg/kg, with an average of 0.322 mg/kg. Six samples exceeded the midpoint SQT, of which 5 samples exceeded the Level II SQT.
- Dioxin and furan TEQ for fish in surface samples ranged from 0.318 to 292 ng/kg TEQ with an average of 28.7 ng/kg TEQ. Twenty-nine samples exceeded the midpoint SQT (11.2 ng/kg), of which 21 samples also exceeded the Level II SQT (21.5 ng/kg). In subsurface samples, the dioxin and furan fish TEQ values ranged from 0.18 to 249 ng/kg TEQ with an average of 25.1 ng/kg TEQ. Eighteen samples exceeded the midpoint SQT of which 14 samples exceeded the Level II SQT.

4.1.2 Clough Island

- Dioxin and furan TEQ for fish in surface samples ranged from 18.2 to 42.8 ng/kg TEQ with an average of 31.5 ng/kg TEQ. All 4 samples exceeded the midpoint SQT (11.2 ng/kg), of which 3 of these samples also exceeded the Level II SQT (21.5 ng/kg). No subsurface samples were collected in this area.

4.1.3 Stewart and Snively Creeks

- Total mercury in surface samples ranged from 0.034 U to 0.048 mg/kg with an average of 0.041 mg/kg. Of the 8 surface samples collected, none exceeded the SQT values. In subsurface samples, total mercury ranged from 0.041 U to 0.054 mg/kg with an average of 0.046 mg/kg. Of the 5 subsurface samples collected, none exceeded the SQT values for mercury.
- Total PCBs in surface samples ranged from 0.0137 U to 0.505 mg/kg, with an average of 0.167 mg/kg. Two samples exceeded the midpoint SQT (0.37 mg/kg); none of the samples exceeded the Level II SQT

(0.68 mg/kg). In subsurface samples, total PCBs ranged from 0.0166 U to 0.554 mg/kg, with an average of 0.236 mg/kg. Two samples exceeded the midpoint SQT; none exceeded the Level II SQT.

- Dioxin and furan TEQ for fish in surface samples ranged from 0.344 to 0.722 ng/kg TEQ with an average of 0.487 ng/kg TEQ. In subsurface samples, the dioxin and furan fish TEQ values ranged from 0.421 to 1.12 ng/kg TEQ, with an average of 0.706 ng/kg TEQ. None of the creek samples, surface or subsurface sediment, exceeded the midpoint or Level II SQTs (11.2 ng/kg and 21.5 ng/kg, respectively).

4.2 Key Findings and Recommendations

The following are key findings and elements recommended to support and define opportunities for further investigation activities in the study area:

4.2.1 Munger Landing Cutoff Channel, Stewart Creek Wetland, and Clough Island

- The results of the sediment characterization indicate low to moderate sediment contamination for mercury, spatially limited moderate to significant sediment contamination for total PCBs, and widespread moderate to significant sediment contamination for and dioxin and furans.
- In the channel, the subsurface samples are relatively uncontaminated in comparison to the overlying surface sediments.
- The highest concentrations of contaminants are observed in the center to west side of the channel, located from the upstream to downstream ends of the small island that separates Munger Landing from the main river channel.
- Widespread exceedances of the midpoint and Level II SQT values for dioxin and furan TEQ for fish were observed in the river (channel and near Clough Island), with 50 percent of surface sediment results exceeding the midpoint SQT and 38 percent exceeding the Level II SQT, indicating that portions of the river sediment may have adverse biological effects due to dioxins and furans.

4.2.2 Stewart and Snively Creeks

- Stewart Creek had low levels of mercury and dioxins and furans detected, all below the Level I SQT, and no PCBs detected, indicating a low risk of adverse effects and likely an insignificant contaminant source to the wetland and river sediments.
- Compared to Stewart Creek, Snively Creek contained PCBs detected below the Level II SQT (0.68 mg/kg) and dioxins and furans below the midpoint SQT (11.2 ng/kg). Although concentrations observed in Snively Creek are greater than Stewart Creek, results are lower than the adjacent wetland and river channel and therefore likely an insignificant contaminant source to the wetland and river sediments.
- These initial investigation results and corresponding physical data collected within the creeks represent an initial baseline of data, as no prior data sets exist. Therefore, further investigation activities may be warranted within Snively Creek to gain a better understanding of potential sources and source control of chemicals of concern through evaluation of sediment deposition, transport capability, and hydrodynamic relationship of creeks to the adjacent wetland and river channel.

SECTION 5

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Tables

Table 1. Sample Location Summary

Munger Landing Sediment Site Characterization, St. Louis River AOC, Minnesota and Wisconsin

Location ID	Latitude[a]	Longitude[a]	Date	Penetration Depth (ft bss)	Recovery (ft bss)	Recovery (%)	Water Surface Elevation[b]	Water Depth (ft)	Sediment Surface Elevation[b]	Depth to Native Clay (ft bss)	Refusal Depth (ft bss)	Native Clay Elevation[b]	Refusal Elevation[b]	Observations			
														Staining	Sheen	Odor	PID Max[d]
ML-SD-01	46.7053330	-92.2027790	10/15/18	10.0	8.1	81%	603.08	18.0	585.08	--	>10[c]	--	--				0.0
ML-SD-02	46.7052280	-92.2027020	10/15/18	5.3	4.7	89%	603.04	18.7	584.34	--	5.3	--	579.04				0.0
ML-SD-03	46.7048090	-92.2027250	10/15/18	10.0	9.7	97%	603.05	3.5	599.55	--	>10[c]	--	--				0.0
ML-SD-04	46.7052850	-92.2038290	10/15/18	10.0	8.7	87%	603.05	6.0	597.05	--	>10[c]	--	--				0.0
ML-SD-05	46.7048010	-92.2038150	10/15/18	10.0	7.0	70%	603.07	5.1	597.97	--	>10[c]	--	--				0.0
ML-SD-06	46.7047970	-92.2043590	10/15/18	10.0	7.0	70%	602.93	8.1	594.83	--	>10[c]	--	--				0.0
ML-SD-07	46.7045280	-92.2050830	10/15/18	10.0	8.7	87%	602.90	9.2	593.70	--	>10[c]	--	--		X		0.0
ML-SD-08	46.7040150	-92.2044170	10/15/18	7.2	7.0	97%	602.91	2.9	600.01	--	7.2	--	592.81				0.0
ML-SD-09	46.7039230	-92.2053170	10/15/18	7.5	5.2	69%	602.99	8.0	594.99	--	7.5	--	587.49				0.0
ML-SD-10	46.7035740	-92.2056700	10/15/18	10.0	8.6	86%	603.03	7.6	595.43	--	>10[c]	--	--				0.0
ML-SD-11	46.7034820	-92.2063190	10/15/18	6.0	6.0	100%	603.09	4.6	598.49	--	6.0	--	592.49				0.0
ML-SD-12	46.7028900	-92.2052440	10/16/18	10.0	9.8	98%	603.13	2.5	600.63	--	>10[c]	--	--				0.0
ML-SD-13	46.7029400	-92.2063870	10/15/18	5.0	4.9	98%	603.18	4.5	598.68	--	5.0	--	593.68				0.0
ML-SD-14	46.7021820	-92.2064370	10/16/18	10	9.4	94%	603.17	8.4	594.77	--	>10[c]	--	--				0.0
ML-SD-15	46.7022460	-92.2054510	10/16/18	9.3	9.0	97%	603.03	4.0	599.03	--	9.3	--	589.73				0.0
ML-SD-16	46.7015050	-92.2057790	10/16/18	10.0	10.0	100%	602.85	5.2	597.65	--	>10[c]	--	--				0.0
ML-SD-17	46.7004580	-92.2070480	10/16/18	3.0	3.0	100%	603.06	4.5	598.56	--	3.0	--	595.56				0.0
ML-SD-18	46.7006930	-92.2054020	10/16/18	9.5	9.2	97%	602.88	3.4	599.48	--	9.5	--	589.98				1.1
ML-SD-19	46.6997950	-92.2050630	10/16/18	10.0	10.0	100%	602.93	3.3	599.63	--	>10[c]	--	--				0.9
ML-SD-20	46.7022780	-92.2050030	10/16/18	10.0	10.0	100%	603.16	2.4	600.76	--	>10[c]	--	--				0.0
ML-SD-21	46.7015340	-92.2051390	10/16/18	10.0	10.0	100%	603.13	3.0	600.13	--	>10[c]	--	--				0.0
ML-SD-22	46.7006560	-92.2048780	10/16/18	9.0	9.0	100%	602.97	3.6	599.37	--	9.0	--	590.37				0.0
ML-SD-23	46.6985560	-92.2044820	10/17/18	10.0	9.8	98%	603.14	6.2	596.94	--	>10[c]	--	--				0.0
ML-SD-24	46.6981520	-92.2047850	10/17/18	10.0	9.4	94%	603.22	8.6	594.62	--	>10[c]	--	--				0.0
ML-SD-25	46.6988620	-92.2055370	10/17/18	10.0	7.8	78%	602.93	7.5	595.43	--	>10[c]	--	--				0.0
ML-SD-26	46.6985590	-92.2050680	10/17/18	10.0	10.0	100%	603.02	8.0	595.02	--	>10[c]	--	--				0.0
ML-SD-27	46.6968530	-92.2065840	10/17/18	5.3	3.7	70%	603.23	3.3	599.93	--	5.3	--	594.63				0.0
ML-SD-28	46.6965850	-92.2050160	10/17/18	9.3	8.4	91%	603.12	4.3	598.82	--	9.3	--	589.52				0.0
ML-SD-29	46.7002170	-92.1947400	10/15/18	--	--	--	603.17	1.0	602.17	--	--	--	--				0.0
ML-SD-30	46.6988170	-92.1943610	10/15/18	--	--	--	603.05	4.1	598.95	--	--	--	--				0.0
ML-SD-31	46.6980030	-92.1945390	10/15/18	--	--	--	603.04	4.0	599.04	--	--	--	--				0.0
ML-SD-32	46.6978550	-92.1936770	10/15/18	--	--	--	603.05	3.2	599.85	--	--	--	--				0.0

Table 1. Sample Location Summary

Munger Landing Sediment Site Characterization, St. Louis River AOC, Minnesota and Wisconsin

														Observations			
Location ID	Latitude[a]	Longitude[a]	Date	Penetration Depth (ft bss)	Recovery (ft bss)	Recovery (%)	Water Surface Elevation[b]	Water Depth (ft)	Sediment Surface Elevation[b]	Depth to Native Clay (ft bss)	Refusal Depth (ft bss)	Native Clay Elevation[b]	Refusal Elevation[b]	Staining	Sheen	Odor	PID Max[d]
ML-SD-33	46.6992900	-92.2139090	10/18/18	1.9	1.2	63%	N/A	0.2	N/A	--	1.9	--	N/A				0.0
ML-SD-34	46.6992960	-92.2117220	10/18/18	2.2	1.8	82%	N/A	0.2	N/A	--	2.2	--	N/A				0.0
ML-SD-35	46.6995140	-92.2107540	10/18/18	2.0	1.3	65%	N/A	0.5	N/A	--	2.0	--	N/A				0.0
ML-SD-36	46.6991770	-92.2097600	10/18/18	1.9	1.6	84%	N/A	2.1	N/A	--	1.9	--	N/A				0.0
ML-SD-37	46.6977530	-92.2158470	10/19/18	1.4	1.2	86%	N/A	0.5	N/A	--	1.4	--	N/A				0.0
ML-SD-38	46.6978490	-92.2151790	10/19/18	2.5	1.7	68%	N/A	0.3	N/A	--	2.5	--	N/A	X		X	0.4
ML-SD-39	46.6976450	-92.2141190	10/19/18	2.4	1.9	79%	N/A	0.2	N/A	--	2.4	--	N/A				0.0
ML-SD-40	46.6976480	-92.2110050	10/18/18	3.5	2.3	66%	N/A	0.3	N/A	--	3.5	--	N/A				0.0

[a] Latitude and longitude coordinates are in decimal degree format, North American Datum of 1983 .

[b] Elevations are reported in International Great Lakes Datum 1985 US Survey feet. Elevation data is not available for Snively and Stewart Creeks.

[c] Refusal not reached, refusal depth exceeds the maximum core tube length of 10 ft.

[d] PID Max readings represent the max value observed. Individual PID readings are included within core logs.

ft = feet; bss = below sediment surface; % = percent; N/A= not applicable; PCB = polychlorinated biphenyl; TOC = Total Organic Carbon

Table 2. Sample Summary

Munger Landing Sediment Site Characterization, St. Louis River AOC, Minnesota and Wisconsin

Location ID	Sample ID	Sample Top Elevation[a] (ft)	Sample Bottom Elevation[a] (ft)	Sample Date	Moisture	TOC	Mercury	Methyl Mercury	PCB Aroclors	Dioxins & Furans	Not Analyzed
ML-SD-01	ML-SD-01-0.0/1.0	585.1	584.1	15 Oct 2018	X	X	X	X	X	X	
ML-SD-01	ML-SD-01-1.0/2.0	584.1	583.1	15 Oct 2018	X	X	X	X	X	X	
ML-SD-01	ML-SD-01-2.0/3.0	583.1	582.1	15 Oct 2018	X	X			X	X	
ML-SD-01	ML-SD-01-3.0/4.0	582.1	581.1	15 Oct 2018							X
ML-SD-01	ML-SD-01-4.0/5.0	581.1	580.1	15 Oct 2018							X
ML-SD-01	ML-SD-01-5.0/6.0	580.1	579.1	15 Oct 2018							X
ML-SD-01	ML-SD-01-6.0/7.0	579.1	578.1	15 Oct 2018							X
ML-SD-01	ML-SD-01-7.0/8.1	578.1	577.0	15 Oct 2018							X
ML-SD-02	ML-SD-02-0.0/1.0	584.3	583.3	15 Oct 2018	X	X	X	X	X	X	
ML-SD-02	ML-SD-02-1.0/2.0	583.3	582.3	15 Oct 2018	X	X	X	X	X	X	
ML-SD-02	ML-SD-02-2.0/3.0	582.3	581.3	15 Oct 2018	X	X	X		X	X	
ML-SD-02	ML-SD-02-3.0/4.0	581.3	580.3	15 Oct 2018	X	X	X		X	X	
ML-SD-02	ML-SD-02-4.0/4.7	580.3	579.6	15 Oct 2018	X	X	X		X	X	
ML-SD-03	ML-SD-03-0.0/1.0	599.5	598.5	16 Oct 2018	X	X	X	X	X	X	
ML-SD-03	ML-SD-03-1.0/2.0	598.5	597.5	16 Oct 2018	X	X	X	X	X	X	
ML-SD-03	ML-SD-03-2.0/3.0	597.5	596.5	16 Oct 2018							X
ML-SD-03	ML-SD-03-3.0/4.0	596.5	595.5	16 Oct 2018							X
ML-SD-03	ML-SD-03-4.0/5.0	595.5	594.5	16 Oct 2018							X
ML-SD-03	ML-SD-03-5.0/6.0	594.5	593.5	16 Oct 2018							X
ML-SD-03	ML-SD-03-6.0/7.0	593.5	592.5	16 Oct 2018							X
ML-SD-03	ML-SD-03-7.0/8.0	592.5	591.5	16 Oct 2018							X
ML-SD-03	ML-SD-03-8.0/9.0	591.5	590.5	16 Oct 2018							X
ML-SD-03	ML-SD-03-9.0/9.7	590.5	589.8	16 Oct 2018							X
ML-SD-04	ML-SD-04-0.0/1.0	597.0	596.0	16 Oct 2018	X	X				X	
ML-SD-04	ML-SD-04-1.0/2.0	596.0	595.0	16 Oct 2018	X	X				X	
ML-SD-04	ML-SD-04-2.0/3.0	595.0	594.0	16 Oct 2018							X
ML-SD-04	ML-SD-04-3.0/4.0	594.0	593.0	16 Oct 2018							X
ML-SD-04	ML-SD-04-4.0/5.0	593.0	592.0	16 Oct 2018							X
ML-SD-04	ML-SD-04-5.0/6.0	592.0	591.0	16 Oct 2018							X
ML-SD-04	ML-SD-04-6.0/7.0	591.0	590.0	16 Oct 2018							X
ML-SD-04	ML-SD-04-7.0/8.0	590.0	589.0	16 Oct 2018							X
ML-SD-04	ML-SD-04-8.0/8.7	589.0	588.3	16 Oct 2018							X
ML-SD-05	ML-SD-05-0.0/1.0	598.0	597.0	15 Oct 2018	X	X			X	X	
ML-SD-05	ML-SD-05-1.0/2.0	597.0	596.0	15 Oct 2018	X	X			X	X	
ML-SD-05	ML-SD-05-2.0/3.0	596.0	595.0	15 Oct 2018							X
ML-SD-05	ML-SD-05-3.0/4.0	595.0	594.0	15 Oct 2018							X
ML-SD-05	ML-SD-05-4.0/5.0	594.0	593.0	15 Oct 2018							X
ML-SD-05	ML-SD-05-5.0/6.0	593.0	592.0	15 Oct 2018							X
ML-SD-05	ML-SD-05-6.0/7.0	592.0	591.0	15 Oct 2018							X
ML-SD-06	ML-SD-06-0.0/1.0	594.8	593.8	16 Oct 2018	X	X				X	
ML-SD-06	ML-SD-06-1.0/2.0	593.8	592.8	16 Oct 2018	X	X				X	
ML-SD-06	ML-SD-06-2.0/3.0	592.8	591.8	16 Oct 2018							X
ML-SD-06	ML-SD-06-3.0/4.0	591.8	590.8	16 Oct 2018							X
ML-SD-06	ML-SD-06-4.0/5.0	590.8	589.8	16 Oct 2018							X
ML-SD-06	ML-SD-06-5.0/6.0	589.8	588.8	16 Oct 2018							X
ML-SD-06	ML-SD-06-6.0/7.0	588.8	587.8	16 Oct 2018							X
ML-SD-07	ML-SD-07-0.0/1.0	593.7	592.7	16 Oct 2018	X	X	X			X	
ML-SD-07	ML-SD-07-1.0/2.0	592.7	591.7	16 Oct 2018	X	X	X			X	
ML-SD-07	ML-SD-07-2.0/3.0	591.7	590.7	16 Oct 2018							X
ML-SD-07	ML-SD-07-3.0/4.0	590.7	589.7	16 Oct 2018							X
ML-SD-07	ML-SD-07-4.0/5.0	589.7	588.7	16 Oct 2018							X
ML-SD-07	ML-SD-07-5.0/6.0	588.7	587.7	16 Oct 2018							X
ML-SD-07	ML-SD-07-6.0/7.0	587.7	586.7	16 Oct 2018							X

Table 2. Sample Summary

Munger Landing Sediment Site Characterization, St. Louis River AOC, Minnesota and Wisconsin

Location ID	Sample ID	Sample Top Elevation[a] (ft)	Sample Bottom Elevation[a] (ft)	Sample Date	Moisture	TOC	Mercury	Methyl Mercury	PCB Aroclors	Dioxins & Furans	Not Analyzed
ML-SD-07	ML-SD-07-7.0/8.0	586.7	585.7	16 Oct 2018							X
ML-SD-07	ML-SD-07-8.0/8.9	585.7	584.8	16 Oct 2018							X
ML-SD-08	ML-SD-08-0.0/1.0	600.0	599.0	16 Oct 2018	X	X	X	X	X	X	
ML-SD-08	ML-SD-08-1.0/2.0	599.0	598.0	16 Oct 2018	X	X	X	X	X	X	
ML-SD-08	ML-SD-08-2.0/3.0	598.0	597.0	16 Oct 2018							X
ML-SD-08	ML-SD-08-3.0/4.0	597.0	596.0	16 Oct 2018							X
ML-SD-08	ML-SD-08-4.0/5.0	596.0	595.0	16 Oct 2018							X
ML-SD-08	ML-SD-08-5.0/6.0	595.0	594.0	16 Oct 2018							X
ML-SD-08	ML-SD-08-6.0/7.2	594.0	592.8	16 Oct 2018							X
ML-SD-09	ML-SD-09-0.0/1.0	595.0	594.0	16 Oct 2018	X	X	X			X	
ML-SD-09	ML-SD-09-1.0/2.0	594.0	593.0	16 Oct 2018	X	X	X			X	
ML-SD-09	ML-SD-09-2.0/3.0	593.0	592.0	16 Oct 2018							X
ML-SD-09	ML-SD-09-3.0/4.0	592.0	591.0	16 Oct 2018							X
ML-SD-09	ML-SD-09-4.0/5.2	591.0	589.8	16 Oct 2018							X
ML-SD-10	ML-SD-10-0.0/1.0	595.4	594.4	16 Oct 2018	X	X	X		X	X	
ML-SD-10	ML-SD-10-1.0/2.0	594.4	593.4	16 Oct 2018	X	X	X		X	X	
ML-SD-10	ML-SD-10-2.0/3.0	593.4	592.4	16 Oct 2018							X
ML-SD-10	ML-SD-10-3.0/4.0	592.4	591.4	16 Oct 2018							X
ML-SD-10	ML-SD-10-4.0/5.0	591.4	590.4	16 Oct 2018							X
ML-SD-10	ML-SD-10-5.0/6.0	590.4	589.4	16 Oct 2018							X
ML-SD-10	ML-SD-10-6.0/7.0	589.4	588.4	16 Oct 2018							X
ML-SD-10	ML-SD-10-7.0/8.0	588.4	587.4	16 Oct 2018							X
ML-SD-10	ML-SD-10-8.0/8.6	587.4	586.8	16 Oct 2018							X
ML-SD-11	ML-SD-11-0.0/1.0	598.5	597.5	16 Oct 2018	X	X	X		X	X	
ML-SD-11	ML-SD-11-1.0/2.0	597.5	596.5	16 Oct 2018	X	X	X		X	X	
ML-SD-11	ML-SD-11-2.0/3.0	596.5	595.5	16 Oct 2018							X
ML-SD-11	ML-SD-11-3.0/4.0	595.5	594.5	16 Oct 2018							X
ML-SD-11	ML-SD-11-4.0/5.0	594.5	593.5	16 Oct 2018							X
ML-SD-11	ML-SD-11-5.0/6.0	593.5	592.5	16 Oct 2018							X
ML-SD-12	ML-SD-12-0.0/1.0	600.6	599.6	17 Oct 2018	X	X	X	X	X	X	
ML-SD-12	ML-SD-12-1.0/2.0	599.6	598.6	17 Oct 2018	X	X	X	X	X	X	
ML-SD-12	ML-SD-12-2.0/3.0	598.6	597.6	17 Oct 2018							X
ML-SD-12	ML-SD-12-3.0/4.0	597.6	596.6	17 Oct 2018							X
ML-SD-12	ML-SD-12-4.0/5.0	596.6	595.6	17 Oct 2018							X
ML-SD-12	ML-SD-12-5.0/6.0	595.6	594.6	17 Oct 2018							X
ML-SD-12	ML-SD-12-6.0/7.0	594.6	593.6	17 Oct 2018							X
ML-SD-12	ML-SD-12-7.0/8.0	593.6	592.6	17 Oct 2018							X
ML-SD-12	ML-SD-12-8.0/9.0	592.6	591.6	17 Oct 2018							X
ML-SD-12	ML-SD-12-9.0/10.0	591.6	590.6	17 Oct 2018							X
ML-SD-13	ML-SD-13-0.0/1.0	598.7	597.7	16 Oct 2018	X	X			X	X	
ML-SD-13	ML-SD-13-1.0/2.0	597.7	596.7	16 Oct 2018	X	X			X	X	
ML-SD-13	ML-SD-13-2.0/3.0	596.7	595.7	16 Oct 2018							X
ML-SD-13	ML-SD-13-3.0/4.0	595.7	594.7	16 Oct 2018							X
ML-SD-13	ML-SD-13-4.0/4.9	594.7	593.8	16 Oct 2018							X
ML-SD-14	ML-SD-14-0.0/1.0	594.8	593.8	17 Oct 2018	X	X			X	X	
ML-SD-14	ML-SD-14-1.0/2.0	593.8	592.8	17 Oct 2018	X	X			X	X	
ML-SD-14	ML-SD-14-2.0/3.0	592.8	591.8	17 Oct 2018	X	X			X	X	
ML-SD-14	ML-SD-14-3.0/4.0	591.8	590.8	17 Oct 2018							X
ML-SD-14	ML-SD-14-4.0/5.0	590.8	589.8	17 Oct 2018							X
ML-SD-14	ML-SD-14-5.0/6.0	589.8	588.8	17 Oct 2018							X
ML-SD-14	ML-SD-14-6.0/7.0	588.8	587.8	17 Oct 2018							X
ML-SD-14	ML-SD-14-7.0/8.0	587.8	586.8	17 Oct 2018							X
ML-SD-14	ML-SD-14-8.0/9.4	586.8	585.4	17 Oct 2018							X

Table 2. Sample Summary

Munger Landing Sediment Site Characterization, St. Louis River AOC, Minnesota and Wisconsin

Location ID	Sample ID	Sample Top Elevation[a] (ft)	Sample Bottom Elevation[a] (ft)	Sample Date	Moisture	TOC	Mercury	Methyl Mercury	PCB Aroclors	Dioxins & Furans	Not Analyzed
ML-SD-15	ML-SD-15-0.0/1.0	599.0	598.0	18 Oct 2018	X	X			X	X	
ML-SD-15	ML-SD-15-1.0/2.0	598.0	597.0	18 Oct 2018	X	X			X	X	
ML-SD-15	ML-SD-15-2.0/3.0	597.0	596.0	18 Oct 2018							X
ML-SD-15	ML-SD-15-3.0/4.0	596.0	595.0	18 Oct 2018							X
ML-SD-15	ML-SD-15-4.0/5.0	595.0	594.0	18 Oct 2018							X
ML-SD-15	ML-SD-15-5.0/6.0	594.0	593.0	18 Oct 2018							X
ML-SD-15	ML-SD-15-6.0/7.0	593.0	592.0	18 Oct 2018							X
ML-SD-15	ML-SD-15-7.0/8.0	592.0	591.0	18 Oct 2018							X
ML-SD-15	ML-SD-15-8.0/9.0	591.0	590.0	18 Oct 2018							X
ML-SD-16	ML-SD-16-0.0/1.0	597.6	596.6	17 Oct 2018	X	X	X	X	X	X	
ML-SD-16	ML-SD-16-1.0/2.0	596.6	595.6	17 Oct 2018	X	X	X	X	X	X	
ML-SD-16	ML-SD-16-2.0/3.0	595.6	594.6	17 Oct 2018	X	X			X		
ML-SD-16	ML-SD-16-3.0/4.0	594.6	593.6	17 Oct 2018							X
ML-SD-16	ML-SD-16-4.0/5.0	593.6	592.6	17 Oct 2018							X
ML-SD-16	ML-SD-16-5.0/6.0	592.6	591.6	17 Oct 2018							X
ML-SD-16	ML-SD-16-6.0/7.0	591.6	590.6	17 Oct 2018							X
ML-SD-16	ML-SD-16-7.0/8.0	590.6	589.6	17 Oct 2018							X
ML-SD-16	ML-SD-16-8.0/9.0	589.6	588.6	17 Oct 2018							X
ML-SD-16	ML-SD-16-9.0/10.0	588.6	587.6	17 Oct 2018							X
ML-SD-17	ML-SD-17-0.0/1.0	598.6	597.6	17 Oct 2018	X	X			X	X	
ML-SD-17	ML-SD-17-1.0/2.0	597.6	596.6	17 Oct 2018	X	X			X	X	
ML-SD-17	ML-SD-17-2.0/3.0	596.6	595.6	17 Oct 2018							X
ML-SD-18	ML-SD-18-0.0/1.0	599.5	598.5	17 Oct 2018	X	X	X	X	X	X	
ML-SD-18	ML-SD-18-1.0/2.0	598.5	597.5	17 Oct 2018	X	X	X	X	X	X	
ML-SD-18	ML-SD-18-2.0/3.0	597.5	596.5	17 Oct 2018							X
ML-SD-18	ML-SD-18-3.0/4.0	596.5	595.5	17 Oct 2018							X
ML-SD-18	ML-SD-18-4.0/5.0	595.5	594.5	17 Oct 2018							X
ML-SD-18	ML-SD-18-5.0/6.0	594.5	593.5	17 Oct 2018							X
ML-SD-18	ML-SD-18-6.0/7.0	593.5	592.5	17 Oct 2018							X
ML-SD-18	ML-SD-18-7.0/8.0	592.5	591.5	17 Oct 2018							X
ML-SD-18	ML-SD-18-8.0/9.2	591.5	590.3	17 Oct 2018							X
ML-SD-19	ML-SD-19-0.0/1.0	599.6	598.6	17 Oct 2018	X	X	X	X	X	X	
ML-SD-19	ML-SD-19-1.0/2.0	598.6	597.6	17 Oct 2018	X	X	X	X	X	X	
ML-SD-19	ML-SD-19-2.0/3.0	597.6	596.6	17 Oct 2018							X
ML-SD-19	ML-SD-19-3.0/4.0	596.6	595.6	17 Oct 2018							X
ML-SD-19	ML-SD-19-4.0/5.0	595.6	594.6	17 Oct 2018							X
ML-SD-19	ML-SD-19-5.0/6.0	594.6	593.6	17 Oct 2018							X
ML-SD-19	ML-SD-19-6.0/7.0	593.6	592.6	17 Oct 2018							X
ML-SD-19	ML-SD-19-7.0/8.0	592.6	591.6	17 Oct 2018							X
ML-SD-19	ML-SD-19-8.0/9.0	591.6	590.6	17 Oct 2018							X
ML-SD-19	ML-SD-19-9.0/10.0	590.6	589.6	17 Oct 2018							X
ML-SD-20	ML-SD-20-0.0/1.0	600.8	599.8	17 Oct 2018	X	X			X	X	
ML-SD-20	ML-SD-20-1.0/2.0	599.8	598.8	17 Oct 2018	X	X			X	X	
ML-SD-20	ML-SD-20-2.0/3.0	598.8	597.8	17 Oct 2018							X
ML-SD-20	ML-SD-20-3.0/4.0	597.8	596.8	17 Oct 2018							X
ML-SD-20	ML-SD-20-4.0/5.0	596.8	595.8	17 Oct 2018							X
ML-SD-20	ML-SD-20-5.0/6.0	595.8	594.8	17 Oct 2018							X
ML-SD-20	ML-SD-20-6.0/7.0	594.8	593.8	17 Oct 2018							X
ML-SD-20	ML-SD-20-7.0/8.0	593.8	592.8	17 Oct 2018							X
ML-SD-20	ML-SD-20-8.0/9.0	592.8	591.8	17 Oct 2018							X
ML-SD-20	ML-SD-20-9.0/10.0	591.8	590.8	17 Oct 2018							X

Table 2. Sample Summary

Munger Landing Sediment Site Characterization, St. Louis River AOC, Minnesota and Wisconsin

Location ID	Sample ID	Sample Top Elevation[a] (ft)	Sample Bottom Elevation[a] (ft)	Sample Date	Moisture	TOC	Mercury	Methyl Mercury	PCB Aroclors	Dioxins & Furans	Not Analyzed
ML-SD-21	ML-SD-21-0.0/1.0	600.1	599.1	17 Oct 2018	X	X	X	X	X	X	
ML-SD-21	ML-SD-21-1.0/2.0	599.1	598.1	17 Oct 2018	X	X	X	X	X	X	
ML-SD-21	ML-SD-21-2.0/3.0	598.1	597.1	17 Oct 2018							X
ML-SD-21	ML-SD-21-3.0/4.0	597.1	596.1	17 Oct 2018							X
ML-SD-21	ML-SD-21-4.0/5.0	596.1	595.1	17 Oct 2018							X
ML-SD-21	ML-SD-21-5.0/6.0	595.1	594.1	17 Oct 2018							X
ML-SD-21	ML-SD-21-6.0/7.0	594.1	593.1	17 Oct 2018							X
ML-SD-21	ML-SD-21-7.0/8.0	593.1	592.1	17 Oct 2018							X
ML-SD-21	ML-SD-21-8.0/9.0	592.1	591.1	17 Oct 2018							X
ML-SD-21	ML-SD-21-9.0/10.0	591.1	590.1	17 Oct 2018							X
ML-SD-22	ML-SD-22-0.0/1.0	599.4	598.4	17 Oct 2018	X	X	X	X	X	X	
ML-SD-22	ML-SD-22-1.0/2.0	598.4	597.4	17 Oct 2018	X	X	X	X	X	X	
ML-SD-22	ML-SD-22-2.0/3.0	597.4	596.4	17 Oct 2018							X
ML-SD-22	ML-SD-22-3.0/4.0	596.4	595.4	17 Oct 2018							X
ML-SD-22	ML-SD-22-4.0/5.0	595.4	594.4	17 Oct 2018							X
ML-SD-22	ML-SD-22-5.0/6.0	594.4	593.4	17 Oct 2018							X
ML-SD-22	ML-SD-22-6.0/7.0	593.4	592.4	17 Oct 2018							X
ML-SD-22	ML-SD-22-7.0/8.0	592.4	591.4	17 Oct 2018							X
ML-SD-22	ML-SD-22-8.0/9.0	591.4	590.4	17 Oct 2018							X
ML-SD-23	ML-SD-23-0.0/1.0	596.9	595.9	18 Oct 2018	X	X			X	X	
ML-SD-23	ML-SD-23-1.0/2.0	595.9	594.9	18 Oct 2018	X	X			X	X	
ML-SD-23	ML-SD-23-2.0/3.0	594.9	593.9	18 Oct 2018	X	X			X	X	
ML-SD-23	ML-SD-23-3.0/4.0	593.9	592.9	18 Oct 2018	X	X			X	X	
ML-SD-23	ML-SD-23-4.0/5.0	592.9	591.9	18 Oct 2018							X
ML-SD-23	ML-SD-23-5.0/6.0	591.9	590.9	18 Oct 2018							X
ML-SD-23	ML-SD-23-6.0/7.0	590.9	589.9	18 Oct 2018							X
ML-SD-23	ML-SD-23-7.0/8.0	589.9	588.9	18 Oct 2018							X
ML-SD-23	ML-SD-23-8.0/9.0	588.9	587.9	18 Oct 2018							X
ML-SD-23	ML-SD-23-9.0/9.8	587.9	587.1	18 Oct 2018							X
ML-SD-24	ML-SD-24-0.0/1.0	594.6	593.6	18 Oct 2018	X	X			X	X	
ML-SD-24	ML-SD-24-1.0/2.0	593.6	592.6	18 Oct 2018	X	X			X	X	
ML-SD-24	ML-SD-24-2.0/3.0	592.6	591.6	18 Oct 2018	X	X			X	X	
ML-SD-24	ML-SD-24-3.0/4.0	591.6	590.6	18 Oct 2018	X	X			X	X	
ML-SD-24	ML-SD-24-4.0/5.0	590.6	589.6	18 Oct 2018							X
ML-SD-24	ML-SD-24-5.0/6.0	589.6	588.6	18 Oct 2018							X
ML-SD-24	ML-SD-24-6.0/7.0	588.6	587.6	18 Oct 2018							X
ML-SD-24	ML-SD-24-7.0/8.0	587.6	586.6	18 Oct 2018							X
ML-SD-24	ML-SD-24-8.0/9.4	586.6	585.2	18 Oct 2018							X
ML-SD-25	ML-SD-25-0.0/1.0	595.4	594.4	18 Oct 2018	X	X			X	X	
ML-SD-25	ML-SD-25-1.0/2.0	594.4	593.4	18 Oct 2018	X	X			X	X	
ML-SD-25	ML-SD-25-2.0/3.0	593.4	592.4	18 Oct 2018							X
ML-SD-25	ML-SD-25-3.0/4.0	592.4	591.4	18 Oct 2018							X
ML-SD-25	ML-SD-25-4.0/5.0	591.4	590.4	18 Oct 2018							X
ML-SD-25	ML-SD-25-5.0/6.0	590.4	589.4	18 Oct 2018							X
ML-SD-25	ML-SD-25-6.0/7.0	589.4	588.4	18 Oct 2018							X
ML-SD-25	ML-SD-25-7.0/7.8	588.4	587.6	18 Oct 2018							X
ML-SD-26	ML-SD-26-0.0/1.0	595.0	594.0	18 Oct 2018	X	X			X	X	
ML-SD-26	ML-SD-26-1.0/2.0	594.0	593.0	18 Oct 2018	X	X			X	X	
ML-SD-26	ML-SD-26-2.0/3.0	593.0	592.0	18 Oct 2018	X	X			X	X	
ML-SD-26	ML-SD-26-3.0/4.0	592.0	591.0	18 Oct 2018	X	X			X	X	
ML-SD-26	ML-SD-26-4.0/5.0	591.0	590.0	18 Oct 2018							X
ML-SD-26	ML-SD-26-5.0/6.0	590.0	589.0	18 Oct 2018							X
ML-SD-26	ML-SD-26-6.0/7.0	589.0	588.0	18 Oct 2018							X

Table 2. Sample Summary

Munger Landing Sediment Site Characterization, St. Louis River AOC, Minnesota and Wisconsin

Location ID	Sample ID	Sample Top Elevation[a] (ft)	Sample Bottom Elevation[a] (ft)	Sample Date	Moisture	TOC	Mercury	Methyl Mercury	PCB Aroclors	Dioxins & Furans	Not Analyzed
ML-SD-26	ML-SD-26-7.0/8.0	588.0	587.0	18 Oct 2018							X
ML-SD-26	ML-SD-26-8.0/9.0	587.0	586.0	18 Oct 2018							X
ML-SD-26	ML-SD-26-9.0/10.0	586.0	585.0	18 Oct 2018							X
ML-SD-27	ML-SD-27-0.0/1.0	599.9	598.9	17 Oct 2018	X	X			X	X	
ML-SD-27	ML-SD-27-1.0/2.0	598.9	597.9	17 Oct 2018	X	X			X		
ML-SD-27	ML-SD-27-2.0/3.0	597.9	596.9	17 Oct 2018	X	X			X		
ML-SD-27	ML-SD-27-3.0/3.7	596.9	596.2	17 Oct 2018	X	X			X		
ML-SD-28	ML-SD-28-0.0/1.0	598.8	597.8	18 Oct 2018	X	X			X	X	
ML-SD-28	ML-SD-28-1.0/2.0	597.8	596.8	18 Oct 2018							X
ML-SD-28	ML-SD-28-2.0/3.0	596.8	595.8	18 Oct 2018							X
ML-SD-28	ML-SD-28-3.0/4.0	595.8	594.8	18 Oct 2018							X
ML-SD-28	ML-SD-28-4.0/5.0	594.8	593.8	18 Oct 2018							X
ML-SD-28	ML-SD-28-5.0/6.0	593.8	592.8	18 Oct 2018							X
ML-SD-28	ML-SD-28-6.0/7.0	592.8	591.8	18 Oct 2018							X
ML-SD-28	ML-SD-28-7.0/8.4	591.8	590.4	18 Oct 2018							X
ML-SD-29	ML-SD-29-0.0/0.25	602.2	601.9	15 Oct 2018	X	X				X	
ML-SD-30	ML-SD-30-0.0/0.25	598.9	598.7	15 Oct 2018	X	X				X	
ML-SD-31	ML-SD-31-0.0/0.25	599.0	598.8	15 Oct 2018	X	X				X	
ML-SD-32	ML-SD-32-0.0/0.25	599.8	599.6	15 Oct 2018	X	X				X	
ML-SD-33	ML-SD-33-0.0/1.2	-	-	18 Oct 2018	X	X	X		X	X	
ML-SD-34	ML-SD-34-0.0/1.0	-	-	18 Oct 2018	X	X	X		X	X	
ML-SD-34	ML-SD-34-1.0/1.8	-	-	18 Oct 2018	X	X	X		X	X	
ML-SD-35	ML-SD-35-0.0/1.3	-	-	19 Oct 2018	X	X	X		X	X	
ML-SD-36	ML-SD-36-0.0/1.0	-	-	19 Oct 2018	X	X	X		X	X	
ML-SD-36	ML-SD-36-1.0/1.6	-	-	19 Oct 2018	X	X	X		X	X	
ML-SD-37	ML-SD-37-0.0/1.2	-	-	19 Oct 2018	X	X	X		X	X	
ML-SD-38	ML-SD-38-0.0/1.0	-	-	19 Oct 2018	X	X	X		X	X	
ML-SD-38	ML-SD-38-1.0/1.7	-	-	19 Oct 2018	X	X	X		X	X	
ML-SD-39	ML-SD-39-0.0/1.0	-	-	19 Oct 2018	X	X	X		X	X	
ML-SD-39	ML-SD-39-1.0/1.9	-	-	19 Oct 2018	X	X	X		X	X	
ML-SD-40	ML-SD-40-0.0/1.0	-	-	19 Oct 2018	X	X	X		X	X	
ML-SD-40	ML-SD-40-1.0/2.3	-	-	19 Oct 2018	X	X	X		X	X	

Notes:

[a] Elevations are reported in International Great Lakes Datum 1985 US Survey feet.
Elevation data is not available for Snively and Stewart Creeks.

ft = feet; PCB = polychlorinated biphenyl; TOC = Total Organic Carbon

Table 3. Analytical Results Summary

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Area	Investigation Year	Sample ID	Interval (ft bss)	Percent Moisture (%)	Total Organic Carbon (mg/kg)	Mercury (mg/kg)	Methyl Mercury (mg/kg)	Total PCB[a] (mg/kg)	Fish TEQ[b] (ng/kg)
			Level I SQT:	**-**	**-**	**0.18**	**-**	**0.060**	**0.85**
			Midpoint SQT:	**-**	**-**	**0.64**	**-**	**0.370**	**11.2**
			Level II SQT:	**-**	**-**	**1.1**	**-**	**0.680**	**21.5**
Channel	2018	ML-SD-01-0.0/1.0	0.0 - 1.0	40.03	23,800	0.38	0.00146 U	0.382	34.5
Channel	2018	ML-SD-01-1.0/2.0	1.0 - 2.0	31.26	13,300	0.05 U	0.00160 U	0.0182 U	0.591 J
Channel	2018	ML-SD-01-2.0/3.0	2.0 - 3.0	32.09	15,000 J	-	-	0.0184 U	0.638 J
Channel	2018	ML-SD-02-0.0/1.0	0.0 - 1.0	55.37	35,400	0.20 J	0.00252 U	0.178	16.8
Channel	2018	ML-SD-02-1.0/2.0	1.0 - 2.0	55.76	53,900	0.89	0.00300 J	0.805	49.6
Channel	2018	ML-SD-02-2.0/3.0	2.0 - 3.0	31.47	14,200 J	0.31 J-	-	0.0183 U	3.11 J
Channel	2018	ML-SD-02-3.0/4.0	3.0 - 4.0	23.96	6,710 J	R	-	0.0165 U	0.920 J
Channel	2018	ML-SD-02-4.0/4.7	4.0 - 4.7	18.82	2,100 J	R	-	0.0154 U	0.323 J
Channel	2018	ML-SD-03-0.0/1.0	0.0 - 1.0	27.74	15,000	0.047 U	0.00120 U	0.0173 U	0.318 J
Channel	2018	ML-SD-03-1.0/2.0	1.0 - 2.0	38.68	22,700	0.052 U	0.00116 U	0.0204 U	0.514 UJ*
Channel	2018	ML-SD-04-0.0/1.0	0.0 - 1.0	36.10	11,400	-	-	-	0.411 J
Channel	2018	ML-SD-04-1.0/2.0	1.0 - 2.0	26.45	3,750	-	-	-	0.432 UJ*
Channel	2018	ML-SD-05-0.0/1.0	0.0 - 1.0	34.70	15,700	-	-	0.0192 U	0.470 J*
Channel	2018	ML-SD-05-1.0/2.0	1.0 - 2.0	27.71	12,800	-	-	0.0173 U	0.432 J*
Channel	2018	ML-SD-06-0.0/1.0	0.0 - 1.0	39.39	17,500	-	-	-	0.663 J
Channel	2018	ML-SD-06-1.0/2.0	1.0 - 2.0	40.19	19,600	-	-	-	0.484 J
Channel	2018	ML-SD-07-0.0/1.0	0.0 - 1.0	41.75	20,000	0.11 J	-	-	22.3
Channel	2018	ML-SD-07-1.0/2.0	1.0 - 2.0	36.10	12,200	0.051 U	-	-	0.484 J
Channel	2018	ML-SD-08-0.0/1.0	0.0 - 1.0	29.31	11,700	0.088 J	0.00106 U	0.0522	0.950 J
Channel	2018	ML-SD-08-1.0/2.0	1.0 - 2.0	30.11	14,300	0.044 U	0.00140 U	0.0179 U	0.488 J*
Channel	2018	ML-SD-09-0.0/1.0	0.0 - 1.0	22.78	672	0.043 U	-	-	0.479 J*
Channel	2018	ML-SD-09-1.0/2.0	1.0 - 2.0	21.59	660	0.042 U	-	-	0.354 J
Channel	2018	ML-SD-10-0.0/1.0	0.0 - 1.0	42.12	24,400	0.057 U	-	0.0216 U	0.532 J*
Channel	2018	ML-SD-10-1.0/2.0	1.0 - 2.0	41.28	21,300	0.055 U	-	0.0213 U	0.505 J*
Channel	2018	ML-SD-11-0.0/1.0	0.0 - 1.0	47.17	36,200	0.53	-	0.0803	58.4
Channel	2018	ML-SD-11-1.0/2.0	1.0 - 2.0	26.27	10,300	0.044 U	-	0.0170 U	0.417 J
Channel	2018	ML-SD-12-0.0/1.0	0.0 - 1.0	37.96	19,800	0.059 J	0.00134 U	0.190	0.511 J
Channel	2018	ML-SD-12-1.0/2.0	1.0 - 2.0	30.71	14,100	0.048 U	0.00137 U	0.0181 U	0.372 J
Channel	2018	ML-SD-13-0.0/1.0	0.0 - 1.0	25.53	15,500	-	-	0.0168 U	0.353 J
Channel	2018	ML-SD-13-1.0/2.0	1.0 - 2.0	25.21	12,600	-	-	0.0167 U	0.434 UJ*
Channel	2018	ML-SD-14-0.0/1.0	0.0 - 1.0	60.88	47,800	-	-	1.45	146
Channel	2018	ML-SD-14-1.0/2.0	1.0 - 2.0	49.56	37,300	-	-	0.0555	77.5 J
Channel	2018	ML-SD-14-2.0/3.0	2.0 - 3.0	33.49	17,000 J	-	-	0.0188 U	0.848 J
Channel	2018	ML-SD-15-0.0/1.0	0.0 - 1.0	40.40	32,500	-	-	0.114	7.91 J
Channel	2018	ML-SD-15-1.0/2.0	1.0 - 2.0	37.98	45,700	-	-	0.0202 U	0.523 J
Channel	2018	ML-SD-16-0.0/1.0	0.0 - 1.0	57.53	50,700	0.077 U	0.00202 U	0.0295 U	2.22 J
Channel	2018	ML-SD-16-1.0/2.0	1.0 - 2.0	67.51	89,300	0.10 U	0.00289 U	0.0385 U	1.25 J
Channel	2018	ML-SD-16-2.0/3.0	2.0 - 3.0	49.76	34,100 J	-	-	0.0249 U	-
Channel	2018	ML-SD-17-0.0/1.0	0.0 - 1.0	42.33	28,500	-	-	1.00	11.2 J
Channel	2018	ML-SD-17-1.0/2.0	1.0 - 2.0	26.75	11,800	-	-	0.0171 U	0.452 UJ*
Channel	2018	ML-SD-18-0.0/1.0	0.0 - 1.0	42.69	25,000	0.095 J	0.00139 U	0.113	0.841 J
Channel	2018	ML-SD-18-1.0/2.0	1.0 - 2.0	34.32	23,500	0.049 U	0.00121 U	0.0191 U	0.488 J*
Channel	2018	ML-SD-19-0.0/1.0	0.0 - 1.0	38.54	27,200	0.050 U	0.00158 U	0.0204 U	0.379 J
Channel	2018	ML-SD-19-1.0/2.0	1.0 - 2.0	34.28	25,100	0.052 U	0.00117 U	0.0190 U	0.487 J*
Channel	2018	ML-SD-20-0.0/1.0	0.0 - 1.0	46.49	40,900	-	-	0.0508	0.619 J
Channel	2018	ML-SD-20-1.0/2.0	1.0 - 2.0	40.94	35,300	-	-	0.0212 U	0.390 J
Channel	2018	ML-SD-21-0.0/1.0	0.0 - 1.0	36.73	24,400	0.052 U	0.00172 U	0.0198 U	0.358 J
Channel	2018	ML-SD-21-1.0/2.0	1.0 - 2.0	37.12	30,500	0.050 U	0.00162 U	0.0199 U	0.497 UJ*
Channel	2018	ML-SD-22-0.0/1.0	0.0 - 1.0	39.86	24,900	0.094 J	0.00160 U	0.0743	0.801 J
Channel	2018	ML-SD-22-1.0/2.0	1.0 - 2.0	27.37	12,100	0.043 U	0.00101 U	0.0172 U	0.357 J

Table 3. Analytical Results Summary

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Area	Investigation Year	Sample ID	Interval (ft bss)	Percent Moisture (%)	Total Organic Carbon (mg/kg)	Mercury (mg/kg)	Methyl Mercury (mg/kg)	Total PCB[a] (mg/kg)	Fish TEQ[b] (ng/kg)
			Level I SQT:	**-**	**-**	**0.18**	**-**	**0.060**	**0.85**
			Midpoint SQT:	**-**	**-**	**0.64**	**-**	**0.370**	**11.2**
			Level II SQT:	**-**	**-**	**1.1**	**-**	**0.680**	**21.5**
Channel	2018	ML-SD-23-0.0/1.0	0.0 - 1.0	60.18	47,100	-	-	0.400	34.9 J
Channel	2018	ML-SD-23-1.0/2.0	1.0 - 2.0	56.95	52,800	-	-	0.171	249
Channel	2018	ML-SD-23-2.0/3.0	2.0 - 3.0	32.82	16,800 J	-	-	0.0186 U	0.423 J*
Channel	2018	ML-SD-23-3.0/4.0	3.0 - 4.0	35.61	17,900 J	-	-	0.0194 U	0.514 J
Channel	2018	ML-SD-24-0.0/1.0	0.0 - 1.0	62.84	45,700	-	-	0.163	20.1 J
Channel	2018	ML-SD-24-1.0/2.0	1.0 - 2.0	59.23	59,900	-	-	1.73	176
Channel	2018	ML-SD-24-2.0/3.0	2.0 - 3.0	50.32	32,500 J	-	-	0.0252 U	10.3 J
Channel	2018	ML-SD-24-3.0/4.0	3.0 - 4.0	28.23	9,060 J	-	-	0.0174 U	0.392 J
Channel	2018	ML-SD-25-0.0/1.0	0.0 - 1.0	56.18	46,900	-	-	0.205	72.8
Channel	2018	ML-SD-25-1.0/2.0	1.0 - 2.0	35.00	16,700	-	-	0.0193 U	1.59 J
Channel	2018	ML-SD-26-0.0/1.0	0.0 - 1.0	56.82	51,200	-	-	0.958	61.6
Channel	2018	ML-SD-26-1.0/2.0	1.0 - 2.0	50.57	39,200	-	-	0.0253 U	116
Channel	2018	ML-SD-26-2.0/3.0	2.0 - 3.0	25.83	13,800 J	-	-	0.0169 U	0.333 J
Channel	2018	ML-SD-26-3.0/4.0	3.0 - 4.0	32.70	10,700 J	-	-	0.0186 U	0.454 J
Channel	2018	ML-SD-27-0.0/1.0	0.0 - 1.0	82.96	287,000	-	-	0.0735 U	2.74 J
Channel	2018	ML-SD-27-1.0/2.0	1.0 - 2.0	71.42	134,000 J	-	-	0.230	-
Channel	2018	ML-SD-27-2.0/3.0	2.0 - 3.0	74.36	184,000 J	-	-	0.0488 U	-
Channel	2018	ML-SD-27-3.0/3.7	3.0 - 3.7	70.17	115,000 J	-	-	0.0419 U	-
Channel	2018	ML-SD-28-0.0/1.0	0.0 - 1.0	23.76	5,920	-	-	0.0164 U	0.404 J
Clough Isl.	2018	ML-SD-29-0.0/0.25	0.0 - 0.25	90.23	226,000	-	-	-	42.8 J
Clough Isl.	2018	ML-SD-30-0.0/0.25	0.0 - 0.25	88.31	223,000	-	-	-	18.2 J
Clough Isl.	2018	ML-SD-31-0.0/0.25	0.0 - 0.25	75.19	102,000	-	-	-	27.0
Clough Isl.	2018	ML-SD-32-0.0/0.25	0.0 - 0.25	87.40	187,000	-	-	-	36.0 J
Creeks	2018	ML-SD-33-0.0/1.2	0.0 - 1.2	16.06	11,300	0.041 U	-	0.0149 U	0.388 J*
Creeks	2018	ML-SD-34-0.0/1.0	0.0 - 1.0	8.47	6,220	0.034 U	-	0.0137 U	0.354 J*
Creeks	2018	ML-SD-34-1.0/1.8	1.0 - 1.8	28.80	10,700	0.049 U	-	0.0176 U	0.452 J*
Creeks	2018	ML-SD-35-0.0/1.3	0.0 - 1.3	24.98	10,200	0.048 J	-	0.0167 U	0.344 J
Creeks	2018	ML-SD-36-0.0/1.0	0.0 - 1.0	33.74	18,700	0.046 U	-	0.0189 U	0.368 J
Creeks	2018	ML-SD-36-1.0/1.6	1.0 - 1.6	24.45	18,400	0.042 U	-	0.0166 U	0.421 J*
Creeks	2018	ML-SD-37-0.0/1.2	0.0 - 1.2	22.14	8,920	0.044 U	-	0.0161 U	0.421 J*
Creeks	2018	ML-SD-38-0.0/1.0	0.0 - 1.0	11.51	2,860	0.035 U	-	0.447	0.576 J
Creeks	2018	ML-SD-38-1.0/1.7	1.0 - 1.7	18.13	7,670	0.041 U	-	0.554	1.04 J
Creeks	2018	ML-SD-39-0.0/1.0	0.0 - 1.0	13.89	6,720	0.040 U	-	0.505	0.720 J
Creeks	2018	ML-SD-39-1.0/1.9	1.0 - 1.9	25.76	18,400	0.054 J	-	0.186	0.493 J
Creeks	2018	ML-SD-40-0.0/1.0	0.0 - 1.0	17.65	7,720	0.040 U	-	0.303	0.722 J
Creeks	2018	ML-SD-40-1.0/2.3	1.0 - 2.3	18.96	8,400	0.042 U	-	0.408	1.12 J
Channel	2014	BW14ML-001-0-0.15	0.0 - 0.5	-	47,900	0.21	-	-	4.87 J
Channel	2014	BW14ML-001-0.15-0.28	0.5 - 0.9	-	32,600	0.27	-	-	-
Channel	2014	BW14ML-001-0.28-0.53	0.9 - 1.7	-	28,600	0.47 J	-	-	-
Channel	2015	BW15ML-001D-0-0.15	0.0 - 0.5	-	31,400	0.22	-	-	13.76
Channel	2015	BW15ML-001D-0.15-0.75	0.5 - 2.5	-	29,400	0.31	-	-	-
Channel	2015	BW15ML-001D-0.75-1.0	2.5 - 3.3	-	46,600	0.79	-	-	-
Channel	2014	BW14ML-002-0-0.15	0.0 - 0.5	-	155,000	0.051 J	-	-	-
Channel	2014	BW14ML-002-0.15-0.37	0.5 - 1.2	-	20,400	0.018 J	-	-	0.18 J
Channel	2014	BW14ML-002-0.37-0.62	1.2 - 2.0	-	2,920	0.013	-	-	-
Channel	2014	BW14ML-003-0-0.15	0.0 - 0.5	-	36,300	0.18	-	-	-
Channel	2014	BW14ML-003-0.15-0.46	0.5 - 1.5	-	43,400	0.38	-	-	-
Channel	2014	BW14ML-003-0.46-0.72	1.5 - 2.4	-	18,300	0.022 J	-	-	-
Channel	2014	BW14ML-004-0-0.15	0.0 - 0.5	-	88,500	0.41	-	0.0505 U	-
Channel	2014	BW14ML-004-0.15-0.41	0.5 - 1.3	-	40,800	0.028 J	-	-	0.18 J
Channel	2014	BW14ML-004-0.41-0.66	1.3 - 2.2	-	3,130	0.017 J	-	-	-

Table 3. Analytical Results Summary

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Area	Investigation Year	Sample ID	Interval (ft bss)	Percent Moisture (%)	Total Organic Carbon (mg/kg)	Mercury (mg/kg)	Methyl Mercury (mg/kg)	Total PCB[a] (mg/kg)	Fish TEQ[b] (ng/kg)
			Level I SQT:	**-**	**-**	**0.18**	**-**	**0.060**	**0.85**
			Midpoint SQT:	**-**	**-**	**0.64**	**-**	**0.370**	**11.2**
			Level II SQT:	**-**	**-**	**1.1**	**-**	**0.680**	**21.5**
Channel	2014	BW14ML-005-0-0.15	0.0 - 0.5	-	18,300	0.085	-	-	-
Channel	2014	BW14ML-005-0.15-0.36	0.5 - 1.2	-	34,400	0.11	-	-	-
Channel	2014	BW14ML-005-0.36-0.61	1.2 - 2.0	-	24,800	0.12	-	-	-
Channel	2014	BW14ML-006-0-0.15	0.0 - 0.5	-	108,000 J	0.17	-	-	2.50 J
Channel	2014	BW14ML-006-0.15-0.36	0.5 - 1.2	-	132,000 J	0.098	-	-	-
Channel	2014	BW14ML-007-0-0.15	0.0 - 0.5	-	41,400	0.19	-	-	-
Channel	2014	BW14ML-007-0.15-0.43	0.5 - 1.4	-	27,000	0.085	-	-	-
Channel	2014	BW14ML-007-0.43-0.68	1.4 - 2.2	-	20,000	0.13	-	-	-
Channel	2014	BW14ML-008-0-0.15	0.0 - 0.5	-	7,660	0.03	-	0.0221 U	-
Channel	2014	BW14ML-008-0.15-0.32	0.5 - 1.0	-	3,770	0.0084 J	-	-	-
Channel	2014	BW14ML-008-0.32-0.57	1.0 - 1.9	-	4,280	0.025 U	-	-	-
Channel	2014	BW14ML-009-0-0.15	0.0 - 0.5	-	27,200	0.049	-	-	-
Channel	2014	BW14ML-009-0.15-0.45	0.5 - 1.5	-	20,500	0.047	-	-	-
Channel	2014	BW14ML-009-0.45-0.70	1.5 - 2.3	-	27,200	0.036	-	-	-
Channel	2014	BW14ML-010-Grab	0.0 - 0.5	-	123,000	0.42	-	-	4.67 J
Channel	2014	BW14ML-011-0-0.15	0.0 - 0.5	-	27,800	0.21	-	-	-
Channel	2014	BW14ML-011-0.15-0.34	0.5 - 1.1	-	47,800	1.1	-	-	-
Channel	2014	BW14ML-011-0.34-0.59	1.1 - 1.9	-	25,400	0.071	-	0.0278 U	-
Channel	2014	BW14ML-012-0-0.15	0.0 - 0.5	-	36,800	0.17	-	-	2.38 J
Channel	2014	BW14ML-012-0.15-0.36	0.5 - 1.2	-	65,100	0.42	-	-	-
Channel	2014	BW14ML-012-0.36-0.61	1.2 - 2.0	-	24,200	0.019 J	-	-	-
Channel	2014	BW14ML-013-0-0.15	0.0 - 0.5	-	32,500	0.31	-	43.7	-
Channel	2014	BW14ML-013-0.15-0.30	0.5 - 1.0	-	94,000	0.54	-	-	-
Channel	2014	BW14ML-013-0.30-0.55	1.0 - 1.8	-	84,300	0.42	-	-	-
Channel	2014	BW14ML-014-0-0.15	0.0 - 0.5	-	42,900	0.41	-	-	-
Channel	2014	BW14ML-014-0.15-0.26	0.5 - 0.9	-	40,800	0.12	-	-	-
Channel	2014	BW14ML-014-0.26-0.51	0.9 - 1.7	-	42,000	0.033	-	-	-
Channel	2014	BW14ML-015-0-0.15	0.0 - 0.5	-	39,000	0.17	-	-	6.71 J
Channel	2014	BW14ML-015-0.15-0.34	0.5 - 1.1	-	50,600	0.32	-	-	-
Channel	2014	BW14ML-015-0.34-0.59	1.1 - 1.9	-	27,800	0.27	-	-	-
Channel	2014	BW14ML-016-0-0.15	0.0 - 0.5	-	67,400	0.063	-	-	-
Channel	2014	BW14ML-016-0.15-0.33	0.5 - 1.1	-	8,930	0.033	-	-	-
Channel	2014	BW14ML-017-0-0.15	0.0 - 0.5	-	7,450	0.029	-	0.0230 U	0.85 J
Channel	2014	BW14ML-017-0.15-0.66	0.5 - 2.2	-	22,100	0.11	-	-	-
Channel	2014	BW14ML-017-0.66-0.91	2.2 - 3.0	-	33,100	0.29	-	-	-
Channel	2015	BW15ML-017D-0-0.15	0.0 - 0.5	-	6,420	0.031	-	-	1.56
Channel	2015	BW15ML-017D-0.15-0.75	0.5 - 2.5	-	11,900	0.074	-	-	-
Channel	2015	BW15ML-017D-0.75-1.0	2.5 - 3.3	-	11,500	0.037	-	-	-
Channel	2015	BW15ML-017D-1.15-1.20	3.8 - 3.9	-	-	0.34	-	0.0355 U	-
Channel	2014	BW14ML-018-0-0.15	0.0 - 0.5	-	68,800	0.36	-	-	6.97 J
Channel	2014	BW14ML-018-0.15-0.26	0.5 - 0.9	-	114,000	0.25	-	-	-
Channel	2014	BW14ML-018-0.26-0.51	0.9 - 1.7	-	109,000	0.061	-	-	-
Channel	2015	BW15ML-018D-0-0.15	0.0 - 0.5	-	41,400	0.14	-	-	-
Channel	2015	BW15ML-018D-0.15-0.75	0.5 - 2.5	-	96,800	0.24	-	-	-
Channel	2015	BW15ML-018D-0.75-1.0	2.5 - 3.3	-	85,900	0.064	-	-	-
Channel	2014	BW14ML-019-0-0.15	0.0 - 0.5	-	58,200	0.35	-	-	-
Channel	2014	BW14ML-019-0.15-0.29	0.5 - 1.0	-	70,200	0.14	-	-	-
Channel	2014	BW14ML-019-0.29-0.54	1.0 - 1.8	-	97,700	0.038 J	-	-	-
Channel	2014	BW14ML-020-0-0.15	0.0 - 0.5	-	110,000 J	0.02 J	-	-	0.72 J
Channel	2014	BW14ML-020-0.15-0.31	0.5 - 1.0	-	6,760	0.024 U	-	-	-
Channel	2014	BW14ML-020-0.31-0.56	1.0 - 1.8	-	2,360	0.021	-	-	-

Table 3. Analytical Results Summary

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Area	Investigation Year	Sample ID	Interval (ft bss)	Percent Moisture (%)	Total Organic Carbon (mg/kg)	Mercury (mg/kg)	Methyl Mercury (mg/kg)	Total PCB[a] (mg/kg)	Fish TEQ[b] (ng/kg)
			Level I SQT:	**-**	**-**	**0.18**	**-**	**0.060**	**0.85**
			Midpoint SQT:	**-**	**-**	**0.64**	**-**	**0.370**	**11.2**
			Level II SQT:	**-**	**-**	**1.1**	**-**	**0.680**	**21.5**
Channel	2014	BW14ML-021-0-0.15	0.0 - 0.5	-	1,930	0.027	-	-	-
Channel	2014	BW14ML-021-0.15-0.35	0.5 - 1.1	-	771	0.01 J	-	0.0209 U	-
Channel	2014	BW14ML-021-0.35-0.60	1.1 - 2.0	-	629	0.0071 J	-	-	-
Channel	2014	BW14ML-022-0-0.15	0.0 - 0.5	-	28,000	0.037	-	-	-
Channel	2014	BW14ML-022-0.15-0.37	0.5 - 1.2	-	28,900	0.052	-	-	2.08 J
Channel	2014	BW14ML-022-0.37-0.62	1.2 - 2.0	-	62,400	0.20	-	-	-
Channel	2014	BW14ML-023-Grab	0.0 - 0.5	-	153,000	0.23	-	-	-
Channel	2014	BW14ML-024-0-0.15	0.0 - 0.5	-	14,100	0.068 J	-	-	-
Channel	2014	BW14ML-024-0.15-0.30	0.5 - 1.0	-	14,200	0.021	-	-	0.46 J
Channel	2014	BW14ML-024-0.30-0.55	1.0 - 1.8	-	15,600	0.021 J	-	-	-
Channel	2014	BW14ML-025-0-0.15	0.0 - 0.5	-	77,000	0.2	-	-	-
Channel	2014	BW14ML-025-0.15-0.33	0.5 - 1.1	-	56,700	0.071	-	-	10.5 J
Channel	2014	BW14ML-025-0.33-0.58	1.1 - 1.9	-	42,100	0.087	-	-	-
Channel	2014	BW14ML-026-0-0.15	0.0 - 0.5	-	38,500	0.18	-	-	-
Channel	2014	BW14ML-026-0.15-0.24	0.5 - 0.8	-	30,100	0.18	-	0.0255 U	-
Channel	2014	BW14ML-026-0.24-0.49	0.8 - 1.6	-	20,500	0.026	-	-	-
Channel	2014	BW14ML-027-0-0.15	0.0 - 0.5	-	7,580	0.025	-	-	-
Channel	2014	BW14ML-027-0.15-0.21	0.5 - 0.7	-	27,600	0.058	-	-	-
Channel	2014	BW14ML-027-0.21-0.46	0.7 - 1.5	-	34,700	0.19	-	-	-
Channel	2014	BW14ML-028-0-0.15	0.0 - 0.5	-	38,400	0.19	-	-	-
Channel	2014	BW14ML-028-0.15-0.44	0.5 - 1.4	-	32,600	0.17	-	-	-
Channel	2014	BW14ML-028-0.44-0.69	1.4 - 2.3	-	14,700	0.0093 J	-	-	-
Channel	2014	BW14ML-029-0-0.15	0.0 - 0.5	-	148,000	0.27	-	-	-
Channel	2014	BW14ML-029-0.15-0.33	0.5 - 1.1	-	140,000	0.13	-	-	-
Channel	2014	BW14ML-029-0.33-0.58	1.1 - 1.9	-	140,000	0.10	-	-	-
Channel	2014	BW14ML-030-0-0.15	0.0 - 0.5	-	51,800	0.17	-	-	-
Channel	2014	BW14ML-030-0.15-0.23	0.5 - 0.8	-	45,200	0.20	-	-	-
Channel	2014	BW14ML-030-0.23-0.48	0.8 - 1.6	-	90,700	0.044	-	-	-
Channel	2014	BW14ML-031-0-0.15	0.0 - 0.5	-	133,000 J	0.27	-	-	-
Channel	2014	BW14ML-031-0.15-0.39	0.5 - 1.3	-	124,000 J	0.14	-	-	-
Channel	2014	BW14ML-032-0-0.15	0.0 - 0.5	-	39,900	0.5	-	-	-
Channel	2014	BW14ML-032-0.15-0.47	0.5 - 1.5	-	34,600	0.54	-	-	85.4 J
Channel	2014	BW14ML-032-0.47-0.72	1.5 - 2.4	-	16,100	0.017 J	-	-	-
Channel	2014	BW14ML-033-0-0.15	0.0 - 0.5	-	25,300	0.099	-	-	-
Channel	2014	BW14ML-033-0.15-0.47	0.5 - 1.5	-	22,600	0.032	-	-	-
Channel	2014	BW14ML-033-0.47-0.72	1.5 - 2.4	-	34,000	0.030	-	-	-
Channel	2014	BW14ML-034-0-0.15	0.0 - 0.5	-	32,800	0.2	-	0.0776	29.6 J
Channel	2014	BW14ML-034-0.15-0.37	0.5 - 1.2	-	21,800	0.046	-	-	-
Channel	2014	BW14ML-034-0.37-0.62	1.2 - 2.0	-	13,900	0.018 J	-	-	-
Channel	2014	BW14ML-035-Grab	0.0 - 0.5	-	234,000	0.077 J	-	-	-
Channel	2014	BW14ML-036-0-0.15	0.0 - 0.5	-	33,300	0.18	-	-	-
Channel	2014	BW14ML-036-0.15-0.42	0.5 - 1.4	-	41,900	0.51	-	-	12.7 J
Channel	2014	BW14ML-036-0.42-0.67	1.4 - 2.2	-	32,300	0.068	-	-	-
Channel	2014	BW14ML-037-0-0.15	0.0 - 0.5	-	44,200	0.19	-	-	-
Channel	2014	BW14ML-037-0.15-0.44	0.5 - 1.4	-	49,800	0.51	-	1.59	-
Channel	2014	BW14ML-037-0.44-0.69	1.4 - 2.3	-	19,100	0.081	-	-	-
Channel	2014	BW14ML-038-0-0.15	0.0 - 0.5	-	35,300	1.2	-	-	-
Channel	2014	BW14ML-038-0.15-0.38	0.5 - 1.2	-	62,400	6.3	-	12.6 J	-
Channel	2014	BW14ML-038-0.38-0.63	1.2 - 2.1	-	10,800 J	0.034	-	-	-
Channel	2015	BW15ML-038D-0-0.15	0.0 - 0.5	-	50,200	8.0	-	2.89	-
Channel	2015	BW15ML-038D-0.15-0.75	0.5 - 2.5	-	25,000	2.1	-	-	-
Channel	2015	BW15ML-038D-0.75-1.0	2.5 - 3.3	-	21,200	0.20	-	-	-

Table 3. Analytical Results Summary

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Area	Investigation Year	Sample ID	Interval (ft bss)	Percent Moisture (%)	Total Organic Carbon (mg/kg)	Mercury (mg/kg)	Methyl Mercury (mg/kg)	Total PCB[a] (mg/kg)	Fish TEQ[b] (ng/kg)
			Level I SQT:	**-**	**-**	**0.18**	**-**	**0.060**	**0.85**
			Midpoint SQT:	**-**	**-**	**0.64**	**-**	**0.370**	**11.2**
			Level II SQT:	**-**	**-**	**1.1**	**-**	**0.680**	**21.5**
Channel	2014	BW14ML-039-0-0.15	0.0 - 0.5	-	5,610	0.0067 J	-	-	-
Channel	2014	BW14ML-039-0.15-0.33	0.5 - 1.1	-	2,160	0.023 U	-	-	-
Channel	2014	BW14ML-039-0.33-0.58	1.1 - 1.9	-	8,150 J	0.024 U	-	-	-
Channel	2015	BW15ML-040-0-0.15	0.0 - 0.5	-	37,800	-	-	0.263	-
Channel	2015	BW15ML-040-0.15-0.24	0.5 - 0.8	-	23,000	-	-	-	6.00
Channel	2015	BW15ML-040D-0-0.15	0.0 - 0.5	-	34,200	0.054	-	0.301	-
Channel	2015	BW15ML-040D-0.15-0.40	0.5 - 1.3	-	22,900	0.047	-	-	5.85
Channel	2017	BW17ML-041-0.0-0.15	0.0 - 0.5	-	15,200	-	-	0.0352 U	-
Channel	2017	BW17ML-041-0.15-0.43	0.5 - 1.4	-	51,800	-	-	0.0339 U	-
Channel	2017	BW17ML-042-0.0-0.15	0.0 - 0.5	-	12,200	-	-	0.0221 U	-
Channel	2017	BW17ML-042-0.15-0.36	0.5 - 1.2	-	19,500	-	-	0.0218 U	-
Channel	2017	BW17ML-043-0.0-0.15	0.0 - 0.5	-	25,600	-	-	0.0269 U	5.16 J
Channel	2017	BW17ML-043-0.15-0.46	0.7 - 1.5	-	29,800	-	-	0.0243 U	53.1
Channel	2017	BW17ML-044-0.0-0.15	0.0 - 0.5	-	34,700	-	-	0.273	88.3
Channel	2017	BW17ML-044-0.15-0.45	0.5 - 1.5	-	24,300	-	-	0.0284 U	12.7
Channel	2017	BW17ML-045-0.0-0.15	0.0 - 0.5	-	52,900	-	-	-	292
Channel	2017	BW17ML-045-0.15-0.41	0.5 - 1.3	-	37,000	-	-	-	5.60
Channel	2017	BW17ML-046-0.0-0.15	0.0 - 0.5	-	56,300	-	-	0.0800	93.0
Channel	2017	BW17ML-046-0.15-0.31	0.5 - 1.0	-	50,200	-	-	0.0298 U	5.72
Channel	2017	BW17ML-047-0.0-0.15	0.0 - 0.5	-	41,700	-	-	0.0395 U	18.2 J
Channel	2017	BW17ML-047-0.15-0.36	0.5 - 1.2	-	40,900	-	-	0.956	118
Channel	2017	BW17ML-048-0.0-0.15	0.0 - 0.5	-	78,300	-	-	0.149	25.7
Channel	2017	BW17ML-048-0.15-0.26	0.5 - 0.9	-	28,700	-	-	0.0640	4.22 J
Channel	2017	BW17ML-049-0.0-0.15	0.0 - 0.5	-	42,300	-	-	0.320	21.9
Channel	2017	BW17ML-049-0.15-0.39	0.5 - 1.3	-	43,000	-	-	0.381	204
Channel	2017	BW17ML-050-0.0-0.15	0.0 - 0.5	-	32,600	-	-	0.126	65.0
Channel	2017	BW17ML-050-0.15-0.44	0.5 - 1.4	-	21,300	-	-	0.0287 U	-
Channel	2017	BW17ML-051-0.0-0.15	0.0 - 0.5	-	25,200	-	-	-	174
Channel	2017	BW17ML-051-0.15-0.36	0.5 - 1.2	-	19,800	-	-	-	46.8
Channel	2017	BW17ML-052-0.0-0.15	0.0 - 0.5	-	32,300	-	-	5.77	13.4
Channel	2017	BW17ML-052-0.15-0.44	0.5 - 1.4	-	19,500	-	-	0.207	5.52 J
Channel	2017	BW17ML-053-0.0-0.15	0.0 - 0.5	-	50,600	-	-	0.185	28.2
Channel	2017	BW17ML-053-0.15-0.39	0.5 - 1.3	-	50,700	-	-	0.343	71.8
Channel	2017	BW17ML-054-0.0-0.15	0.0 - 0.5	-	36,900	-	-	0.184	82.7
Channel	2017	BW17ML-054-0.15-0.40	0.5 - 1.3	-	16,800	-	-	0.0288 U	15.3
Channel	2017	BW17ML-055-0.0-0.15	0.0 - 0.5	-	35,800	-	-	0.117	41.1
Channel	2017	BW17ML-055-0.15-0.40	0.5 - 1.3	-	49,500	-	-	0.0328 U	75.2
Channel	2017	BW17ML-056-0.0-0.15	0.0 - 0.5	-	23,900	-	-	0.0769	18.6
Channel	2017	BW17ML-056-0.15-0.34	0.5 - 1.1	-	20,500	-	-	0.0818	53.4
Channel	2017	BW17ML-057-0.0-0.15	0.0 - 0.5	-	54,100	-	-	0.0456 U	-
Channel	2017	BW17ML-057-0.15-0.38	0.5 - 1.2	-	43,400	-	-	0.101	-
Wetland	2017	BW17ML-058-0.0-0.15	0.0 - 0.5	-	36,100	-	-	0.226	16.7
Wetland	2017	BW17ML-058-0.15-0.45	0.5 - 1.5	-	85,100	-	-	0.224	17.5
Channel	2017	BW17ML-059-0.0-0.15	0.0 - 0.5	-	32,300	-	-	0.0335 U	-
Channel	2017	BW17ML-060-0.0-0.15	0.0 - 0.5	-	16,300	-	-	0.0406 U	20.1
Channel	2017	BW17ML-060-0.15-0.41	0.5 - 1.3	-	54,400	-	-	0.187	-
Wetland	2017	BW17ML-061-0.0-0.15	0.0 - 0.5	-	101,000	-	-	0.502	31.7
Wetland	2017	BW17ML-061-0.15-0.39	0.5 - 1.3	-	83,800	-	-	0.142	24.7
Channel	2017	BW17ML-062-0.0-0.15	0.0 - 0.5	-	118,000	-	-	-	31.0
Channel	2017	BW17ML-063-0.0-0.15	0.0 - 0.5	-	34,200	-	-	0.0505 U	26.1
Channel	2017	BW17ML-063-0.15-0.42	0.5 - 1.4	-	14,600	-	-	0.0228 U	-

Table 3. Analytical Results Summary

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Area	Investigation Year	Sample ID	Interval (ft bss)	Percent Moisture (%)	Total Organic Carbon (mg/kg)	Mercury (mg/kg)	Methyl Mercury (mg/kg)	Total PCB[a] (mg/kg)	Fish TEQ[b] (ng/kg)
			Level I SQT:	**-**	**-**	**0.18**	**-**	**0.060**	**0.85**
			Midpoint SQT:	**-**	**-**	**0.64**	**-**	**0.370**	**11.2**
			Level II SQT:	**-**	**-**	**1.1**	**-**	**0.680**	**21.5**
Channel	2017	BW17ML-064-0.0-0.15	0.0 - 0.5	-	32,400	-	-	0.0423 U	-
Channel	2017	BW17ML-064-0.15-0.38	0.5 - 1.2	-	24,600	-	-	0.0919	-
Channel	2017	BW17ML-065-0.0-0.15	0.0 - 0.5	-	119,000	-	-	0.161	-
Channel	2017	BW17ML-065-0.15-0.50	0.5 - 1.6	-	189,000	-	-	0.217	-
Channel	2017	BW17ML-066-0.0-0.15	0.0 - 0.5	-	24,100	-	-	0.0430 U	-
Channel	2017	BW17ML-066-0.15-0.32	0.5 - 1.0	-	33,000	-	-	0.0306 U	-
Channel	2017	BW17ML-067-0.0-0.10	0.0 - 0.3	-	19,300	-	-	0.0295 U	-
Channel	2017	BW17ML-067-0.15-0.39	0.5 - 1.3	-	29,000	-	-	0.0244 U	-

Notes:

Yellow highlighting inindicates the result value is greater than or equal to the Level I SQT[c].

Orange highlighting inindicates the result value is greater than or equal to the midpoint SQT[d].

Light red highlighting inindicates the result value is greater than or equal to the Level II SQT[c].

[a]Total PCBs were calculated by summing the detected results for PCB Aroclors. If all Aroclors were reported as nondetect, one-half of the highest individual quantitation limit was used and qualified "U" as nondetect.

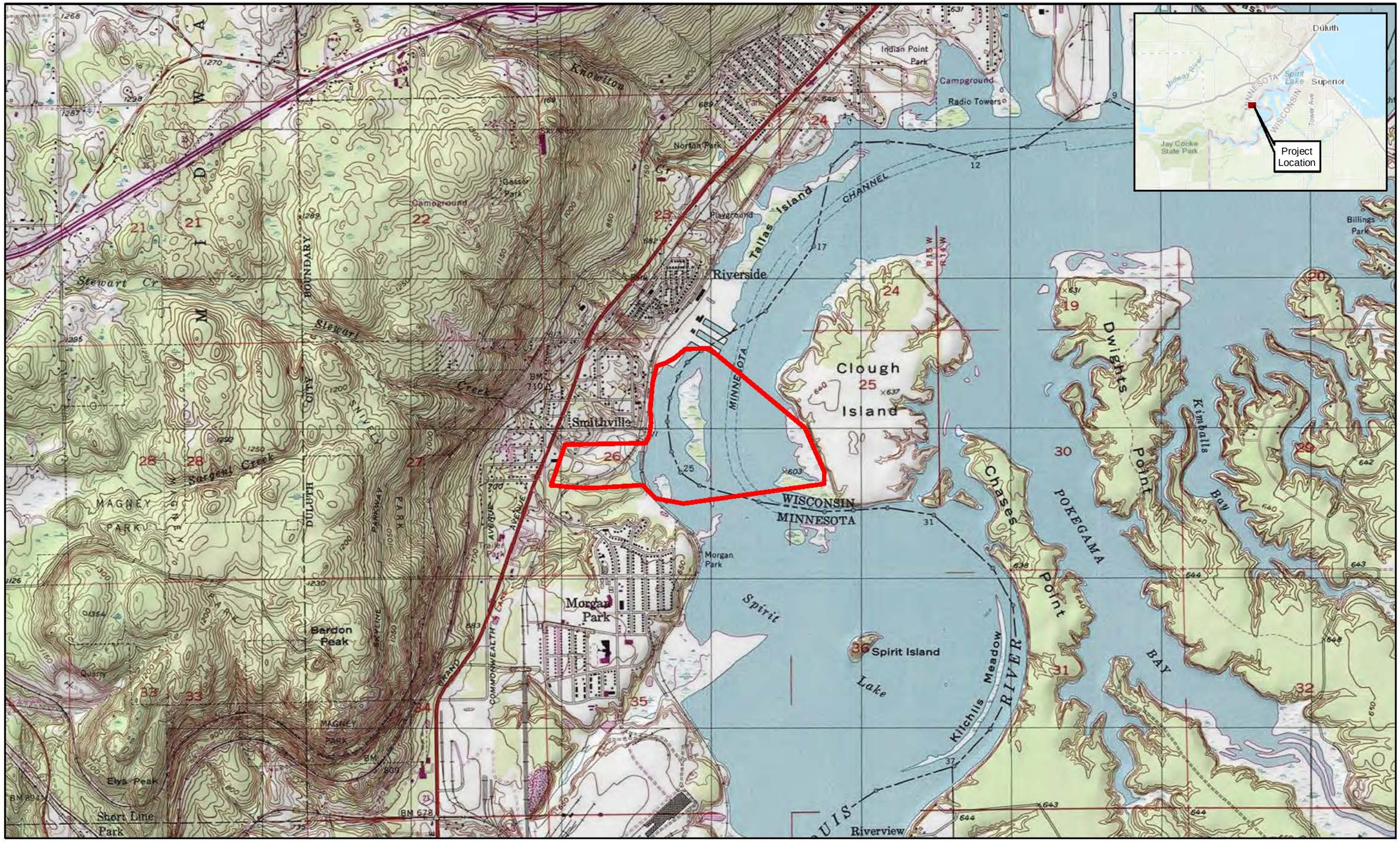
[b]Dioxin and furan toxicity equivalency (TEQ) values for fish were calculated using the EPA Advanced Kaplan Meier TEQ Calculator using the 1998 toxic equivalency factors (Van den Berg et al. 1998). When fewer than 3 individual congeners were reported as detected, the Kaplan Meier approach couldn't be used due to insufficient data. In these cases, one-half of the detection limit was used to calculate the TEQ value. TEQ results for samples with only 1 or 2 detected congeners are qualified “J” and samples with no detectable congeners were qualified “UJ”.

[c]Guidance for the Use and Application of Sediment Quality Targets for the Protection of Sediment-Dwelling Organisms in Minnesota (MPCA 2007).

[d]Midpoint between the Level I and Level II SQT, equal to the cleanup levels presented in the Munger Landing FFS (Bay West 2018).

PCB = polychlorinated biphenyl; TEQ = toxicity equivalence; ft = feet; bss = below sediment surface; % = percent; mg/kg = milligrams per kilogram; ng/kg = nanogram per kilogram; SQT = sediment quality target; - = parameter not analyzed; J = Estimated; R = Rejected; U = Nondetect; UJ = Estimated nondetect; * = Indicates one-half of the detection limit was used to calculate the TEQ value.

Figures



Legend

Munger Landing Site

Base Map Source:
USGS 7.5-minute Topographic Quadrangle:
West Duluth (published 1983)

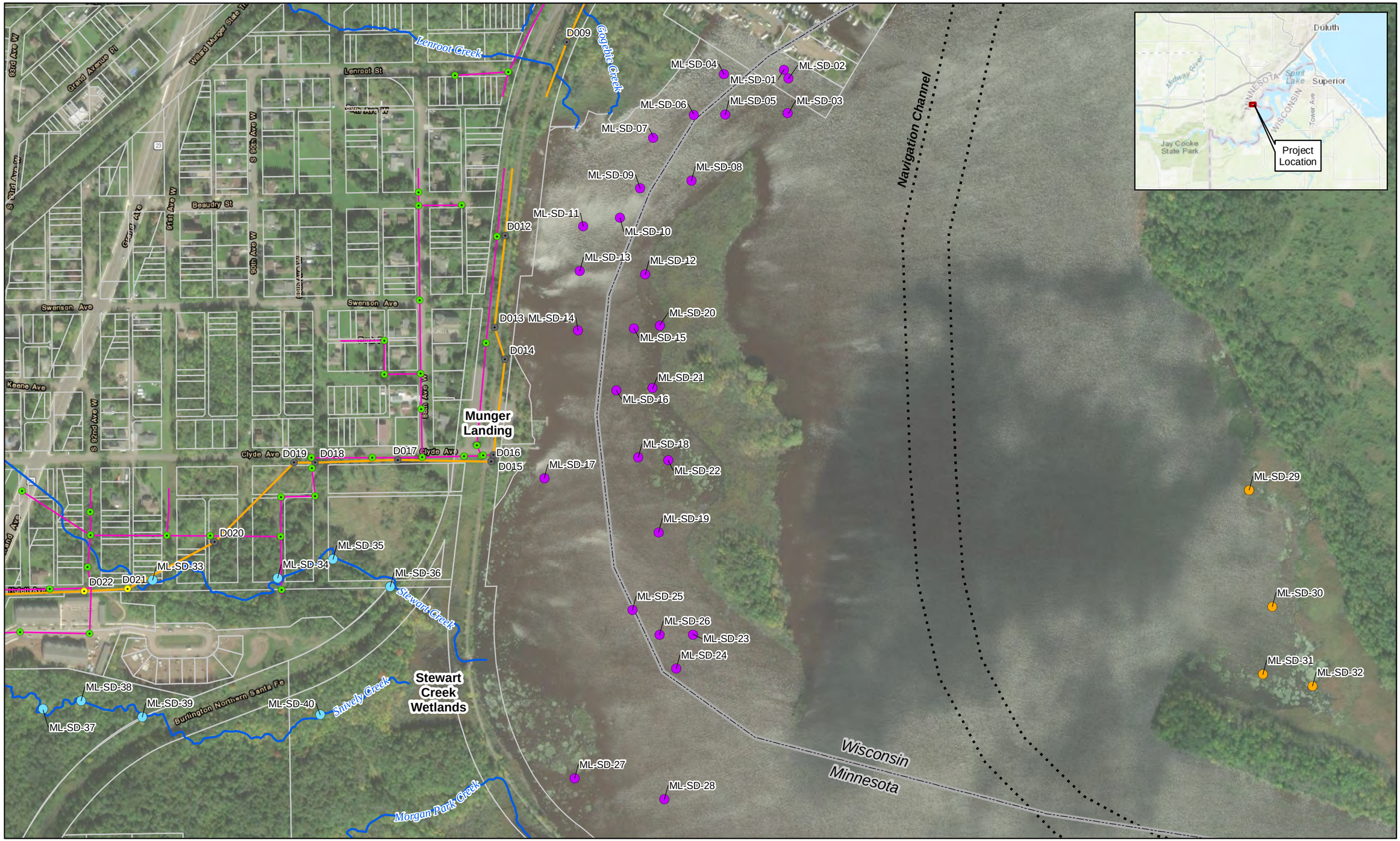
0 610 1,220
Meters

0 2,000 4,000
Feet

N

Figure 1
Project Location
Munger Landing Sediment Characterization
Minnesota and Wisconsin

ch2m:



Legend

As-Collected Sample Locations
- Manual Core Location
- Ponar Grab
- Vibracore Location

- City Manhole
- City Sewer

WLSSD Manholes
- Drop
- Standard

WLSSD Collection System
- Gravity

- Creek
- State Boundary
- Navigation Channel
- Parcel Boundary

Note:
WLSSD = Western Lake Superior Sanitary District

N

0 400 800
Feet

Figure **2**
2018 **Sediment** Sample Locations
Munger Landing Sediment Characterization
Minnesota and Wisconsin

ch2m:

R:\ENBG\00_PROJ\E\EPA\MUNGERLANDING\MAPFILES\FIGURE_2_2018_SAMPLE_LOCATIONS.MXD AESPEJO

Notes:
1. 2017 DigitalGlobe Imagery Basemap.
2. All values are reported in milligrams per kilogram (mg/kg).
   - Result value is below the Level I SQT[a] (0.18 mg/kg).
   - Result value exceeds the Level I SQT[a] (0.18 mg/kg).
   - Result value exceeds the midpoint SQT[b] (0.64 mg/kg).
   - Result value exceeds the Level II SQT[a] (1.1 mg/kg).
3. Mercury concentrations are shown below the location identifier for locations with midpoint or Level II SQT exceedances.

[a]Guidance for the Use and Application of Sediment Quality Targets (SQT) for the Protection of Sediment-Dwelling Organisms in Minnesota (MPCA 2007).
[b]The midpoint between the Level I and Level II SQT is equal to the cleanup levels presented in the Munger Landing Focused Feasibility Study (Bay West 2018).

N

0 225 450
Feet

Figure 3
Mercury Concentrations in Surface Sediment
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

ch2m

R:\ENBG\00_PROJ\E\EPA\MUNGERLANDING\MAPFILES\ANALYTICAL\FIGURE_3_SAMPLE_RESULTS_HG_SURFACE.MXD AESPEJO 7/30/2019

Notes:

1. 2017 DigitalGlobe Imagery Basemap.
2. Sample interval reported in feet below sediment surface (e.g., 0.0-0.1).
3. All values are reported in milligrams per kilogram (mg/kg).
4. Mercury concentrations are shown below the location identifier for locations with midpoint or Level II SQT exceedances.

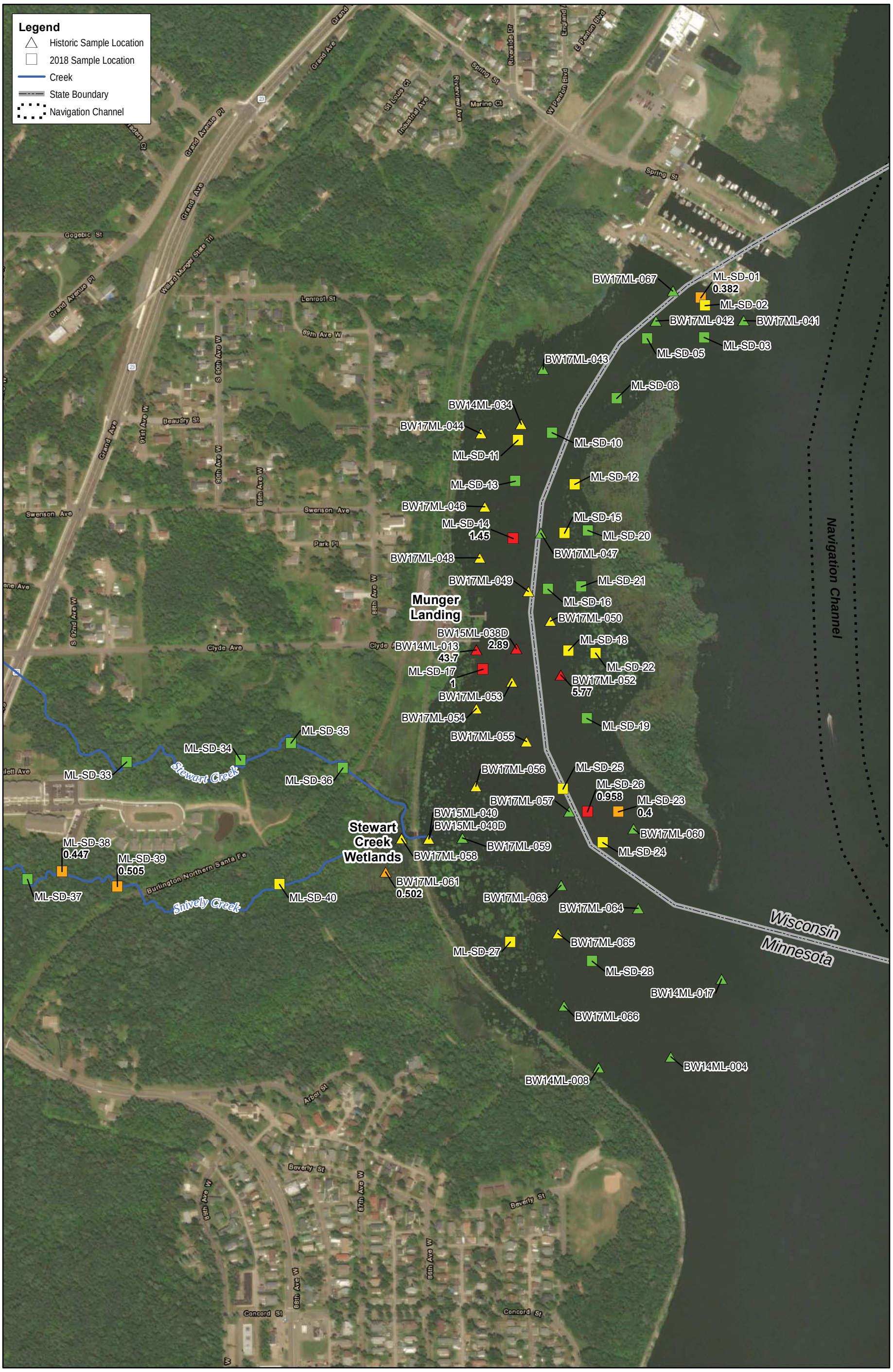
- Result value is below the Level I SQT[a] (0.18 mg/kg).
- Result value exceeds the Level I SQT[a] (0.18 mg/kg).
- Result value exceeds the midpoint SQT[b] (0.64 mg/kg).
- Result value exceeds the Level II SQT[a] (1.1 mg/kg).

[a]Guidance for the Use and Application of Sediment Quality Targets (SQT) for the Protection of Sediment-Dwelling Organisms in Minnesota (MPCA 2007).
[b]The midpoint between the Level I and Level II SQT is equal to the cleanup levels presented in the Munger Landing Focused Feasibility Study (Bay West 2018).

Figure 4
Maximum Mercury Concentrations in Sediment
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

ch2m:

R:\ENBG\00_PROJ\E\EPA\MUNGERLANDING\MAPFILES\ANALYTICAL\FIGURE_4_MAX_HG_SEDIMENT.MXD AESPEJO 7/30/2019

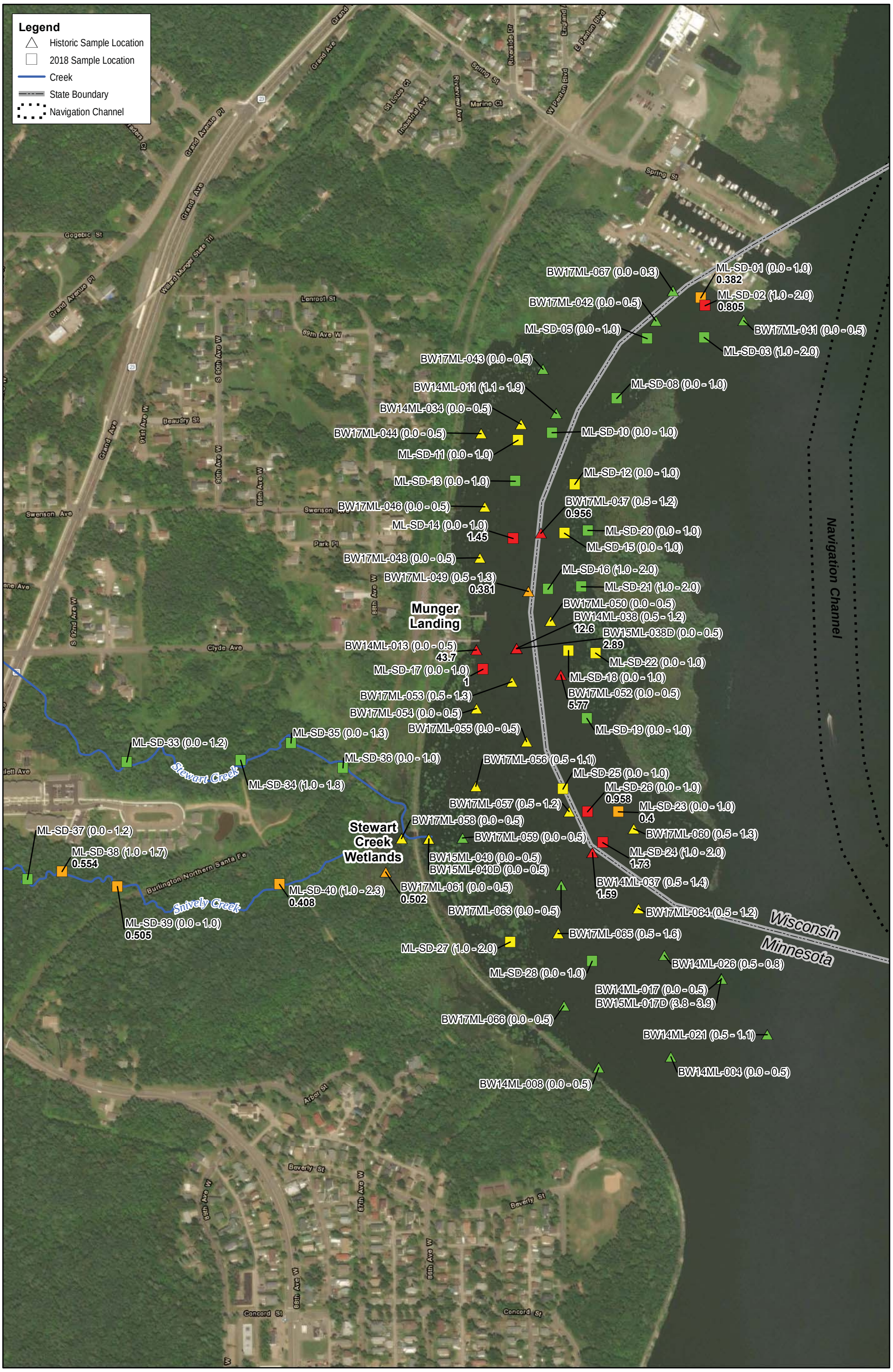


Notes:
1. 2017 DigitalGlobe Imagery Basemap.
2. All values are reported in milligrams per kilogram (mg/kg).
   - Result value is below the Level I SQT[a] (0.060 mg/kg).
   - Result value exceeds the Level I SQT[a] (0.060 mg/kg).
   - Result value exceeds the midpoint SQT[b] (0.370 mg/kg).
   - Result value exceeds the Level II SQT[a] (0.680 mg/kg).
3. Total PCB concentrations are shown below the location identifier for locations with midpoint or Level II SQT exceedances.

[a]Guidance for the Use and Application of Sediment Quality Targets (SQT) for the Protection of Sediment-Dwelling Organisms in Minnesota (MPCA 2007).
[b]The midpoint between the Level I and Level II SQT is equal to the cleanup levels presented in the Munger Landing Focused Feasibility Study (Bay West 2018).

Figure 5
Total PCB Concentrations in Surface Sediment
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

ch2m



Notes:

1. 2017 DigitalGlobe Imagery Basemap.
2. Sample interval reported in feet below sediment surface (e.g., 0.0-0.1).
3. All values are reported in milligrams per kilogram (mg/kg).
4. Total PCB concentrations are shown below the location identifier for locations with midpoint or Level II SQT exceedances.

- Result value is below the Level I SQT[a] (0.060 mg/kg).
- Result value exceeds the Level I SQT[a] (0.060 mg/kg).
- Result value exceeds the midpoint SQT[b] (0.370 mg/kg).
- Result value exceeds the Level II SQT[a] (0.680 mg/kg).

[a]Guidance for the Use and Application of Sediment Quality Targets (SQT) for the Protection of Sediment-Dwelling Organisms in Minnesota (MPCA 2007).
[b]The midpoint between the Level I and Level II SQT is equal to the cleanup levels presented in the Munger Landing Focused Feasibility Study (Bay West 2018).

N

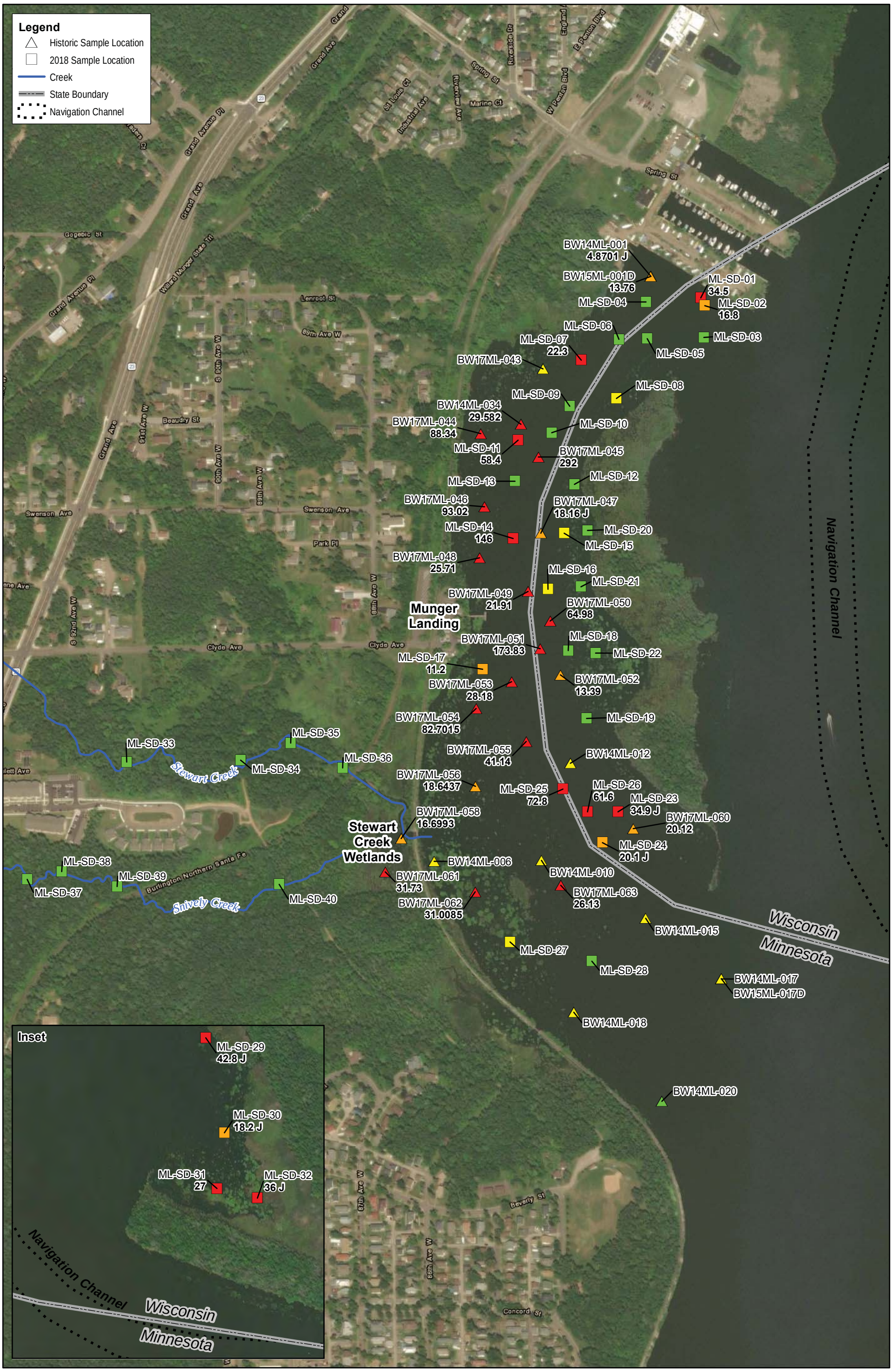
0 225 450

Feet

Figure 6
Maximum Total PCB Concentrations in Sediment
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

ch2m

R:\ENBG\00_PROJ\E\EPA\MUNGERLANDING\MAPFILES\ANALYTICAL\FIGURE_6_MAX_PCB_SEDIMENT.MXD AESPEJO 7/30/2019



Notes:
1. 2017 DigitalGlobe Imagery Basemap.
2. All values are reported in nanograms per kilogram (mg/kg).
   - Result value is below the Level I SQT[a] (0.85 ng/kg).
   - Result value exceeds the Level I SQT[a] (0.85 ng/kg).
   - Result value exceeds the midpoint SQT[b] (11.2 ng/kg).
   - Result value exceeds the Level II SQT[a] (21.5 ng/kg).
3. Fish toxicity equivalence values are shown below the location identifier for locations with midpoint or Level II SQT exceedances.

[a]Guidance for the Use and Application of Sediment Quality Targets (SQT) for the Protection of Sediment-Dwelling Organisms in Minnesota (MPCA 2007).
[b]The midpoint between the Level I and Level II SQT is equal to the cleanup levels presented in the Munger Landing Focused Feasibility Study (Bay West 2018).

Figure 7
Fish Toxicity Equivalence in Surface Sediment
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

ch2m

R:\ENBG\00_PROJ\E\EPA\MUNGERLANDING\MAPFILES\ANALYTICAL\FIGURE_7_SAMPLE_RESULTS_FISH_TEQ_SURFACE.MXD AESPEJO 7/30/2019

Notes:
1. 2017 DigitalGlobe Imagery Basemap.
2. Sample interval reported in feet below sediment surface (e.g., 0.0-0.1).
3. All values are reported in nanograms per kilogram (ng/kg).
4. Fish toxicity equivalence values are shown below the location identifier for locations with midpoint or Level II SQT exceedances.

- Result value is below the Level I SQT[a] (0.85 ng/kg).
- Result value exceeds the Level I SQT[a] (0.85 ng/kg).
- Result value exceeds the midpoint SQT[b] (11.2 ng/kg).
- Result value exceeds the Level II SQT[a] (21.5 ng/kg).

[a]Guidance for the Use and Application of Sediment Quality Targets (SQT) for the Protection of Sediment-Dwelling Organisms in Minnesota (MPCA 2007).
[b]The midpoint between the Level I and Level II SQT is equal to the cleanup levels presented in the Munger Landing Focused Feasibility Study (Bay West 2018).

N
0 225 450
Feet

Figure 8
Maximum Fish Toxicity Equivalence in Sediment
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin

ch2m

R:\ENBG\00_PROJ\E\EPA\MUNGERLANDING\MAPFILES\ANALYTICAL\FIGURE_8_MAX_FISH_TEQ_SEDIMENT.MXD AESPEJO 7/30/2019

Appendix A
Data Usability Report

Data Usability Memorandum
Munger Landing Sediment Characterization
St. Louis River AOC, Minnesota and Wisconsin
Task Order No. 68HE0518F0693, Contract No. EP-R5-11-09

PREPARED FOR:	U.S. Environmental Protection Agency - Great Lakes National Program Office
PREPARED BY:	CH2M HILL
DATE:	May 30, 2019
PROJECT NUMBER:	EG1693SC

This data usability memorandum presents the quality assessment of the data collected during the sediment characterization of the Munger Landing site within the St. Louis River Area of Concern (AOC) in Minnesota and Wisconsin. The primary objective for the sediment characterization was to obtain the data necessary to fill gaps and identify areas that may require further investigation or remedial action, if either Snively Creek or Stewart Creek may be ongoing contaminant sources to the Munger Landing sediments. CH2M HILL, Inc. (CH2M) performed the investigation for the U.S. Environmental Protection Agency (EPA) Great Lakes National Program Office (GLNPO) in accordance with Task Order No. 68HE0518F0693, Contract No. EP-R5-11-09.

Sediment sampling occurred on October 14 through October 20, 2018. Due to an expedited project schedule, the fieldwork was performed based on the draft Data Quality Objectives quality assurance plan (DQO; CH2M 2018a) and health and safety plan (HASP; CH2M 2018b). Prior to field activities, the draft DQO was conditionally approved by EPA GLNPO on October 11, 2018. Following field activities, the field sampling and quality assurance project plan (FSP-QAPP; CH2M 2019) was submitted to EPA GLNPO. All work was performed in accordance with the following site-specific plans prepared and approved by EPA:

- CH2M HILL (CH2M). 2018a. *Draft Data Quality Objectives, Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin Site Characterization*. October.
- CH2M HILL (CH2M). 2018b. *Health and Safety Plan, Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin.* October.
- CH2M HILL (CH2M). 2019. *Field Sampling and Quality Assurance Project Plan, Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin Site Characterization.* May.

Field and analytical results were evaluated using the criteria of precision, accuracy, representativeness, comparability, and completeness. Sample collection methods, processing and analytical methods, general field observations, and the analytical data will be summarized in a site characterization report submitted separately.

Field Data

The following subsections summarize field data collected during the sampling activities. Deviations from the sampling program and potential impacts on the usability of the data and decision making are also discussed.

Survey Data

The survey activities were performed following the procedures outlined in the DQOs and FSP-QAPP (CH2M 2018a and 2019):

- Manual sediment cores and ponar sample locations were surveyed by CH2M using a differential Global Positioning System (GPS) receiver capable of submeter accuracy. Vibracore sediment sample location coordinates were surveyed by the EPA's Research Vessel (R/V) Mudpuppy II using differential GPS receivers capable of submeter accuracy.
- Sampling locations were referenced horizontally using latitude and longitude coordinates in decimal degree format, North American Datum of 1983 coordinate system. The completed GPS data checklists are provided in **Attachment 1**.
- Sediment surface elevations are reported in International Great Lakes Datum 1985 US Survey feet. Sediment surface elevation data are not available in Snively and Stewart Creek, this will not adversely affect the data usability.
- Water elevation data were documented at the time of core or Ponar collection for each location from the National Oceanic and Atmospheric Administration gauge station #9099064 or U.S. Geological Survey gauge station 464646092052900, Superior Bay Duluth Ship Canal at Duluth, Minnesota.
- Water depth measurements were collected before sediment coring to the nearest 0.1 foot at each location using a surveyor's rod outfitted with a 6-inch-diameter plate or a surveyor's tape outfitted with a sounding disc per U.S. Army Corps of Engineers guidance (2013).

Sediment Sampling

Sediment cores or Ponar grab samples were collected from a total of 40 locations. CH2M used manual coring methods at 8 locations from Snively Creek and Stewart Creek, Cetacean Marine staff aboard the EPA's R/V Mudpuppy II collected vibracore samples from 28 locations, and CH2M accompanied by Wisconsin Department of Natural Resource staff used a petite Ponar sampler to collect samples from four locations along Clough Island.

Pocket penetrometer and Torvane shear-strength measurements were not collected during sediment core processing because significant cohesive material was not recovered in any of the cores. This will not adversely affect the data usability.

Deviations

The following summarizes minor deviations associated with sample locations, sample processing, and sample analysis.

- Vibracore locations SD-27 and SD-28 were offset 130 feet to the northwest and 47 feet southeast of the proposed location, respectively, due to physical obstructions that included research fishnets and anchors.
- Dioxin and furan congeners and total PCBs composite samples were collected from sediment waste material and submitted for analysis.
- A subset of field duplicates for TOC analysis were inadvertently not collected at a frequency of 10 percent.

Analytical Laboratory Data

Samples were collected and shipped to Pace Analytical laboratories for analysis. Pace Analytical in Green Bay, Wisconsin was used as the primary lab for this project. Pace Analytical methods and corresponding laboratory assignments are presented in **Table 1**.

Table 1. Analytical Method and Laboratory Information

Analyte Class	Matrix	Method Citations	Laboratory Assignment
Mercury	Sediment	SW-846 7471B	Pace Analytical, Green Bay, WI
Methyl Mercury	Sediment	EPA 1630	Pace Analytical, Duluth, MN
PCB Aroclors	Sediment	SW-846 3541/8082	Pace Analytical, Green Bay, WI
TOC	Sediment	Lloyd Kahn	Pace Analytical, Green Bay, WI
Dioxin/Furan Congeners	Sediment	EPA 1613B	Pace Analytical, Minneapolis, MN

Two hundred and forty-two sediment samples and 24 field duplicate samples were collected from 40 locations. Seventy-one sediment samples and 7 field duplicate samples from the upper sediment intervals were submitted to the laboratory for analysis and the remaining 171 samples and 17 field duplicates collected from the lower intervals were placed on hold for pending analysis by the laboratory. Upon review of the laboratory's preliminary data by EPA, Minnesota Pollution Control Agency, and the Wisconsin Department of Natural Resources, 15 samples and 2 field duplicates originally placed on hold were selected for laboratory analysis, resulting in 86 samples and 9 field duplicates analyzed. The number of samples collected from each location and analyses performed are presented in **Table 2**.

QA/QC sediment samples were collected as described in the FSP-QAPP (CH2M 2019) except for TOC, where field duplicate samples were inadvertently not collected at the 10 percent frequency. QA/QC samples included field duplicates, matrix spikes/matrix spike duplicates, and two equipment blank samples. The equipment blank samples were collected by pouring deionized water over decontaminated sampling equipment, including the Ponar sampler (ML-EB-002-10182018) and stainless-steel spoon (ML-EB-001-10182018) used to homogenize the sediment samples.

One solid waste sample was collected and analyzed for waste characterization parameters as well as total PCBs and dioxin/furan congeners. The results of the sample were used to characterize the IDW for disposal. The waste data were not validated and are not included in this memorandum.

In addition to the samples collected in the field, EPA's Quality Assurance Technical Support (QATS) contractor, APTIM Federal Services, LLC (APTIM), submitted three performance evaluation samples (PES) to Pace Analytical laboratory. Each performance evaluation sample was designated for one of the following analyses: PCB Aroclors, dioxin/furan congeners, or mercury.

Upon receipt at the laboratory, the samples were logged and batched into sample delivery groups (SDGs). The SDGs and sample identifications (IDs) of analyzed samples are presented in **Table 3**.

Table 2. Analytical Summary for Sediment Core and QA/QC Samples

	Number of Samples Analyzed					Number of Samples Placed on Hold[a]				
Location Identification	PCB Aroclors	Dioxin/Furan	Mercury	Methyl Mercury	TOC	PCB Aroclors	Dioxin/Furan	Mercury	Methyl Mercury	TOC
ML-SD-01	3	3	2	2	3	5	5	6	-	5

Table 2. Analytical Summary for Sediment Core and QA/QC Samples

	Number of Samples Analyzed					Number of Samples Placed on Hold[a]				
Location Identification	PCB Aroclors	Dioxin/Furan	Mercury	Methyl Mercury	TOC	PCB Aroclors	Dioxin/Furan	Mercury	Methyl Mercury	TOC
ML-SD-02	5	5	5	2	5	-	-	-	-	-
ML-SD-03	2	2	2	2	2	8	8	8	-	8
ML-SD-04	-	2	-	-	2	-	7	-	-	7
ML-SD-05	2	2	-	-	2	5	5	-	-	5
ML-SD-06	-	2	-	-	2	-	5	-	-	5
ML-SD-07	-	2	2	-	2	-	7	7	-	7
ML-SD-08	2	2	2	2	2	5	5	5	-	5
ML-SD-09	-	2	2	-	2	-	3	3	-	3
ML-SD-10	2	2	2	-	2	7	7	7	-	7
ML-SD-11	2	2	2	-	2	4	4	4	-	4
ML-SD-12	2	2	2	2	2	8	8	8	-	8
ML-SD-13	2	2	-	-	2	3	3	-	-	3
ML-SD-14	3	3	-	-	3	6	6	-	-	6
ML-SD-15	2	2	-	-	2	7	7	-	-	7
ML-SD-16	3	2	2	2	3	7	8	8	-	7
ML-SD-17	2	2	-	-	2	1	1	-	-	1
ML-SD-18	2	2	2	2	2	7	7	7	-	7
ML-SD-19	2	2	2	2	2	8	8	8	-	8
ML-SD-20	2	2	-	-	2	8	8	-	-	8
ML-SD-21	2	2	2	2	2	8	8	8	-	8
ML-SD-22	2	2	2	2	2	7	7	7	-	7
ML-SD-23	4	4	-	-	4	6	6	-	-	6
ML-SD-24	4	4	-	-	4	5	5	-	-	5
ML-SD-25	2	2	-	-	2	6	6	-	-	6
ML-SD-26	4	4	-	-	4	6	6	-	-	6
ML-SD-27	4	1	-	-	4	-	3	-	-	-
ML-SD-28	1	1	-	-	1	7	7	-	-	7
ML-SD-29	-	1	-	-	1	-	-	-	-	-
ML-SD-30	-	1	-	-	1	-	-	-	-	-
ML-SD-31	-	1	-	-	1	-	-	-	-	-
ML-SD-32	-	1	-	-	1	-	-	-	-	-
ML-SD-33	1	1	1	-	1	-	-	-	-	-

Table 2. Analytical Summary for Sediment Core and QA/QC Samples

	Number of Samples Analyzed					Number of Samples Placed on Hold[a]				
Location Identification	**PCB Aroclors**	**Dioxin/Furan**	**Mercury**	**Methyl Mercury**	**TOC**	**PCB Aroclors**	**Dioxin/Furan**	**Mercury**	**Methyl Mercury**	**TOC**
ML-SD-34	2	2	2	-	2	-	-	-	-	-
ML-SD-35	1	1	1	-	1	-	-	-	-	-
ML-SD-36	2	2	2	-	2	-	-	-	-	-
ML-SD-37	1	1	1	-	1	-	-	-	-	-
ML-SD-38	2	2	2	-	2	-	-	-	-	-
ML-SD-39	2	2	2	-	2	-	-	-	-	-
ML-SD-40	2	2	2	-	2	-	-	-	-	-
Native Sample Count[b]	**74**	**82**	**44**	**20**	**86**	**134**	**160**	**86**	**0**	**156**
QA/QC Samples										
FD	*9*	*9*	*4*	*2*	*3*	*13*	*15*	*9*	-	-
MS/MSD	*4*	*4*	*2*	*1*	-	*8*	*10*	*6*	-	-
EB	*2*	*2*	*2*	*2*	-	-	-	-	-	-
PES	*1*	*1*	*1*	-	-	-	-	-	-	-

[a] Samples were placed on hold at the laboratory and were not analyzed.
[b] Sample count excludes QA/QC samples.
EB = equipment blank; FD = field duplicate; MS/MSD = matrix spike and matrix spike duplicate; PES = performance evaluation sample

Table 3. Analyzed Sample Identification Summary

Sample ID	Analytical SDG No.[a]	Dioxin SDG No.	Methyl Mercury SDG No.	Sample ID	Analytical SDG No.[a]	Dioxin SDG No.	Methyl Mercury SDG No.
ML-SD-01-0.0/1.0	40177757	40177781	40177782	ML-SD-20-1.0/2.0	40177941	40177939	-
ML-SD-01-0.0/1.0-FD	40177757	40177781	40177782	ML-SD-21-0.0/1.0	40177941	40177939	40177918
ML-SD-01-1.0/2.0	40177757	40177781	40177782	ML-SD-21-1.0/2.0	40177941	40177939	40177918
ML-SD-01-2.0/3.0	40179190	40179190	-	ML-SD-22-0.0/1.0	40178112	40177992	-
ML-SD-02-0.0/1.0	40177757	40177781	40177782	ML-SD-22-1.0/2.0	40178112	40177992	-
ML-SD-02-1.0/2.0	40177757	40177781	40177782	ML-SD-23-0.0/1.0	40179190	40179190	-
ML-SD-02-2.0/3.0	40179190	40179190	-	ML-SD-23-1.0/2.0	40179190	40179190	-
ML-SD-02-3.0/4.0	40179190	40179190	-	ML-SD-23-2.0/3.0	40179190	40179190	-
ML-SD-02-4.0/4.7	40179190	40179190	-	ML-SD-23-2.0/3.0-FD	40178112	40177992	-
ML-SD-03-0.0/1.0	40177823	40177827	40177822	ML-SD-23-3.0/4.0	40179190	40179190	-
ML-SD-03-1.0/2.0	40177823	40177827	40177822	ML-SD-24-0.0/1.0	40178112	40177992	-
ML-SD-04-0.0/1.0	40177823	40177827	-	ML-SD-24-1.0/2.0	40178112	40177992	-
ML-SD-04-1.0/2.0	40177823	40177827	-	ML-SD-24-2.0/3.0	40179190	40179190	-

Table 3. Analyzed Sample Identification Summary

Sample ID	Analytical SDG No.[a]	Dioxin SDG No.	Methyl Mercury SDG No.	Sample ID	Analytical SDG No.[a]	Dioxin SDG No.	Methyl Mercury SDG No.
ML-SD-05-0.0/1.0	40177757	40177781	-	ML-SD-24-2.0/3.0-FD	40179190	40179190	-
ML-SD-05-0.0/1.0-FD	40177757	40177781	-	ML-SD-24-3.0/4.0	40179190	40179190	-
ML-SD-05-1.0/2.0	40177757	40177781	-	ML-SD-25-0.0/1.0	40178112	40177992	-
ML-SD-06-0.0/1.0	40177823	40177827	-	ML-SD-25-1.0/2.0	40178112	40177992	-
ML-SD-06-1.0/2.0	40177823	40177827	-	ML-SD-26-0.0/1.0	40178112	40177992	-
ML-SD-07-0.0/1.0	40177823	40177827	-	ML-SD-26-1.0/2.0	40178112	40177992	-
ML-SD-07-1.0/2.0	40177823	40177827	-	ML-SD-26-1.0/2.0-FD	40178112	40177992	-
ML-SD-08-0.0/1.0	40177823	40177827	40177822	ML-SD-26-2.0/3.0	40179190	40179190	-
ML-SD-08-1.0/2.0	40177823	40177827	40177822	ML-SD-26-3.0/4.0	40179190	40179190	-
ML-SD-09-0.0/1.0	40177823	40177827	-	ML-SD-27-0.0/1.0	40177941	40177939	-
ML-SD-09-1.0/2.0	40177823	40177827	-	ML-SD-27-1.0/2.0	40179190	-	-
ML-SD-10-0.0/1.0	40177823	40177827	-	ML-SD-27-2.0/3.0	40179190	-	-
ML-SD-10-0.0/1.0-FD	40177823	40177827	-	ML-SD-27-3.0/3.7	40179190	-	-
ML-SD-10-1.0/2.0	40177823	40177827	-	ML-SD-28-0.0/1.0	40178112	40177992	-
ML-SD-11-0.0/1.0	40177823	40177827	-	ML-SD-29-0.0/0.25	40177757	40177781	-
ML-SD-11-1.0/2.0	40177823	40177827	-	ML-SD-30-0.0/0.25	40177757	40177781	-
ML-SD-12-0.0/1.0	40177941	40177939	40177918	ML-SD-31-0.0/0.25	40177757	40177781	-
ML-SD-12-1.0/2.0	40177941	40177939	40177918	ML-SD-32-0.0/0.25	40177757	40177781	-
ML-SD-13-0.0/1.0	40177823	40177827	-	ML-SD-33-0.0/1.2	40178112	40177992	-
ML-SD-13-0.0/1.0-FD	40177823	40177827	-	ML-SD-34-0.0/1.0	40178112	40177992	-
ML-SD-13-1.0/2.0	40177823	40177827	-	ML-SD-34-0.0/1.0-FD	40178112	40177992	-
ML-SD-14-0.0/1.0	40177941	40177939	-	ML-SD-34-1.0/1.8	40178112	40177992	-
ML-SD-14-1.0/2.0	40177941	40177939	-	ML-SD-35-0.0/1.3	40178113	40177993	-
ML-SD-14-2.0/3.0	40179190	40179190	-	ML-SD-36-0.0/1.0	40178113	40177993	-
ML-SD-15-0.0/1.0	40178112	40177992	-	ML-SD-36-1.0/1.6	40178113	40177993	-
ML-SD-15-1.0/2.0	40178112	40177992	-	ML-SD-37-0.0/1.2	40178113	40177993	-
ML-SD-16-0.0/1.0	40177941	40177939	40177918	ML-SD-38-0.0/1.0	40178113	40177993	-
ML-SD-16-1.0/2.0	40177941	40177939	40177918	ML-SD-38-1.0/1.7	40178113	40177993	-
ML-SD-16-2.0/3.0	40179190	-	-	ML-SD-39-0.0/1.0	40178113	40177993	-
ML-SD-17-0.0/1.0	40177941	40177939	-	ML-SD-39-1.0/1.9	40178113	40177993	-
ML-SD-17-1.0/2.0	40177941	40177939	-	ML-SD-40-0.0/1.0	40178113	40177993	-
ML-SD-18-0.0/1.0	40177941	40177939	40177918	ML-SD-40-1.0/2.3	40178113	40177993	-
ML-SD-18-1.0/2.0	40177941	40177939	40177918	ML-EB-001-10182018	40177935	40177938	40177936
ML-SD-19-0.0/1.0	40177941	40177939	40177918	ML-EB-002-10182018	40177935	40177938	40177936

Table 3. Analyzed Sample Identification Summary

Sample ID	Analytical SDG No.[a]	Dioxin SDG No.	Methyl Mercury SDG No.	Sample ID	Analytical SDG No.[a]	Dioxin SDG No.	Methyl Mercury SDG No.
ML-SD-19-1.0/2.0	40177941	40177939	40177918	AS1962[b]	4077704	-	-
ML-SD-19-1.0/2.0-FD	40177941	40177939	40177918	DS00317[b]	-	4077708	-
ML-SD-20-0.0/1.0	40177941	40177939	-	MS02615[b]	4077704	-	-

[a] SDG number for laboratory analysis of one or more parameters (PCB Aroclors, mercury and/or TOC)
[b] Performance evaluation sample

Data Review, Verification, and Validation

Staged Electronic Data Deliverables (SEDD) were submitted by the laboratory to EPA's electronic data exchange and evaluation system (EXES) as part of a pilot study. Upon successful upload of the SEDD files, data assessment checks were performed by the EPA Analytical Services Branch, and subsequent validation by EPA's QATS contactor, APTIM.

Data were qualified according to the measurement quality objectives specified in the FSP-QAPP for each parameter. Data qualifiers were applied to sample results when the QC statistics indicated a possible bias to specific compounds or analytes associated with a particular method and sample batch. Multiple qualifiers are routinely applied to specific sample method/matrix/analyte combinations, but the final qualifier will be the most conservative of the applied validation qualifiers. Standard data qualifiers were used as a means of classifying the data regarding their conformance to QC requirements. The applied data qualifiers are defined in **Table 4**.

Table 4. Qualifier Definitions

Qualifier	Definition
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample result was rejected because of serious deficiencies in the ability to analyze the sample and meet the QC criteria. The presence or absence of the analyte could not be verified.

Independent Validation

APTIM completed Tier 1 validation on 100 percent of the data and Tier 2 on 20 percent of the data for mercury, methyl mercury, TOC, and dioxin/furan congeners. Tier 1 and Tier 2 validation was performed on 100 percent of the PCB data. The results of the APTIM validation review are summarized in the release of validated data reports provided in **Attachment 2**. A summary of qualifiers applied by APTIM provided below:

- Two samples (ML-SD-02-3.0/4.0 and ML-SD-02-4.0/4.7) were rejected by APTIM for hold time exceedances for mercury by method SW-846 7471B; R.
- Hold time exceedance qualifiers were applied to TOC and mercury; J and J-.
- Surrogate recovery qualifiers were applied to PCB Aroclors; UJ.
- Continuing calibration verification qualifiers were applied to PCB Aroclors; UJ.
- For dioxin data the laboratory is reporting non-detects and estimate "J" value sample concentrations based on the Estimated Detection Limit (EDL). The EXES program is reporting the non-detected results to either the Method Detection Limit (MDL) or EDL, whichever is the greater value. As a result, some laboratory-reported "J" value analyte results (between the EDL and Reporting Limit [RL]) are reported as detects by the laboratory as estimated ("J" values); however, the analyte concentration is less than the reported adjusted analyte MDL for the sample in the electronic data deliverable file.
  - Sample results between the EDL and RL qualified as estimate; J.
  - Polychlorinated diphenyl ether (PCDE) interference qualifiers were applied to dioxin and furan congeners; J.
  - Calibration range exceedance qualifiers were applied to dioxin and furan congeners; J.
  - Internal standard recovery qualifiers were applied to dioxin and furan congeners; UJ.
  - Ion ratio outside of criteria qualifiers were applied to dioxin and furan congeners and were reported at the Estimated Maximum Possible Concentration (EMPC); J.
  - Samples less than 10 percent solid qualifiers were applied to dioxin and furan congeners; J.
  - Homologue Totals without their own labeled standards qualified; UJ, J.

CH2M Validation Review and Findings

CH2M reviewed the EPA independent validator's results and their changes to data qualifiers, specifically as it relates to data usability. The evaluation assessed how the data, as qualified by the data validator, would be used for project decision making.

Equipment Blank Samples

The CH2M validator found that the APTIM validator did not include evaluation of equipment blank contamination as it applies to the native field samples. The CH2M validator reviewed the data and found that the equipment blanks were free from contamination; therefore, no qualifiers were applied to the data.

Equipment blank sample ML-EB-001-10182018 is associated with all field-collected sediment core samples. Equipment blank sample ML-EB-002-10182018 is associated with samples collected at four locations (SD-29, SD-30, SD-31 and SD-32).

Conclusions

The goal of the data assessment is to determine if deviations from the FSP-QAPP affect the usability of the field data and the analytical results, and whether the field and laboratory data can be used to support the decision-making process.

The following summary highlights the data evaluation findings:

- Two proposed sampling locations were adjusted in the field due to site conditions (physical obstructions). The adjusted locations will not adversely affect the data usability.
- Field duplicate samples were not collected at a 10 percent frequency for TOC. Three field duplicates were collected for 86 native sediment samples that were analyzed by the laboratory (29 percent frequency). This will not adversely affect the data usability.
- Field duplicate samples were not analyzed at a 10 percent frequency for mercury. Four field duplicates were analyzed for 47 native mercury samples that were analyzed by the laboratory (12 percent frequency). This will not adversely affect the data usability.
- Matrix spike and matrix spike duplicate (MS/MSD) samples were not analyzed at a 20 percent frequency for mercury. Two MS/MSD samples were analyzed for 47 native mercury samples that were analyzed by the laboratory (24 percent frequency). This will not adversely affect the data usability.
- The most accurate, precise, representative, and comparable samples were determined by data validation and reported to be final.
- CH2M validators and chemists determined that the data quality objectives were met, as measured by field and laboratory QC indicators.
- Two samples analyzed for mercury were rejected by the third-party validators for hold time exceedances. The percentage of usable mercury data is 95.75 percent. The completeness objective of 90 percent was met for all method/analyte combinations.

References

CH2M HILL (CH2M). 2018a. *Draft Data Quality Objectives, Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin Site Characterization*. October.

CH2M HILL (CH2M). 2018b. *Health and Safety Plan, Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin.* October.

CH2M HILL (CH2M). 2019. *Field Sampling and Quality Assurance Project Plan, Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin Site Characterization.* May.

U.S. Army Corps of Engineers. 2013. *US Army Corps of Engineers Hydrographic Surveying Manual (No. 1110-2-1003, Appendix B – Manual Depth Measurement Techniques*. November. Accessed April 2015. http://www.publications.usace.army.mil/ Portals /76/Publications/EngineerManuals/EM_1110-2-1003.pdf.

Attachment 1
Locational Data Checklist and Metadata Recording Forms

U.S. EPA Great Lakes National Program Office
Locational Data Checklist and Metadata Recording Form

This document accompanies *GLNPO's Great Lakes Legacy Act Data Reporting Standard* , Version 1.0, March 2010, which provides detailed data reporting guidance for project data including required electronic data deliverables (EDD). In addition to the EDD and project field forms, project participants are required to complete this checklist at the end of each sampling event. Copies of completed forms should be submitted to the GLNPO Project Lead.

Contact Information

Contact Name: Raja Kaliappan
Phone Number: 414-847-0304
Affiliation: CH2M
E-mail Address: Raja.Kaliappan@jacobs.com

Study Information

Project Title: Munger Landing Sediment Characterization
Site Name: Munger Landing Sediment Characterization St. Louis River AOC, Minnesota & Wisconsin Site Characterization
Sampling Start Date: 10/15/2018
Sampling Stop Date: 10/19/2018

Preparation Activities (please confirm each activity in the boxes to the right)

1. Sampling staff are trained in GPS Field Data Collection and have familiarized themselves with the GPS unit used for this project (certified training recommended). ☑
2. Determined window of satellite availability. http://www.trimble.com/planningsoftware_ts.asp ☐
3. Established at least two control points for both vertical and horizontal accuracy. ☐
   For assistance locating control points visit http://www.ngs.noaa.gov/cgi-bin/datasheet.prl or http://www.geocaching.com/mark/. This may not be feasible if the GPS unit is mounted to a vessel. *
4. Located 3 reference points. * ☑

Data Collection Activities (please confirm each activity in the boxes to the right)

1. GPS unit was configured to collect data only when the following requirements were met:
   a. A minimum of four satellites ☑
   b. Position dilution of precision (PDOP)<=6 ☐
   c. Satellite elevation >=15° above the horizon ☐
   d. A minimum signal-to-noise ratio (refer to GPS user manual for recommendation) ☐
2. Collected point data based on the nearest base station's logging interval. ☐
3. Collected point data for a period of at least 1 minute per location. ☐
4. Reported locational data in WGS 84 or NAD 83 (please specify WGS 84). ☑

Please provide an explanation if a box was not checked for any of the responses above and specify deviations (include sample IDs if applicable):

*Collect these points on at least the first day of sampling. Collecting on each sampling day is recommended. Record on page 2.

GPS Unit Specifications

GPS Brand and model number: GeoXH 2008-3000
Model accuracy: Real-Time H-Star Accuracy

Data Processing

Which of the following best describes any data correction that may have been performed:

☐ real-time correction - specify type _____
☑ post processed differential correction - provide base station id and location CORS, Wisconsin Point 6 (WIS6)
☐ no correction
☐ other, please specify _____

Quality Information

Describe any difficulties in collecting locational data: _____

List final post-processed accuracy of the data: 62% 5-15cm accuracy, 17.24% between 15-50cm accuracy, 20.69% between 30-50cm accuracy.

Data Collector:

Confirm required information has been provided.

Signature _____ Date _____

GLNPO Project Lead:

Confirm required information has been provided.

Signature _____ Date _____

U.S. EPA Great Lakes National Program Office
GPS Daily Check

Collect these data on at least the first day of sampling. Collecting on each sampling day is recommended.

Project Title: Munger Landing

Date: 10/15/2018 - 10/19/2018

Horizontal Control Point 1

Benchmark ID: _____ Time: _____

Established Latitude: _____ Measured Latitude: _____

Established Longitude: _____ Measured Longitude: _____

Displacement (include UOM): _____

Horizontal Control Point 2

Benchmark ID: _____ Time: _____

Established Latitude: _____ Measured Latitude: _____

Established Longitude: _____ Measured Longitude: _____

Displacement (include UOM): _____

Vertical Control Point 1

Benchmark ID: _____ Time: _____

Established Elevation: _____ Measured Elevation: _____

Displacement (include UOM): _____

Vertical Control Point 2

Benchmark ID: _____ Time: _____

Established Elevation: _____ Measured Elevation: _____

Displacement (include UOM): _____

Reference Point 1

Time: 09:11

Physical/Locational description: ref101918 0911am

Measured Latitude: 46.705730289 Measured Longitude: -92.20321804

Reference Point 2

Time: 13:48

Physical/Locational description: Reference Point 10/19/18 PM

Measured Latitude: 46.705763804 Measured Longitude: -92.203240007

Reference Point 3

Time: 14:43

Physical/Locational description: ref1

Measured Latitude: 46.705755502 Measured Longitude: -92.203230040

U.S. EPA Great Lakes National Program Office
Locational Data Checklist and Metadata Recording Form

This document accompanies *GLNPO's Great Lakes Legacy Act Data Reporting Standard*, Version 1.0, March 2010, which provides detailed data reporting guidance for project data including required electronic data deliverables (EDD). In addition to the EDD and project field forms, project participants are required to complete this checklist at the end of each sampling event. Copies of completed forms should be submitted to the GLNPO Project Lead.

Contact Information

Contact Name: Joe Bonem
Phone Number: 989 686 9640
Affiliation: Cetacean Marine
E-mail Address: jbonem@cetaceanmarine.com

Study Information

Project Title: Munger Landing Sediment Sampling
Site Name: Munger Landing, Duluth, MN
Sampling Start Date: 10-15-14
Sampling Stop Date: 10-17-14

Preparation Activities (please confirm each activity in the boxes to the right)

1. Sampling staff are trained in GPS Field Data Collection and have familiarized themselves with the GPS unit used for this project (certified training recommended). ☑
2. Determined window of satellite availability. http://www.trimble.com/planningsoftware_ts.asp ☐
3. Established at least two control points for both vertical and horizontal accuracy. For assistance locating control points visit http://www.ngs.noaa.gov/cgi-bin/datasheet.prl or http://www.geocaching.com/mark/. This may not be feasible if the GPS unit is mounted to a vessel. * ☑
4. Located 3 reference points. * ☐

Data Collection Activities (please confirm each activity in the boxes to the right)

1. GPS unit was configured to collect data only when the following requirements were met:
   a. A minimum of four satellites ☑
   b. Position dilution of precision (PDOP)<=6 ☑
   c. Satellite elevation >=15° above the horizon ☐
   d. A minimum signal-to-noise ratio (refer to GPS user manual for recommendation) ☑
2. Collected point data based on the nearest base station's logging interval. ☑
3. Collected point data for a period of at least 1 minute per location. ☑
4. Reported locational data in WGS 84 or NAD 83 (please specify NAD 83). ☑

Please provide an explanation if a box was not checked for any of the responses above and specify deviations (include sample IDs if applicable):

Sometimes satellites below 15° had to be used in order to collect data. Only 1 reference point used because sampling area was small

*Collect these points on at least the first day of sampling. Collecting on each sampling day is recommended. Record on page 2.

GPS Unit Specifications

GPS Brand and model number: Trimble PRO XRS
Model accuracy: Sub meter

Data Processing

Which of the following best describes any data correction that may have been performed:

☒ real-time correction - specify type: Beacon
☒ post processed differential correction - provide base station id and location: Cors, Wisconsin point 6 (wis6)
☐ no correction
☐ other, please specify

Quality Information

Describe any difficulties in collecting locational data: Too few satellites at times

List final post-processed accuracy of the data: 97.7% of positions < 1 meter

Data Collector:

Confirm required information has been provided.

Signature: J E Bonem
Date: 11-6-14

GLNPO Project Lead:

Confirm required information has been provided.

Signature
Date

U.S. EPA Great Lakes National Program Office
GPS Daily Check

Collect these data on at least the first day of sampling. Collecting on each sampling day is recommended.

Project Title: Munger Landing Sediment Sampling
Date: 10-14-18

Horizontal Control Point 1

Benchmark ID: Louis (DM2824) Time: 1540
Established Latitude: 46° 43' 41.84370" N Measured Latitude: 46° 43' 41.83854" N
Established Longitude: 92° 11' 04.02633" W Measured Longitude: 92° 11' 04.02126" W
Displacement (include UOM): .62 Ft

Horizontal Control Point 2

Benchmark ID: Olson (AA9913) Time: 1605
Established Latitude: 46° 47' 16.04831" N Measured Latitude: 46° 47' 16.05 27" N
Established Longitude: 92° 05' 41.42260" W Measured Longitude: 92° 05' 41.43152" W
Displacement (include UOM): .75 Ft

Vertical Control Point 1

Benchmark ID: Louis (DM2824) Time: 1540
Established Elevation: 168.034 m HAE Measured Elevation: 168.12 m HAE
Displacement (include UOM): .086 m

Vertical Control Point 2

Benchmark ID: Olson (AA9913) Time: 1605
Established Elevation: 166.701 m HAE Measured Elevation: 166.87 m HAE
Displacement (include UOM): .169 m

Reference Point 1

Time: 1525
Physical/Locational description: Cleat on Dock @ Spirit Lake MARINA
Measured Latitude: 46° 42.364711' N Measured Longitude: 92° 12.104910' W

Reference Point 2

Time:
Physical/Locational description:
Measured Latitude: Measured Longitude:

Reference Point 3

Time:
Physical/Locational description:
Measured Latitude: Measured Longitude:

U.S. EPA Great Lakes National Program Office
GPS Daily Check

Collect these data on at least the first day of sampling. Collecting on each sampling day is recommended.

Project Title: Munger Landing Sediment Sampling

Date: 10-15-18

Horizontal Control Point 1

Benchmark ID: _____ Time: _____

Established Latitude: _____ Measured Latitude: _____

Established Longitude: _____ Measured Longitude: _____

Displacement (include UOM): _____

Horizontal Control Point 2

Benchmark ID: _____ Time: _____

Established Latitude: _____ Measured Latitude: _____

Established Longitude: _____ Measured Longitude: _____

Displacement (include UOM): _____

Vertical Control Point 1

Benchmark ID: _____ Time: _____

Established Elevation: _____ Measured Elevation: _____

Displacement (include UOM): _____

Vertical Control Point 2

Benchmark ID: _____ Time: _____

Established Elevation: _____ Measured Elevation: _____

Displacement (include UOM): _____

Reference Point 1

Time: 0625

Physical/Locational description: cleat on Dock @ Split Lake Marina

Measured Latitude: 46° 42.364663'N Measured Longitude: 92° 12.104720'W

Reference Point 2

Time: _____

Physical/Locational description: _____

Measured Latitude: _____ Measured Longitude: _____

Reference Point 3

Time: _____

Physical/Locational description: _____

Measured Latitude: _____ Measured Longitude: _____

U.S. EPA Great Lakes National Program Office
GPS Daily Check

Collect these data on at least the first day of sampling. Collecting on each sampling day is recommended.

Project Title: Munger Landing Sediment SAMPLING

Date: 10-16-18

Horizontal Control Point 1

Benchmark ID: _____ Time: _____

Established Latitude: _____ Measured Latitude: _____

Established Longitude: _____ Measured Longitude: _____

Displacement (include UOM): _____

Horizontal Control Point 2

Benchmark ID: _____ Time: _____

Established Latitude: _____ Measured Latitude: _____

Established Longitude: _____ Measured Longitude: _____

Displacement (include UOM): _____

Vertical Control Point 1

Benchmark ID: _____ Time: _____

Established Elevation: _____ Measured Elevation: _____

Displacement (include UOM): _____

Vertical Control Point 2

Benchmark ID: _____ Time: _____

Established Elevation: _____ Measured Elevation: _____

Displacement (include UOM): _____

Reference Point 1

Time: 0745

Physical/Locational description: CLEAT on Dock @ Spirit Lake MARINA

Measured Latitude: 46° 42.365119' N Measured Longitude: 92° 12.105161' W

Reference Point 2

Time: _____

Physical/Locational description: _____

Measured Latitude: _____ Measured Longitude: _____

Reference Point 3

Time: _____

Physical/Locational description: _____

Measured Latitude: _____ Measured Longitude: _____

U.S. EPA Great Lakes National Program Office
GPS Daily Check

Collect these data on at least the first day of sampling. Collecting on each sampling day is recommended.

Project Title: Munger Landing Sediment Sampling
Date: 10-17-18

Horizontal Control Point 1

Benchmark ID: _____ Time: _____

Established Latitude: _____ Measured Latitude: _____

Established Longitude: _____ Measured Longitude: _____

Displacement (include UOM): _____

Horizontal Control Point 2

Benchmark ID: _____ Time: _____

Established Latitude: _____ Measured Latitude: _____

Established Longitude: _____ Measured Longitude: _____

Displacement (include UOM): _____

Vertical Control Point 1

Benchmark ID: _____ Time: _____

Established Elevation: _____ Measured Elevation: _____

Displacement (include UOM): _____

Vertical Control Point 2

Benchmark ID: _____ Time: _____

Established Elevation: _____ Measured Elevation: _____

Displacement (include UOM): _____

Reference Point 1

Time: 0745

Physical/Locational description: Client on Dock @ Split Lake Marina

Measured Latitude: 46° 42.364500'N Measured Longitude: 92° 12.104958'W

Reference Point 2

Time: _____

Physical/Locational description: _____

Measured Latitude: _____ Measured Longitude: _____

Reference Point 3

Time: _____

Physical/Locational description: _____

Measured Latitude: _____ Measured Longitude: _____

Attachment 2
APTIM Validated Data Report

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40177757
Received for Review: 11/30/2018, 12/04/2018, and 12/10/2018

LABORATORY: Pace Analytical Laboratories, Green Bay, Wisconsin

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 2 Validation Review

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177757

Number and Type of Samples: 12 Sediment Samples for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A).

EPA Sample Numbers:

ML-SD-01-0.0/1.0	ML-SD-02-1.0/2.0	ML-SD-29-0.0/0.25
ML-SD-01-0.0/1.0-FD	ML-SD-05-0.0/1.0	ML-SD-30-0.0/0.25
ML-SD-01-1.0/2.0	ML-SD-05-0.0/1.0-FD	ML-SD-31-0.0/0.25
ML-SD-02-0.0/1.0	ML-SD-05-1.0/2.0	ML-SD-32-0.0/0.25

Case Number: 47930 SDG Number: 40177757
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Twelve (12) sediment samples for Case 47930, SDG 40177757 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/15/2018 and shipped to Pace Analytical Laboratory in Green Bay, Wisconsin for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A) analysis.

The organic fraction was validated/verified by the QATS Program in accordance with the National Functional Guidelines for Organic Superfund Methods Data Review, January 2017, and the inorganic fractions by the National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. Tier 2 review was applied to all fractions. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the tables below are summaries of the data qualified in each fraction.

DATA QUALIFICATION SUMMARY TABLES

Aroclor Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Total Organic Carbon Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Case Number: 47930 SDG Number: 40177757
Site Name: Munger Landing Laboratory: Pace Analytical

AROCLOR ANALYSIS

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. GC PERFORMANCE

No problems were found.

3. CALIBRATION - INITIAL AND CONTINUING CALIBRATION

No problems were found.

4. BLANKS

No problems were found.

5. SURROGATE RECOVERY

No problems were found.

6. MATRIX SPIKE AND MATRIX SPIKE DUPLICATE

The MS/MSD solution consisted of Aroclor-1260 only. No problems were found.

7. LABORATORY CONTROL SAMPLE

The LCS solution consisted of Aroclor-1260 only. No problems were found.

8. FIELD BLANK AND FIELD DUPLICATES

Sample ML-SD-01-0.0/1.0-FD is the field duplicate of sample ML-SD-01-0.0/1.0 and ML-SD-05-0.0/1.0-FD is the field duplicate of sample ML-SD-05-0.0/1.0. For one field duplicate pair the RPD between sample results was within the 100% QC limit and for one pair no Aroclors were detected.

9. INTERNAL STANDARDS

Not applicable.

10. COMPOUND IDENTIFICATION

No problems were found.

Case Number: 47930 SDG Number: 40177757
Site Name: Munger Landing Laboratory: Pace Analytical

11. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

No problems were found.

12. SYSTEM PERFORMANCE

No problems were found.

13. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Rebecca Garry DATE: 12/17/2018

Case Number: 47930 SDG Number: 40177757
Site Name: Munger Landing Laboratory: Pace Analytical

MERCURY

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. INITIAL CALIBRATION

No problems were found.

3. INITIAL AND CONTINUING CALIBRATION VERIFICATION

No problems were found.

4. CRI STANDARD

No problems were found.

5. BLANKS – INITIAL AND CONTINUING

No problems were found.

6. PREPARATION BLANK

No problems were found.

7. PRE-DIGESTION/DISTILLATION MATRIX SPIKE

No problems were found.

8. POST DIGESTION SPIKE

A post-digestion spike is not required for mercury analysis.

9. LABORATORY DUPLICATE

A laboratory duplicate was not analyzed.

10. FIELD DUPLICATE COMPARISON

Sample ML-SD-01-0.0/1.0-FD is the field duplicate of sample ML-SD-01-0.0/1.0. The RPD is less than the 100% RPD criteria.

11. ICP INTERFERENCE CHECK SAMPLE

An ICSAB is not required for mercury analysis.

Case Number: 47930 SDG Number: 40177757
Site Name: Munger Landing Laboratory: Pace Analytical

12. LABORATORY CONTROL SAMPLE

No problems were found.

13. SERIAL DILUTION

A serial dilution is not required for mercury analysis.

14. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Lydia Heter DATE 01/07/2019

Case Number: 47930 SDG Number: 40177757
Site Name: Munger Landing Laboratory: Pace Analytical

TOTAL ORGANIC CARBON (TOC)

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. INITIAL CALIBRATION

No problems were found.

3. INITIAL AND CONTINUING CALIBRATION VERIFICATION

An initial calibration was analyzed on 10/31/2017 and the correlation coefficient was 0.99984. Note that the initial calibration is almost one year older than the associated sample analysis; however, SOP S-GB-1-076-REV.02 states up to one year is acceptable. No qualification necessary.

4. BLANKS – INITIAL AND CONTINUING

No problems were found.

5. PREPARATION BLANK

No problems were found.

6. PRE-DIGESTION/DISTILLATION MATRIX SPIKE

No problems were found. The MS/MSD recoveries were within the expanded criteria allowed by the NFG for solid samples.

7. LABORATORY DUPLICATE

A Laboratory Duplicate was not analyzed with this SDG.

8. FIELD DUPLICATE COMPARISON

A Field Duplicate was not analyzed with this SDG although two field duplicate samples were designated for TOC analysis according to the Chain-of-Custody (COC).

9. LABORATORY CONTROL SAMPLE

No problems were found.

10. ADDITIONAL INFORMATION

Sample ML-SD-01-0.0/1.0 (40177757001) was analyzed in quadruplicate as required in the laboratory SOP. The %RSD between the results was less than the 40% criteria specified in the SOP for both samples.

REVIEWED BY: Timothy Vonnahme DATE: 01/11/2019

Case Number: 47930 SDG Number: 40177757
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: April 02, 2019

SUBJECT: Review of Data for SDG Number: 40177781
Received for Review: 01/04/2019 and 03/15/2019

LABORATORY: Pace Analytical Laboratories, Minneapolis, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ Validation Review

QATS has reviewed the validated data for the following project:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177781

Number and Type of Samples: 12 Sediment Samples for Dioxins and Furans (EPA 8290/8290A).

EPA Sample Numbers:

ML-SD-01-0.0/1.0	ML-SD-02-1.0/2.0	ML-SD-29-0.0/0.25
ML-SD-01-0.0/1.0-FD	ML-SD-05-0.0/1.0	ML-SD-30-0.0/0.25
ML-SD-01-1.0/2.0	ML-SD-05-0.0/1.0-FD	ML-SD-31-0.0/0.25
ML-SD-02-0.0/1.0	ML-SD-05-1.0/2.0	ML-SD-32-0.0/0.25

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177781
Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Twelve (12) sediment samples for Case 47930, SDG 40177781 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/15/2018 and shipped to Pace Analytical Laboratory in Minneapolis, Minnesota for Dioxins and Furans (EPA 8290/8290A) analysis.

The Dioxin/Furan data were validated/verified by the QATS Program in accordance with the National Functional Guidelines for High Resolution Superfund Methods Data Review, April 2016, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 1+(*) review was applied to the Dioxin data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Note that the laboratory is reporting non-detects and "J" value (estimated) sample concentrations based on the Estimated Detection Limit (EDL). The EXES program is reporting the non-detected results to either the Method Detection Limit (MDL) or EDL, whichever is the greater value. As a result, some laboratory-reported "J" value analyte results (between the EDL and Reporting Limit (RL)) are reported as detects by the laboratory as estimated ("J" values); however, the analyte concentration is less than the reported adjusted analyte MDL for the sample in the EDD file.

Listed in the table below is the summary of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Dioxin/Furan Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
PCDE Interference	1,2,3,4,7,8-HxCDF	J Detects	ML-SD-01-0.0/1.0 ML-SD-01-0.0/1.0-FD
PCDE Interference	1,2,3,6,7,8-HxCDF	J Detects	ML-SD-30-0.0/0.25 ML-SD-32-0.0/0.25
Result exceeds the calibration range of the instrument	OCDD	J Detect	ML-SD-02-1.0/2.0
Internal Standard recovery outside acceptance limits	1,2,3,4,7,8-HxCDD 1,2,3,4,6,7,8-HpCDF	UJ Non-detects	ML-SD-05-0.0/1.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	1,2,3,7,8,9-HxCDF	J Detect	ML-SD-01-0.0/1.0-FD ML-SD-31-0.0/0.25
Qualified "J" (EMPC) due ion ratios not meeting criteria	1,2,3,7,8,9-HxCDD	J Detect	ML-SD-01-1.0/2.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	2,3,4,7,8-PeCDF	J Detect	ML-SD-02-0.0/1.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	OCDD	J Detect	ML-SD-05-0.0/1.0 ML-SD-05-1.0/2.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	1,2,3,4,6,7,8-HpCDF OCDF	J Detect	ML-SD-05-0.0/1.0-FD
Qualified "J" (EMPC) due ion ratios not meeting criteria	1,2,3,7,8,9-HxCDF 1,2,3,4,7,8,9-HpCDF	J Detect	ML-SD-29-0.0/0.25

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177781
Laboratory: Pace Analytical

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
Qualified "J" (EMPC) due ion ratios not meeting criteria	2,3,4,7,8-PeCDF 1,2,3,7,8-PeCDD 1,2,3,7,8,9-HxCDF 1,2,3,4,7,8-HxCDD	J Detects	ML-SD-30-0.0/0.25
Sample results are between the EDL and the RL	2,3,4,7,8-PeCDF 1,2,3,7,8-PeCDF 1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,7,8,9-HxCDF	J Estimated	ML-SD-01-0.0/1.0
Sample results are between the EDL and the RL	2,3,4,7,8-PeCDF 1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF	J Detects	ML-SD-01-0.0/1.0-FD
Sample results are between the EDL and the RL	OCDF 1,2,3,6,7,8-HxCDF 1,2,3,6,7,8-HxCDD 1,2,3,4,6,7,8-HpCDD	J Detects	ML-SD-01-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,7,8-PeCDF 1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,7,8,9-HxCDF 1,2,3,4,7,8-HxCDF 1,2,3,4,7,8-HxCDD 1,2,3,4,7,8,9-HpCDF	J Detects	ML-SD-02-0.0/1.0
Sample results are between the EDL or MDL and the CRQL	1,2,3,7,8-PeCDF 1,2,3,7,8-PeCDD 2,3,4,6,7,8-HxCDF 1,2,3,7,8,9-HxCDF	J Detects	ML-SD-02-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD OCDD	J Detects	ML-SD-05-0.0/1.0-FD
Sample results are between the EDL and the RL	2,3,7,8-TCDF 2,3,7,8-TCDD 1,2,3,7,8-PeCDF 2,3,4,7,8-PeCDF 1,2,3,7,8-PeCDD 1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,7,8,9-HxCDF 1,2,3,4,7,8-HxCDD 1,2,3,6,7,8-HxCDD 1,2,3,7,8,9-HxCDD 1,2,3,4,7,8,9-HpCDF	J Detects	ML-SD-29-0.0/0.25
Sample results are between the EDL and the RL	2,3,7,8-TCDF 2,3,7,8-TCDD 1,2,3,7,8-PeCDF 1,2,3,4,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,6,7,8-HxCDD 1,2,3,7,8,9-HxCDD 1,2,3,4,7,8,9-HpCDF	J Detects	ML-SD-30-0.0/0.25
Sample results are between the EDL and the RL	2,3,7,8-TCDD 1,2,3,7,8-PeCDF 2,3,4,7,8-PeCDF 1,2,3,7,8-PeCDD 1,2,3,4,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,4,7,8-HxCDD	J Detects	ML-SD-31-0.0/0.25

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177781
Laboratory: Pace Analytical

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
	1,2,3,4,7,8,9-HpCDF		
Sample results are between the EDL and the RL	2,3,7,8-TCDF 2,3,7,8-TCDD 1,2,3,7,8-PeCDF 2,3,4,7,8-PeCDF 1,2,3,7,8-PeCDD 1,2,3,4,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,7,8,9-HxCDF 1,2,3,4,7,8-HxCDD 1,2,3,6,7,8-HxCDD 1,2,3,7,8,9-HxCDD 1,2,3,4,7,8,9-HpCDF	J Detects	ML-SD-32-0.0/0.25
Sample is less than 10 percent solids (9.8%)	2,3,7,8-TCDF 2,3,7,8-TCDD 1,2,3,7,8-PeCDF 2,3,4,7,8-PeCDF 1,2,3,7,8-PeCDD 1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,7,8,9-HxCDF 1,2,3,4,7,8-HxCDD 1,2,3,6,7,8-HxCDD 1,2,3,7,8,9-HxCDD 1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total TCDF Total TCDD Total PeCDF Total PeCDD Total HxCDF Total HxCDD Total HpCDF Total HpCDD	J Detects	ML-SD-29-0.0/0.25
Reported Homologue Totals Qualified per NFG	Total TCDF Total TCDD Total PeCDF Total PeCDD Total HxCDF Total HxCDD Total HpCDF Total HpCDD	J Detects UJ Non-detects	ML-SD-01-0.0/1.0 ML-SD-02-1.0/2.0 ML-SD-29-0.0/0.25 ML-SD-01-0.0/1.0-FD ML-SD-05-0.0/1.0 ML-SD-30-0.0/0.25 ML-SD-01-1.0/2.0 ML-SD-05-0.0/1.0-FD ML-SD-31-0.0/0.25 ML-SD-02-0.0/1.0 ML-SD-05-1.0/2.0 ML-SD-32-0.0/0.25

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177781
Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40177782
Received for Review: 12/13/2018 and 01/03/2019

LABORATORY: Pace Analytical Laboratories, Duluth, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 2 Validation Review

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177782

Number and Type of Samples: 5 Sediment Samples for Methyl Mercury (EPA 1630).

EPA Sample Numbers:

ML-SD-01-0.0/1.0	ML-SD-01-1.0/2.0	ML-SD-02-1.0/2.0
ML-SD-01-0.0/1.0-FD	ML-SD-02-0.0/1.0	

Case Number: 47930 SDG Number: 40177782
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Five (5) sediment samples for Case 47930, SDG 40177782 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/15/2018 and shipped to Pace Analytical Laboratory in Duluth, Minnesota for Methyl Mercury (EPA 1630) analysis.

The Methyl Mercury data were validated/verified by the QATS Program in accordance with the National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 2 review was applied the Methyl Mercury data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the table below are summaries of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Methyl Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Case Number: 47930 SDG Number: 40177782
Site Name: Munger Landing Laboratory: Pace Analytical

METHYL MERCURY

1. HOLDING TIME AND PRESERVATION

The samples for methyl mercury analysis arrived at the laboratory at 8.9℃ which exceeds the required 6.0℃ temperature. Since the temperature at receipt is less than 10℃, and using professional judgment, no qualification was applied.

2. INITIAL CALIBRATION

No problems were found.

3. INITIAL AND CONTINUING CALIBRATION VERIFICATION

No problems were found.

4. CRI STANDARD

No problems were found.

5. BLANKS – INITIAL AND CONTINUING

No problems were found.

6. PREPARATION BLANK

No problems were found.

7. PRE-DIGESTION/DISTILLATION MATRIX SPIKE

No problems were found.

8. POST DIGESTION SPIKE

A post-digestion spike was not analyzed.

9. LABORATORY DUPLICATE

A laboratory duplicate was not analyzed.

10. FIELD DUPLICATE COMPARISON

Sample ML-SD-01-0.0/1.0-FD is the field duplicate of sample ML-SD-01-0.0/1.0. The RPD is less than the 100% RPD criteria.

11. ICP INTERFERENCE CHECK SAMPLE

An ICSAB is not required for methyl mercury analysis.

Case Number: 47930 SDG Number: 40177782
Site Name: Munger Landing Laboratory: Pace Analytical

12. LABORATORY CONTROL SAMPLE

No problems were found.

13. SERIAL DILUTION

A serial dilution is not required for methyl mercury analysis.

14. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Michael Nys DATE 12/17/2018

Case Number: 47930 SDG Number: 40177782
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40177822
Received for Review: 12/13/2018 and 01/03/2019

LABORATORY: Pace Analytical Laboratories, Duluth, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ Validation Review

QATS has reviewed the validated data for the following project:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177822

Number and Type of Samples: 4 Sediment Samples for Methyl Mercury (EPA 1630).

EPA Sample Numbers:

ML-SD-03-0.0/1.0	ML-SD-08-0.0/1.0
ML-SD-03-1.0/2.0	ML-SD-08-1.0/2.0

Case Number: 47930 SDG Number: 40177822
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Four (4) sediment samples for Case 47930, SDG 40177822 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/16/2018 and shipped to Pace Analytical Laboratory in Duluth, Minnesota for Methyl Mercury (EPA 1630) analysis.

The Methyl Mercury data were validated/verified by the QATS Program in accordance with the Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 1+ review was applied to the Methyl Mercury data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the table below are summaries of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Methyl Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930 SDG Number: 40177822
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40177823
Received for Review: 12/05/2018, 12/07/2018, 12/19/2018, and 12/20/2018

LABORATORY: Pace Analytical Laboratories, Green Bay, Wisconsin

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1 and Tier 2 Validation Reviews

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177823

Number and Type of Samples: 20 Sediment Samples for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A).

EPA Sample Numbers:

ML-SD-03-0.0/1.0	ML-SD-07-1.0/2.0	ML-SD-10-1.0/2.0
ML-SD-03-1.0/2.0	ML-SD-08-0.0/1.0	ML-SD-11-0.0/1.0
ML-SD-04-0.0/1.0	ML-SD-08-1.0/2.0	ML-SD-11-1.0/2.0
ML-SD-04-1.0/2.0	ML-SD-09-0.0/1.0	ML-SD-13-0.0/1.0
ML-SD-06-0.0/1.0	ML-SD-09-1.0/2.0	ML-SD-13-0.0/1.0-FD
ML-SD-06-1.0/2.0	ML-SD-10-0.0/1.0	ML-SD-13-1.0/2.0
ML-SD-07-0.0/1.0	ML-SD-10-0.0/1.0-FD	

Case Number: 47930 SDG Number: 40177823
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Twenty (20) sediment samples for Case 47930, SDG 40177823 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/16/2018 and shipped to Pace Analytical Laboratory in Green Bay, Wisconsin for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A) analysis.

The organic fraction was validated/verified by the QATS Program in accordance with the National Functional Guidelines for Organic Superfund Methods Data Review, January 2017, and the inorganic fractions by the National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. Tier 2 review was applied to the Aroclor fraction and Tier 1+(*) review was applied to the Mercury and TOC fractions. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the tables below are summaries of the data qualified in each fraction.

DATA QUALIFICATION SUMMARY TABLES

Aroclor Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
Low Surrogate Recovery	Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, Aroclor-1260, Aroclor-1262 Aroclor-1268	UJ	1 Sample

Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Total Organic Carbon Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930 SDG Number: 40177823
Site Name: Munger Landing Laboratory: Pace Analytical

AROCLOR ANALYSIS

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. GC PERFORMANCE

No problems were found.

3. CALIBRATION - INITIAL AND CONTINUING CALIBRATION

No problems were found.

4. BLANKS

No problems were found.

5. SURROGATE RECOVERY

The percent recovery (%R) for surrogate Decachlorobiphenyl (DCBP) of 46%R in one Aroclor sample is less than the laboratory-established QC limits (49-104%) on the quantitation column. Note that the laboratory only reports surrogate recoveries from the quantitation column, which appears to be the RTX-CLP GC column for instrument 40GCS9. No Aroclors were detected in the sample. The non-detected Aroclors in the following sample are qualified "UJ":

ML-SD-03-1.0/2.0 – Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, Aroclor-1260, Aroclor-1262, Aroclor-1268

6. MATRIX SPIKE AND MATRIX SPIKE DUPLICATE

The MS/MSD solution consisted of Aroclor-1260 only. No problems were found.

7. LABORATORY CONTROL SAMPLE

The LCS solution consisted of Aroclor-1260 only. No problems were found.

8. FIELD BLANK AND FIELD DUPLICATES

Sample ML-SD-10-0.0/1.0-FD is the field duplicate of sample ML-SD-10-0.0/1.0 and ML-SD-13-0.0/1.0-FD is the field duplicate of sample ML-SD-13-0.0/1.0. No Aroclors were detected in either pair.

9. INTERNAL STANDARDS

Not applicable.

Case Number: 47930 SDG Number: 40177823
Site Name: Munger Landing Laboratory: Pace Analytical

10. COMPOUND IDENTIFICATION

No problems were found.

11. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

No problems were found.

12. SYSTEM PERFORMANCE

No problems were found.

13. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Rebecca Garry DATE: 01/04/2019

Case Number: 47930 SDG Number: 40177823
Site Name: Munger Landing Laboratory: Pace Analytical

NPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: April 02, 2019

SUBJECT: Review of Data for SDG Number: 40177827
Received for Review: 01/10/2019 and 03/15/2019

LABORATORY: Pace Analytical Laboratories, Minneapolis, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ Validation Review

QATS has reviewed the validated data for the following project:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177827

Number and Type of Samples: 20 Sediment Samples for Dioxins and Furans (EPA 8290/8290A).

EPA Sample Numbers:

ML-SD-03-0.0/1.0	ML-SD-03-1.0/2.0	ML-SD-04-0.0/1.0
ML-SD-04-1.0/2.0	ML-SD-06-0.0/1.0	ML-SD-06-1.0/2.0
ML-SD-07-0.0/1.0	ML-SD-07-1.0/2.0	ML-SD-08-0.0/1.0
ML-SD-08-1.0/2.0	ML-SD-09-0.0/1.0	ML-SD-09-1.0/2.0
ML-SD-10-0.0/1.0	ML-SD-10-0.0/1.0-FD	ML-SD-10-1.0/2.0
ML-SD-11-0.0/1.0	ML-SD-11-1.0/2.0	ML-SD-13-0.0/1.0
ML-SD-13-0.0/1.0-FD	ML-SD-13-1.0/2.0	

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177827
Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Twenty (20) sediment samples for Case 47930, SDG 40177827 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/16/2018 and shipped to Pace Analytical Laboratory in Minneapolis, Minnesota for Dioxins and Furans (EPA 8290/8290A) analysis.

The Dioxin/Furan data were validated/verified by the QATS Program in accordance with the National Functional Guidelines for High Resolution Superfund Methods Data Review, April 2016, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 1+(*) review was applied to the Dioxin data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Note that the laboratory is reporting non-detects and "J" value (estimated) sample concentrations based on the Estimated Detection Limit (EDL). The EXES program is reporting the non-detected results to either the Method Detection Limit (MDL) or EDL, whichever is the greater value. As a result, some laboratory-reported "J" value analyte results (between the EDL and Reporting Limit (RL)) are reported as detects by the laboratory as estimated ("J" values); however, the analyte concentration is less than the reported adjusted analyte MDL for the sample in the EDD file.

Listed in the table below is the summary of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Dioxin/Furan Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
Qualified "J" (EMPC) due ion ratios not meeting criteria	OCDF	J Detects	ML-SD-04-0.0/1.0 ML-SD-11-1.0/2.0 ML-SD-13-0.0/1.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	2,3,7,8-TCDF 1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF	J Detects	ML-SD-06-0.0/1.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	2,3,7,8-TCDF OCDF	J Detects	ML-SD-06-1.0/2.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	1,2,3,7,8-PeCDF	J Detect	ML-SD-07-0.0/1.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	OCDD	J Detect	ML-SD-08-1.0/2.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	1,2,3,4,6,7,8-HpCDF	J Detect	ML-SD-09-0.0/1.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	2,3,4,7,8-PeCDF 1,2,3,4,7,8-HxCDF 1,2,3,7,8,9-HxCDF	J Detects	ML-SD-11-0.0/1.0
Qualified "J" (EMPC) due ion ratios not meeting criteria	1,2,3,6,7,8-HxCDD OCDF	J Detects	ML-SD-13-0.0/1.0-FD
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD 1,2,3,4,6,7,8-HpCDF	J Detects	ML-SD-03-0.0/1.0 ML-SD-09-1.0/2.0

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177827
Laboratory: Pace Analytical

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
	OCDD		ML-SD-13-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD 1,2,3,4,6,7,8-HpCDF 2,3,7,8-TCDF	J Detects	ML-SD-04-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD OCDF	J Detects	ML-SD-06-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD 1,2,3,4,6,7,8-HpCDF 1,2,3,6,7,8-HxCDF	J Detects	ML-SD-06-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD 1,2,3,4,6,7,8-HpCDF	J Detects	ML-SD-06-1.0/2.0 ML-SD-10-0.0/1.0-FD
Sample results are between the EDL and the RL	1,2,3,4,7,8-HxCDD 1,2,3,7,8,9-HxCDF 1,2,3,7,8-PeCDD 2,3,4,7,8-PeCDF	J Detects	ML-SD-07-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD OCDF	J Detects	ML-SD-07-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,6,7,8-HxCDD 1,2,3,6,7,8-HxCDF	J Detects	ML-SD-08-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDF OCDD	J Detects	ML-SD-10-0.0/1.0 ML-SD-10-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,7,8-PeCDF	J Detects	ML-SD-11-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD	J Detects	ML-SD-11-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD 1,2,3,6,7,8-HxCDF	J Detects	ML-SD-13-0.0/1.0-FD
Reported Homologue Totals Qualified per NFG	Total TCDF Total TCDD Total PeCDF Total PeCDD Total HxCDF Total HxCDD Total HpCDF Total HpCDD	J Detects UJ Non-detects	ML-SD-03-0.0/1.0 ML-SD-03-1.0/2.0 ML-SD-04-0.0/1.0 ML-SD-04-1.0/2.0 ML-SD-06-0.0/1.0 ML-SD-06-1.0/2.0 ML-SD-07-0.0/1.0 ML-SD-07-1.0/2.0 ML-SD-08-0.0/1.0 ML-SD-08-1.0/2.0 ML-SD-09-0.0/1.0 ML-SD-09-1.0/2.0 ML-SD-10-0.0/1.0 ML-SD-10-0.0/1.0-FD ML-SD-10-1.0/2.0 ML-SD-11-0.0/1.0 ML-SD-11-1.0/2.0 ML-SD-13-0.0/1.0 ML-SD-13-0.0/1.0-FD ML-SD-13-1.0/2.0

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177827
Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40177918
Received for Review: 12/13/2018 and 01/03/2019

LABORATORY: Pace Analytical Laboratories, Duluth, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ Validation Review

QATS has reviewed the validated data for the following project:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177918

Number and Type of Samples: 13 Sediment Samples for Methyl Mercury (EPA 1630).

EPA Sample Numbers:

ML-SD-12-0.0/1.0	ML-SD-18-1.0/2.0	ML-SD-21-0.0/1.0
ML-SD-12-1.0/2.0	ML-SD-19-0.0/1.0	ML-SD-21-1.0/2.0
ML-SD-16-0.0/1.0	ML-SD-19-1.0/2.0	ML-SD-22-0.0/1.0
ML-SD-16-1.0/2.0	ML-SD-19-1.0/2.0-FD	ML-SD-22-1.0/2.0
ML-SD-18-0.0/1.0		

Case Number: 47930 SDG Number: 40177918
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Thirteen (13) sediment samples for Case 47930, SDG 40177918 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/17/2018 and shipped to Pace Analytical Laboratory in Duluth, Minnesota for Methyl Mercury (EPA 1630) analysis.

The Methyl Mercury data were validated/verified by the QATS Program in accordance with the Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 1+(*) review was applied to the Methyl Mercury data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the table below are summaries of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Methyl Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930 SDG Number: 40177918
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40177935
Received for Review: 12/05/2018 and 12/07/2018

LABORATORY: Pace Analytical Laboratories, Green Bay, Wisconsin

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 2 Validation Review

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177935

Number and Type of Samples: 2 Equipment Blanks for Mercury (SW-846 7471B) and Aroclor (SW-846 8082A)

EPA Sample Numbers: ML-EB-001-10182018 ML-EB-002-10182018

Case Number: 47930 SDG Number: 40177935
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Two (2) equipment blanks for Case 47930, SDG 40177935 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/18/2018 and shipped to Pace Analytical Laboratory in Green Bay, Wisconsin for Mercury (SW-846 7471B) and Aroclor (SW-846 8082A) analysis.

The organic fraction was validated/verified by the QATS Program in accordance with the National Functional Guidelines for Organic Superfund Methods Data Review, January 2017, and the inorganic fraction by the National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. Tier 2 review was applied to both fractions. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the tables below are summaries of the data qualified in each fraction.

DATA QUALIFICATION SUMMARY TABLES

Aroclor Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Case Number: 47930 SDG Number: 40177935
Site Name: Munger Landing Laboratory: Pace Analytical

AROCLOR ANALYSIS

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. GC PERFORMANCE

No problems were found.

3. CALIBRATION - INITIAL AND CONTINUING CALIBRATION

No problems were found.

4. BLANKS

No problems were found.

5. SURROGATE RECOVERY

No problems were found.

6. MATRIX SPIKE AND MATRIX SPIKE DUPLICATE

No MS/MSD were analyzed.

7. LABORATORY CONTROL SAMPLE

The LCS solution consisted of Aroclor-1260 only. No problems were found.

8. FIELD BLANK AND FIELD DUPLICATES

No Aroclors were detected in the two field blanks. Field duplicates were not analyzed.

9. INTERNAL STANDARDS

Not applicable.

10. COMPOUND IDENTIFICATION

No problems were found.

11. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

No problems were found.

12. SYSTEM PERFORMANCE

No problems were found.

Case Number: 47930 SDG Number: 40177935
Site Name: Munger Landing Laboratory: Pace Analytical

13. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Rebecca Garry DATE: 01/04/2019

Case Number: 47930 SDG Number: 40177935
Site Name: Munger Landing Laboratory: Pace Analytical

MERCURY

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. INITIAL CALIBRATION

No problems were found.

3. INITIAL AND CONTINUING CALIBRATION VERIFICATION

No problems were found.

4. CRI STANDARD

No problems were found.

5. BLANKS – INITIAL AND CONTINUING

No problems were found.

6. PREPARATION BLANK

No problems were found.

7. PRE-DIGESTION/DISTILLATION MATRIX SPIKE

No problems were found.

8. POST DIGESTION SPIKE

A post-digestion spike is not required for mercury analysis.

9. LABORATORY DUPLICATE

A laboratory duplicate was not analyzed.

10. FIELD DUPLICATE COMPARISON

A field duplicate was not analyzed with this SDG.

11. ICP INTERFERENCE CHECK SAMPLE

An ICSAB is not required for mercury analysis.

Case Number: 47930 SDG Number: 40177935
Site Name: Munger Landing Laboratory: Pace Analytical

12. LABORATORY CONTROL SAMPLE

No problems were found.

13. SERIAL DILUTION

A serial dilution is not required for mercury analysis.

14. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Lydia Heter DATE 01/08/2019

Case Number: 47930 SDG Number: 40177935
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40177936
Received for Review: 12/13/2018 and 01/03/2019

LABORATORY: Pace Analytical Laboratories, Duluth, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 2 Validation Review

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177936

Number and Type of Samples: 2 Equipment Blanks for Methyl Mercury (EPA 1630).

EPA Sample Numbers: ML-EB-001-10182018 ML-EB-002-10182018

Case Number: 47930 SDG Number: 40177936
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Two (2) equipment blanks for Case 47930, SDG 40177936 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/18/2018 and shipped to Pace Analytical Laboratory in Duluth, Minnesota for Methyl Mercury (EPA 1630) analysis.

The Methyl Mercury data were validated/verified by the QATS Program in accordance with the National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 2 review was applied the Methyl Mercury data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the table below are summaries of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Methyl Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Case Number: 47930 SDG Number: 40177936
Site Name: Munger Landing Laboratory: Pace Analytical

METHYL MERCURY

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. INITIAL CALIBRATION

No problems were found.

3. INITIAL AND CONTINUING CALIBRATION VERIFICATION

No problems were found.

4. CRI STANDARD

No problems were found.

5. BLANKS – INITIAL AND CONTINUING

No problems were found.

6. PREPARATION BLANK

No problems were found.

7. PRE-DIGESTION/DISTILLATION MATRIX SPIKE

No problems were found.

8. POST DIGESTION SPIKE

A post-digestion spike was not analyzed.

9. LABORATORY DUPLICATE

A laboratory duplicate was not analyzed.

10. FIELD DUPLICATE COMPARISON

A field duplicate was not analyzed with this SDG.

11. ICP INTERFERENCE CHECK SAMPLE

An ICSAB is not required for methyl mercury analysis.

12. LABORATORY CONTROL SAMPLE

No problems were found.

Case Number: 47930 SDG Number: 40177936
Site Name: Munger Landing Laboratory: Pace Analytical

13. SERIAL DILUTION

A serial dilution is not required for methyl mercury analysis.

14. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Michael Nys DATE 12/20/2018

Case Number: 47930 SDG Number: 40177936
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: April 16, 2019

SUBJECT: Review of Data for SDG Number: 40177938
Received for Review: 02/26/2019 and 03/15/2019

LABORATORY: Pace Analytical Laboratories, Minneapolis, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ Validation Review

QATS has reviewed the validated data for the following project:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177938

Number and Type of Samples: 2 Water Samples for Dioxins and Furans (EPA 8290/8290A).

EPA Sample Numbers: ML-EB-002-10182018 ML-EB-001-10182018

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177938
Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Two (2) equipment blank samples for Case 47930, SDG 40177938 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/18/2018 and shipped to Pace Analytical Laboratory in Minneapolis, Minnesota for Dioxins and Furans (EPA 8290/8290A) analysis.

The Dioxin/Furan data were validated/verified by the QATS Program in accordance with the National Functional Guidelines for High Resolution Superfund Methods Data Review, April 2016, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 1+(*) review was applied to the Dioxin data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the table below is the summary of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Dioxin/Furan Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
Reported Homologue Totals Qualified per NFG	Total TCDF Total TCDD Total PeCDF Total PeCDD Total HxCDF Total HxCDD Total HpCDF Total HpCDD	UJ Non-detects	ML-EB-002-10182018 ML-EB-001-10182018

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177938
Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: April 02, 2019

SUBJECT: Review of Data for SDG Number: 40177939
Received for Review: 01/04/2019 and 03/15/2019

LABORATORY: Pace Analytical Laboratories, Minneapolis, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ Validation Review

QATS has reviewed the validated data for the following project:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177939

Number and Type of Samples: 20 Sediment Samples for Dioxins and Furans (EPA 8290/8290A).

EPA Sample Numbers:

ML-SD-12-0.0/1.0	ML-SD-17-1.0/2.0	ML-SD-20-1.0/2.0
ML-SD-12-1.0/2.0	ML-SD-18-0.0/1.0	ML-SD-21-0.0/1.0
ML-SD-14-0.0/1.0	ML-SD-18-1.0/2.0	ML-SD-21-1.0/2.0
ML-SD-14-1.0/2.0	ML-SD-19-0.0/1.0	ML-SD-22-0.0/1.0
ML-SD-16-0.0/1.0	ML-SD-19-1.0/2.0	ML-SD-22-1.0/2.0
ML-SD-16-1.0/2.0	ML-SD-19-1.0/2.0-FD	ML-SD-27-0.0/1.0
ML-SD-17-0.0/1.0	ML-SD-20-0.0/1.0	

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177939
Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Twenty (20) sediment samples for Case 47930, SDG 40177939 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/17/2018 and shipped to Pace Analytical Laboratory in Minneapolis, Minnesota for Dioxins and Furans (EPA 8290/8290A) analysis.

The Dioxin/Furan data were validated/verified by the QATS Program in accordance with the National Functional Guidelines for High Resolution Superfund Methods Data Review, April 2016, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. Tier 1+(*) review was applied to the Dioxin data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Note that the laboratory is reporting non-detects and "J" value (estimated) sample concentrations based on the Estimated Detection Limit (EDL). The EXES program is reporting the non-detected results to either the Method Detection Limit (MDL) or EDL, whichever is the greater value. As a result, some laboratory-reported "J" value analyte results (between the EDL and Reporting Limit (RL)) are reported as detects by the laboratory as estimated ("J" values); however, the analyte concentration is less than the reported adjusted analyte MDL for the sample in the EDD file.

Listed in the table below is the summary of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Dioxin/Furan Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
Qualified "J" (EMPC) due to ion ratios not meeting criteria	OCDF	J Detects	ML-SD-12-1.0/2.0
PCDE interferences	1,2,3,4,7,8-HxCDF	J Detects	ML-SD-14-1.0/2.0
Result exceeds the calibration range of the instrument	1,2,3,4,6,7,8-HpCDF Total HpCDF OCDD	J Detects	ML-SD-14.0.0/1.0
Result exceeds the calibration range of the instrument	1,2,3,4,6,7,8-HpCDF Total HpCDF	J Detects	ML-SD-14-1.0/2.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	2,3,4,6,7,8-HxCDF 1,2,3,4,7,8,9-HpCDF	J Detects	ML-SD-16-0.0/1.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,6,7,8-HxCDF OCDF	J Detects	ML-SD-16-1.0/2.0 ML-SD-18-0.0/1.0 ML-SD-20-0.0/1.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,7,8-PeCDF 2,3,4,6,7,8-HxCDF	J Detects	ML-SD-17-0.0/1.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,4,6,7,8-HpCDD	J Detects	ML-SD-19-0.0/1.0 ML-SD-20-1.0/2.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,4,6,7,8-HpCDF	J Detects	ML-SD-19-1.0/2.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	OCDD	J Detects	ML-SD-21-0.0/1.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDD	J Detects	ML-SD-22-0.0/1.0

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177939
Laboratory: Pace Analytical

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDD	J Detects	ML-SD-22-1.0/2.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,6,7,8-HxCDD 1,2,3,7,8,9-HxCDD	J Detects	ML-SD-27-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD 1,2,3,6,7,8-HxCDF OCDF	J Detects	ML-SD-12-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDD	J Detects	ML-SD-12-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,7,8-PeCDF	J Detects	ML-SD-14-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,7,8-HxCDD 1,2,3,7,8-PeCDF 2,3,7,8-TCDF	J Detects	ML-SD-14-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,7,8,9-HxCDD 1,2,3,6,7,8-HxCDD 1,2,3,7,8,9-HxCDF 2,3,7,8-TCDF 2,3,4,7,8-PeCDF 1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF	J Detects	ML-SD-16-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD 1,2,3,6,7,8-HxCDD 1,2,3,4,7,8-HxCDF 2,3,4,6,7,8-HxCDF	J Detects	ML-SD-16-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,7,8,9-HxCDD 1,2,3,4,7,8-HxCDD 1,2,3,4,7,8-HxCDF 1,2,3,7,8,9-HxCDF 1,2,3,7,8-PeCDD 2,3,4,7,8-PeCDF 2,3,7,8-TCDD 2,3,7,8-TCDF	J Detects	ML-SD-17-0.0/1.0
Sample results are between the EDL and the RL	2,3,4,7,8-PeCDF	J Detects	ML-SD-18-0.0/1.0
Sample results are between the EDL and the RL	OCDD	J Detects	ML-SD-18-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDF OCDD	J Detects	ML-SD-19-0.0/1.0
Sample results are between the EDL and the RL	OCDD	J Detects	ML-SD-19-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD 1,2,3,6,7,8-HxCDD	J Detects	ML-SD-20-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDF OCDD	J Detects	ML-SD-20-1.0/2.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD	J Detects	ML-SD-21-0.0/1.0
Sample results are between the EDL and the RL	1,2,3,6,7,8-HxCDF 2,3,4,6,7,8-HxCDF OCDF	J Detects	ML-SD-22-0.0/1.0
Sample results are between the EDL and the RL	OCDF	J Detects	ML-SD-22-1.0/2.0

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177939
Laboratory: Pace Analytical

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD 1,2,3,4,7,8-HxCDF 1,2,3,6,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,4,7,8-HxCDD OCDF 2,3,7,8-TCDF	J Detects	ML-SD-27-0.0/1.0
Reported Homologue Totals Qualified per NFG	Total TCDF Total TCDD Total PeCDF Total PeCDD Total HxCDF Total HxCDD Total HpCDF Total HpCDD	J Detects UJ Non-detects	ML-SD-12-0.0/1.0 ML-SD-17-1.0/2.0 ML-SD-20-1.0/2.0 ML-SD-12-1.0/2.0 ML-SD-18-0.0/1.0 ML-SD-21-0.0/1.0 ML-SD-14-0.0/1.0 ML-SD-18-1.0/2.0 ML-SD-21-1.0/2.0 ML-SD-14-1.0/2.0 ML-SD-19-0.0/1.0 ML-SD-22-0.0/1.0 ML-SD-16-0.0/1.0 ML-SD-19-1.0/2.0 ML-SD-22-1.0/2.0 ML-SD-16-1.0/2.0 ML-SD-19-1.0/2.0-FD ML-SD-27-0.0/1.0 ML-SD-17-0.0/1.0 ML-SD-20-0.0/1.0

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177939
Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40177941
Received for Review: 12/05/2018 and 12/07/2018

LABORATORY: Pace Analytical Laboratories, Green Bay, Wisconsin

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ and Tier 2 Validation Reviews

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177941

Number and Type of Samples: 20 Sediment Samples for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A).

EPA Sample Numbers:

ML-SD-12-0.0/1.0	ML-SD-17-1.0/2.0	ML-SD-20-1.0/2.0
ML-SD-12-1.0/2.0	ML-SD-18-0.0/1.0	ML-SD-21-0.0/1.0
ML-SD-14-0.0/1.0	ML-SD-18-1.0/2.0	ML-SD-21-1.0/2.0
ML-SD-14-1.0/2.0	ML-SD-19-0.0/1.0	ML-SD-22-0.0/1.0
ML-SD-16-0.0/1.0	ML-SD-19-1.0/2.0	ML-SD-22-1.0/2.0
ML-SD-16-1.0/2.0	ML-SD-19-1.0/2.0-FD	ML-SD-27-0.0/1.0
ML-SD-17-0.0/1.0	ML-SD-20-0.0/1.0	

Case Number: 47930 SDG Number: 40177941
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Twenty (20) sediment samples for Case 47930, SDG 40177941 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/17/2018 and shipped to Pace Analytical Laboratory in Green Bay, Wisconsin for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A) analysis.

The organic fraction was validated/verified by the QATS Program in accordance with the National Functional Guidelines for Organic Superfund Methods Data Review, January 2017, and the inorganic fractions by the National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. Tier 2 review was applied to the Aroclor fraction and Tier 1+(*) review was applied to the Mercury and TOC fractions. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the tables below are summaries of the data qualified in each fraction.

DATA QUALIFICATION SUMMARY TABLES

Aroclor Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Total Organic Carbon Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930 SDG Number: 40177941
Site Name: Munger Landing Laboratory: Pace Analytical

AROCLOR ANALYSIS

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. GC PERFORMANCE

No problems were found.

3. CALIBRATION - INITIAL AND CONTINUING CALIBRATION

No problems were found.

4. BLANKS

No problems were found.

5. SURROGATE RECOVERY

No problems were found.

6. MATRIX SPIKE AND MATRIX SPIKE DUPLICATE

The MS/MSD solution consisted of Aroclor-1260 only. No problems were found.

7. LABORATORY CONTROL SAMPLE

The LCS solution consisted of Aroclor-1260 only. No problems were found.

8. FIELD BLANK AND FIELD DUPLICATES

Sample ML-SD-19-1.0/2.0-FD is the field duplicate of sample ML-SD-19-1.0/2.0. No Aroclors were detected.

9. INTERNAL STANDARDS

Not applicable.

10. COMPOUND IDENTIFICATION

No problems were found.

Case Number: 47930 SDG Number: 40177941
Site Name: Munger Landing Laboratory: Pace Analytical

11. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

For one sample in this SDG, Aroclor-1260 was detected at a concentration of 55.5 µg/kg on one GC column, slightly above the reporting limit (RL) of 49.6 µg/kg. The analyte was not detected on the confirmation column. Note that this laboratory uses one GC column for quantitation, and one for confirmation only. The laboratory reported in the Narrative, "The peak ratio of Aroclor 1260 for sample ML-SD-14-1.0/2.0 was below the signal threshold on the confirmation column. The analyst visually confirmed the presence of the pattern. The PC code was applied to the confirmation column quantitation report to note the occurrence."

Due to the visual confirmation of Aroclor-1260 by the analyst on the confirmation column, the QATS validator concurs with the result and the "J" qualifier applied by the laboratory.

12. SYSTEM PERFORMANCE

No problems were found.

13. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Rebecca Garry DATE: 12/17/2018

Case Number: 47930 SDG Number: 40177941
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: April 02, 2019

SUBJECT: Review of Data for SDG Number: 40177992
Received for Review: 02/26/2019 and 03/15/2019

LABORATORY: Pace Analytical Laboratories, Minneapolis, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 2 Validation Review

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177992

Number and Type of Samples: 16 Sediment Samples for Dioxins and Furans (EPA 8290/8290A).

EPA Sample Numbers:

ML-SD-15-0.0/1.0	ML-SD-15-1.0/2.0	ML-SD-23-0.0/1.0
ML-SD-23-1.0/2.0	ML-SD-24-0.0/1.0	ML-SD-24-1.0/2.0
ML-SD-25-0.0/1.0	ML-SD-25-1.0/2.0	ML-SD-26-0.0/1.0
ML-SD-26-1.0/2.0	ML-SD-26-1.0/2.0-FD	ML-SD-28-0.0/1.0
ML-SD-33-0.0/1.2	ML-SD-34-0.0/1.0	ML-SD-34-0.0/1.0-FD
ML-SD-34-1.0/1.8		

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177992
Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Sixteen (16) sediment samples for Case 47930, SDG 40177992 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/18/2018 and shipped to Pace Analytical Laboratory in Minneapolis, Minnesota for Dioxins and Furans (EPA 8290/8290A) analysis.

The Dioxin/Furan data were validated/verified by the QATS Program in accordance with the National Functional Guidelines for High Resolution Superfund Methods Data Review, April 2016, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 2 review was applied to the Dioxin data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Note that the laboratory is reporting non-detects and "J" value (estimated) sample concentrations based on the Estimated Detection Limit (EDL). The EXES program is reporting the non-detected results to either the Method Detection Limit (MDL) or EDL, whichever is the greater value. As a result, some laboratory-reported "J" value analyte results (between the EDL and Reporting Limit (RL)) are reported as detects by the laboratory as estimated ("J" values); however, the analyte concentration is less than the reported adjusted analyte MDL for the sample in the EDD file.

Listed in the table below is a summary of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Dioxin/Furan Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
Qualified "J" (EMPC) due to ion ratios not meeting criteria	2,3,4,7,8-PeCDF	J Detect	1 Sample
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,4,7,8-HxCDD	J Detect	1 Sample
Qualified "J" (EMPC) due to ion ratios not meeting criteria	2,3,4,7,8-PeCDF 1,2,3,7,8-PeCDD 1,2,3,7,8,9-HxCDF 1,2,3,4,7,8-HxCDD 1,2,3,4,7,8,9-HpCDF	J Detects	1 Sample
PCDE Interference	1,2,3,7,8-PeCDF 1,2,3,7,8,9-HxCDF	J Detects	1 Sample
PCDE Interference	1,2,3,7,8-PeCDF	J Detect	1 Sample
PCDE Interference	1,2,3,4,7,8-HxCDF	J Detect	1 Sample
Result exceeds the calibration range of the instrument	1,2,3,4,6,7,8-HpCDF Total HpCDF OCDD	J Detects	3 Samples
Result exceeds the calibration range of the instrument	Total HpCDF OCDD	J Detects	1 Sample
Result exceeds the calibration range of the instrument	1,2,3,4,6,7,8-HpCDF Total HpCDF	J Detects	1 Sample

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40177992
Laboratory: Pace Analytical

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
	Total HpCDD OCDD		
Sample results are between the EDL and the RL	Various	J Detects	14 Samples
Reported Homologue Totals Qualified per NFG	Total TCDF Total TCDD Total PeCDF Total PeCDD Total HxCDF Total HxCDD Total HpCDF Total HpCDD	J Detects UJ Non-detects	16 Samples

CHLORINATED DIBENZO-P-DIOXIN (CDD) AND CHLORINATED DIBENZOFURAN (CDF)

1. DATA COMPLETENESS

Data package was complete.

2. HOLDING TIME AND PRESERVATION

No problems were found.

3. INSTRUMENT PERFORMANCE

No problems were found.

4. CALIBRATION - INITIAL AND CONTINUING CALIBRATION

No problems were found.

5. ANALYTICAL SEQUENCE

No problems were found.

6. BLANKS – METHOD, RINSATE, FIELD

No target compounds were detected in the method blank.

7. LABELED COMPOUND RECOVERY

No problems were found.

8. INTERNAL STANDARD AREA RESPONSE

No problems were found.

9. ISOMER SPECIFICITY AND TEF

No problems were found.

10. SECOND COLUMN CONFIRMATION

No problems were found.

11. LABORATORY CONTROL SAMPLE

No problems were found.

12. MATRIX SPIKE AND MATRIX SPIKE DUPLICATE, IF APPLICABLE

No problems were found.

13. FIELD DUPLICATES, IF APPLICABLE

Samples ML-SD-26-1.0/2.0-FD and ML-SD-34-0.0/1.0-FD are the field duplicates of samples ML-SD-26-1.0/2.0 and ML-SD-34-0.0/1.0, respectively. All RPDs were within criteria.

14. ADDITIONAL INFORMATION

Ion Abundance Ratios:
Seven (7) target compounds in three samples listed ratios exceeding criteria, and were reported as Estimated Maximum Possible Concentration (EMPC) by the laboratory. Therefore, the following target compound (EMPCs) results in the following samples were qualified "J" by the QATS validator:

ML-SD-15-0.0/1.0: 2,3,4,7,8-PeCDF
ML-SD-23-0.0/1.0: 1,2,3,4,7,8-HxCDD
ML-SD-25-1.0/2.0: 2,3,4,7,8-PeCDF, 1,2,3,7,8-PeCDD, 1,2,3,7,8,9-HxCDF, 1,2,3,4,7,8-HxCDD, 1,2,3,4,7,8,9-HpCDF

PCDE Interference:
Four (4) target compounds in three samples are qualified "J" due to PCDE interference:

ML-SD-25-0.0/1.0: 1,2,3,4,7,8-HxCDF
ML-SD-24-1.0/2.0: 1,2,3,7,8-PeCDF
ML-SD-23-1.0/2.0: 1,2,3,7,8-PeCDF, 1,2,3,7,8,9-HxCDF

Calibration Range Exceeded:
Fifteen (15) target compounds in five samples exceeded the calibration range of the instrument and were qualified "J" by the QATS validator:

ML-SD-26-1.0/2.0:	1,2,3,4,6,7,8-HpCDF, Total HpCDF, OCDD
ML-SD-26-1.0/2.0-FD:	1,2,3,4,6,7,8-HpCDF, Total HpCDF, OCDD
ML-SD-23-1.0/2.0:	1,2,3,4,6,7,8-HpCDF, Total HpCDF, OCDD
ML-SD-26-0.0/1.0:	Total HpCDF, OCDD
ML-SD-24-1.0/2.0:	1,2,3,4,6,7,8-HpCDF, Total HpCDF, Total HpCDD, OCDD

Homologue Totals:
Per National Functional Guidelines, Homologue Total detected results were qualified as estimated "J" and non-detected results as estimated "UJ" in the following samples:

ML-SD-15-0.0/1.0	ML-SD-15-1.0/2.0	ML-SD-23-0.0/1.0
ML-SD-23-1.0/2.0	ML-SD-24-0.0/1.0	ML-SD-24-1.0/2.0
ML-SD-25-0.0/1.0	ML-SD-25-1.0/2.0	ML-SD-26-0.0/1.0
ML-SD-26-1.0/2.0	ML-SD-26-1.0/2.0-FD	ML-SD-28-0.0/1.0
ML-SD-33-0.0/1.2	ML-SD-34-0.0/1.0	ML-SD-34-0.0/1.0-FD
ML-SD-34-1.0/1.8		

Estimated Detects:
The following sample results are between the EDL and CRQL and are qualified "J":

ML-SD-15-0.0/1.0: 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,7,8,9-HxCDF; 2,3,4,6,7,8-HxCDF; 1,2,3,7,8-PeCDD; 1,2,3,7,8-PeCDF; 2,3,7,8-TCDD; 2,3,7,8-TCDF

ML-SD-15-1.0/2.0: 1,2,3,4,6,7,8-HpCDD; 1,2,3,6,7,8-HxCDF; OCDF

ML-SD-23-0.0/1.0: 1,2,3,4,7,8,9-HpCDF; 1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDF; 2,3,4,6,7,8-HxCDF; 1,2,3,7,8-PeCDD; 2,3,4,7,8-PeCDF; 2,3,7,8-TCDD

ML-SD-24-0.0/1.0: 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 1,2,3,4,7,8-HxCDF; 2,3,4,6,7,8-HxCDF; 1,2,3,7,8-PeCDD; 1,2,3,7,8-PeCDF; 2,3,4,7,8-PeCDF; 2,3,7,8-TCDD

ML-SD-25-0.0/1.0: 1,2,3,7,8,9-HxCDF; 2,3,4,6,7,8-HxCDF; 1,2,3,7,8-PeCDF; 2,3,4,7,8-PeCDF

ML-SD-25-1.0/2.0: 1,2,3,6,7,8-HxCDD; 1,2,3,7,8,9-HxCDD; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDF; 2,3,4,6,7,8-HxCDF

ML-SD-26-0.0/1.0: 1,2,3,7,8,9-HxCDF; 2,3,4,6,7,8-HxCDF; 1,2,3,7,8-PeCDD; 1,2,3,7,8-PeCDF

ML-SD-26-1.0/2.0: 1,2,3,7,8-PeCDF

ML-SD-26-1.0/2.0-FD: 1,2,3,7,8-PeCDF

ML-SD-28-0.0/1.0: 1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; OCDF

ML-SD-33-0.0/1.2: OCDD

ML-SD-34-0.0/1.0: OCDD

ML-SD-34-0.0/1.0-FD: OCDD

ML-SD-34-1.0/1.8: OCDD

REVIEWED BY: Timothy Vonnahme DATE: 03/08/2019

Case Number: 47930
Site Name: Munger Landing
SDG Number: 40177992
Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: April 02, 2019

SUBJECT: Review of Data for SDG Number: 40177993
Received for Review: 01/04/2019 and 03/15/2019

LABORATORY: Pace Analytical Laboratories, Minneapolis, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 2 Validation Review

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40177993

Number and Type of Samples: 10 Sediment Samples for Dioxins and Furans (EPA 8290/8290A).

EPA Sample Numbers:

ML-SD-35-0.0/1.3	ML-SD-38-0.0/1.0	ML-SD-39-1.0/1.9
ML-SD-36-0.0/1.0	ML-SD-38-1.0/1.7	ML-SD-40-0.0/1.0
ML-SD-36-1.0/1.6	ML-SD-39-0.0/1.0	ML-SD-40-1.0/2.3
ML-SD-37-0.0/1.2		

Case Number: 47930
Site Name: Munger Landing
SDG Number: 40177993
Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Ten (10) sediment samples for Case 47930, SDG 40177993 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/19/2018 and shipped to Pace Analytical Laboratory in Minneapolis, Minnesota for Dioxins and Furans (EPA 8290/8290A) analysis.

The Dioxin/Furan data were validated/verified by the QATS Program in accordance with the National Functional Guidelines for High Resolution Superfund Methods Data Review, April 2016, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 2 review was applied to the Dioxin data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Note that the laboratory is reporting non-detects and "J" value (estimated) sample concentrations based on the Estimated Detection Limit (EDL). The EXES program is reporting the non-detected results to either the Method Detection Limit (MDL) or EDL, whichever is the greater value. As a result, some laboratory-reported "J" value analyte results (between the EDL and Reporting Limit (RL)) are reported as detects by the laboratory as estimated ("J" values); however, the analyte concentration is less than the reported adjusted analyte MDL for the sample in the EDD file.

Listed in the table below is a summary of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Dioxin/Furan Fraction

Criteria Exceeded	Compounds	Validation Qualifier	Samples Impacted
Qualified "J" (EMPC) due to ion ratios not meeting criteria	2,3,4,7,8-PeCDF 1,2,3,4,6,7,8-HpCDF 1,2,3,4,7,8,9-HpCDF	J Detects	2 Samples
Qualified "J" (EMPC) due to ion ratios not meeting criteria	2,3,4,6,7,8-HxCDF	J Detects	1 Sample
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,4,7,8,9-HpCDF	J Detects	1 Sample
Qualified "J" (EMPC) due to ion ratios not meeting criteria	OCDD	J Detects	1 Sample
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,4,7,8,9-HpCDF 1,2,3,6,7,8-HxCDF	J Detects	1 Sample
Sample results are between the EDL and the RL	Various	J Detects	10 Samples
Reported Homologue Totals Qualified per NFG	Total TCDF Total TCDD Total PeCDF Total PeCDD Total HxCDF Total HxCDD Total HpCDF Total HpCDD	J Detects UJ Non-detects	10 Samples

CHLORINATED DIBENZO-P-DIOXIN (CDD) AND CHLORINATED DIBENZOFURAN (CDF)

1. DATA COMPLETENESS

Data package was complete.

2. HOLDING TIME AND PRESERVATION

No problems were found.

3. INSTRUMENT PERFORMANCE

No problems were found.

4. CALIBRATION - INITIAL AND CONTINUING CALIBRATION

No problems were found.

5. ANALYTICAL SEQUENCE

No problems were found.

6. BLANKS – METHOD, RINSATE, FIELD

No target compounds were detected in method blank DFBLKRB above the EDL.

7. LABELED COMPOUND RECOVERY

No problems were found.

8. INTERNAL STANDARD AREA RESPONSE

No problems were found.

9. ISOMER SPECIFICITY AND TEF

No problems were found.

10. SECOND COLUMN CONFIRMATION

No problems were found.

11. LABORATORY CONTROL SAMPLE

No problems were found.

12. MATRIX SPIKE AND MATRIX SPIKE DUPLICATE, IF APPLICABLE

Not applicable for this SDG data set.

13. FIELD DUPLICATES, IF APPLICABLE

Not applicable for this SDG data set.

14. ADDITIONAL INFORMATION

Ion Abundance Ratios:
Eleven (11) target compounds in six samples listed ratios exceeding criteria, and were reported as Estimated Maximum Possible Concentration (EMPC) by the laboratory. Therefore, the following target compound (EMPCs) results in the following samples were qualified "J" by the QATS validator:

ML-SD-38-0.0/1.0: 2,3,4,7,8-PeCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF
ML-SD-38-1.0/1.7: 2,3,4,6,7,8-HxCDF
ML-SD-39-1.0/1.9: 2,3,4,7,8-PeCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF
ML-SD-36-0.0/1.0: OCDD
ML-SD-40-0.0/1.0: 1,2,3,4,7,8,9-HpCDF
ML-SD-40-1.0/2.3: 1,2,3,6,7,8-HxCDF, 1,2,3,4,7,8,9-HpCDF

Homologue Totals:
Per National Functional Guidelines, Homologue Total detected results were qualified as estimated "J" and non-detected results as estimated "UJ" in the following samples:

ML-SD-35-0.0/1.3	ML-SD-38-0.0/1.0	ML-SD-39-1.0/1.9
ML-SD-36-0.0/1.0	ML-SD-38-1.0/1.7	ML-SD-40-0.0/1.0
ML-SD-36-1.0/1.6	ML-SD-39-0.0/1.0	ML-SD-40-1.0/2.3
ML-SD-37-0.0/1.2		

Estimated Detects:
The following sample results are between the EDL and CRQL and are qualified "J":

ML-SD-35-0.0/1.3: 1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; OCDF

ML-SD-36-0.0/1.0: 1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF

ML-SD-36-1.0/1.6: OCDD

ML-SD-37-0.0/1.2: OCDD

ML-SD-38-0.0/1.0: 1,2,3,4,6,7,8-HpCDD; 1,2,3,4,7,8-HxCDF; OCDF

ML-SD-38-1.0/1.7: 1,2,3,4,7,8,9-HpCDF; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDF; 2,3,4,7,8-PeCDF

ML-SD-39-0.0/1.0: 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8-HxCDF; OCDF; 2,3,4,7,8-PeCDF

ML-SD-39-1.0/1.9: 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDD; 1,2,3,4,6,7,8-HpCDD; OCDF

ML-SD-40-0.0/1.0: 1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8-HxCDF; OCDF; 2,3,4,7,8-PeCDF

ML-SD-40-1.0/2.3: 1,2,3,4,6,7,8-HpCDD; 1,2,3,4,6,7,8-HpCDF; 1,2,3,4,7,8-HxCDF; 2,3,4,6,7,8-HxCDF; 2,3,4,7,8-PeCDF

REVIEWED BY: Timothy Vonnahme DATE: 01-08-2019

Case Number: 47930
Site Name: Munger Landing
SDG Number: 40177993
Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40178112
Received for Review: 12/05/2018 and 12/07/2018

LABORATORY: Pace Analytical Laboratories, Green Bay, Wisconsin

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ and Tier 2 Validation Reviews

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40178112

Number and Type of Samples: 16 Sediment Samples for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A).

EPA Sample Numbers:

ML-SD-15-0.0/1.0	ML-SD-25-0.0/1.0	ML-SD-28-0.0/1.0
ML-SD-15-1.0/2.0	ML-SD-25-1.0/2.0	ML-SD-33-0.0/1.2
ML-SD-23-0.0/1.0	ML-SD-26-0.0/1.0	ML-SD-34-0.0/1.0
ML-SD-23-1.0/2.0	ML-SD-26-1.0/2.0	ML-SD-34-0.0/1.0-FD
ML-SD-24-0.0/1.0	ML-SD-26-1.0/2.0-FD	ML-SD-34-1.0/1.8
ML-SD-24-1.0/2.0		

Case Number: 47930 SDG Number: 40178112
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Sixteen (16) sediment samples for Case 47930, SDG 40178112 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/18/2018 and shipped to Pace Analytical Laboratory in Green Bay, Wisconsin for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A) analysis.

The organic fraction was validated/verified by the QATS Program in accordance with the National Functional Guidelines for Organic Superfund Methods Data Review, January 2017, and the inorganic fractions by the National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. Tier 2 review was applied to the Aroclor fraction and Tier 1+(*) review was applied to the Mercury and TOC fractions. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the tables below are summaries of the data qualified in each fraction.

DATA QUALIFICATION SUMMARY TABLES

Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Aroclor Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Total Organic Carbon Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930 SDG Number: 40178112
Site Name: Munger Landing Laboratory: Pace Analytical

AROCLOR ANALYSIS

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. GC PERFORMANCE

No problems were found.

3. CALIBRATION - INITIAL AND CONTINUING CALIBRATION

No problems were found.

4. BLANKS

No problems were found.

5. SURROGATE RECOVERY

No problems were found.

6. MATRIX SPIKE AND MATRIX SPIKE DUPLICATE

The MS/MSD solution consisted of Aroclor-1260 only. No problems were found.

7. LABORATORY CONTROL SAMPLE

The LCS solution consisted of Aroclor-1260 only. No problems were found.

8. FIELD BLANK AND FIELD DUPLICATES

Sample ML-SD-26-1.0/2.0 -FD is the field duplicate of sample ML-SD-26-1.0/2.0 and ML-SD-34-0.0/1.0-FD is the field duplicate of sample ML-SD-34-0.0/1.0. No Aroclors were detected in either pair.

9. INTERNAL STANDARDS

Not applicable.

10. COMPOUND IDENTIFICATION

No problems were found.

11. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

No problems were found.

Case Number: 47930 SDG Number: 40178112
Site Name: Munger Landing Laboratory: Pace Analytical

12. SYSTEM PERFORMANCE

No problems were found.

13. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Rebecca Garry DATE: 12/17/2018

Case Number: 47930 SDG Number: 40178112
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 24, 2019

SUBJECT: Review of Data for SDG Number: 40178113
Received for Review: 12/05/2018 and 12/07/2018

LABORATORY: Pace Analytical Laboratories, Green Bay, Wisconsin

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 2 Validation Review

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40178113

Number and Type of Samples: 10 Sediment Samples for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A).

EPA Sample Numbers:

ML-SD-35-0.0/1.3	ML-SD-38-0.0/1.0	ML-SD-39-1.0/1.9
ML-SD-36-0.0/1.0	ML-SD-38-1.0/1.7	ML-SD-40-0.0/1.0
ML-SD-36-1.0/1.6	ML-SD-39-0.0/1.0	ML-SD-40-1.0/2.3
ML-SD-37-0.0/1.2		

Case Number: 47930 SDG Number: 40178113
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Ten (10) sediment samples for Case 47930, SDG 40178113 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/19/2018 and shipped to Pace Analytical Laboratory in Green Bay, Wisconsin for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A) analysis.

The organic fraction was validated/verified by the QATS Program in accordance with the National Functional Guidelines for Organic Superfund Methods Data Review, January 2017, and the inorganic fractions by the National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. Tier 2 review was applied to all fractions. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the tables below are summaries of the data qualified in each fraction.

DATA QUALIFICATION SUMMARY TABLES

Aroclor Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Mercury Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Total Organic Carbon Fraction

Criteria Exceeded	Analytes	Validation Qualifier	Samples Impacted
No Criteria Exceeded			

Case Number: 47930 SDG Number: 40178113
Site Name: Munger Landing Laboratory: Pace Analytical

AROCLOR ANALYSIS

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. GC PERFORMANCE

No problems were found.

3. CALIBRATION - INITIAL AND CONTINUING CALIBRATION

No problems were found.

4. BLANKS

No problems were found.

5. SURROGATE RECOVERY

No problems were found.

6. MATRIX SPIKE AND MATRIX SPIKE DUPLICATE

The parent sample for the MS/MSD analyses are in a separate SDG. The MS/MSD solution consisted of Aroclor-1260 only.

7. LABORATORY CONTROL SAMPLE

The LCS solution consisted of Aroclor-1260 only. No problems were found.

8. FIELD BLANK AND FIELD DUPLICATES

No field blanks or field duplicates were analyzed in this SDG,

9. INTERNAL STANDARDS

Not applicable.

10. COMPOUND IDENTIFICATION

No problems were found.

11. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

No problems were found.

12. SYSTEM PERFORMANCE

No problems were found.

Case Number: 47930 SDG Number: 40178113
Site Name: Munger Landing Laboratory: Pace Analytical

13. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Rebecca Garry DATE: 12/17/2018

Case Number: 47930 SDG Number: 40178113
Site Name: Munger Landing Laboratory: Pace Analytical

MERCURY

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. INITIAL CALIBRATION

No problems were found.

3. INITIAL AND CONTINUING CALIBRATION VERIFICATION

No problems were found.

4. CRI STANDARD

No problems were found.

5. BLANKS – INITIAL AND CONTINUING

No problems were found.

6. PREPARATION BLANK

No problems were found.

7. PRE-DIGESTION/DISTILLATION MATRIX SPIKE

No problems were found.

8. POST DIGESTION SPIKE

A post-digestion spike is not required for mercury analysis.

9. LABORATORY DUPLICATE

A laboratory duplicate was not analyzed.

10. FIELD DUPLICATE COMPARISON

A field duplicate sample was not analyzed with this SDG.

11. ICP INTERFERENCE CHECK SAMPLE

An ICSAB is not required for mercury analysis.

12. LABORATORY CONTROL SAMPLE

No problems were found.

Case Number: 47930 SDG Number: 40178113
Site Name: Munger Landing Laboratory: Pace Analytical

13. SERIAL DILUTION

A serial dilution is not required for mercury analysis.

14. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Lydia Heter DATE 01/09/2019

Case Number: 47930 SDG Number: 40178113
Site Name: Munger Landing Laboratory: Pace Analytical

TOTAL ORGANIC CARBON (TOC)

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. INITIAL CALIBRATION

No problems were found.

3. INITIAL AND CONTINUING CALIBRATION VERIFICATION

The initial calibration is almost one year older than sample analysis; however, SOP S-GB-1-076-REV.02 states up to one year is acceptable. All of the SDG samples were associated with this calibration.

4. BLANKS – INITIAL AND CONTINUING

No problems were found.

5. PREPARATION BLANK

No problems were found.

6. PRE-DIGESTION/DISTILLATION MATRIX SPIKE

No problems were found.

7. LABORATORY DUPLICATE

A Laboratory Duplicate was not analyzed with this SDG.

8. FIELD DUPLICATE COMPARISON

A Field Duplicate was not analyzed with this SDG.

9. LABORATORY CONTROL SAMPLE

No problems were found.

10. ADDITIONAL INFORMATION

Sample ML-SD-39-1.0/1.9 was analyzed in quadruplicate as required in the laboratory SOP. The %RSD between the results was less than the 40% criteria specified in the SOP for both samples.

REVIEWED BY: Michael Nys DATE: 01/09/2019

Case Number: 47930 SDG Number: 40178113
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: January 30, 2019

SUBJECT: Review of Data for SDG Number: 40178190
Received for Review: 01/04/2019, 01/08/2019, and 01/25/2019

LABORATORY: Pace Analytical Laboratories, Green Bay, Wisconsin

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ and Tier 2 Validation Reviews

QATS has reviewed the data for the following SDG:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40178190

Number and Type of Samples: 17 Sediment Samples for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A).

EPA Sample Numbers:

ML-SD-01-2.0/3.0	ML-SD-23-2.0/3.0	ML-SD-26-2.0/3.0
ML-SD-02-2.0/3.0	ML-SD-23-2.0/3.0-FD	ML-SD-26-3.0/4.0
ML-SD-02-3.0/4.0	ML-SD-23-3.0/4.0	ML-SD-27-1.0/2.0
ML-SD-02-4.0/4.7	ML-SD-24-2.0/3.0	ML-SD-27-2.0/3.0
ML-SD-14-2.0/3.0	ML-SD-24-2.0/3.0-FD	ML-SD-27-3.0/3.7
ML-SD-16-2.0/3.0	ML-SD-24-3.0/4.0	

Case Number: 47930 SDG Number: 40178190
Site Name: Munger Landing Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Seventeen (17) sediment samples for Case 47930, SDG 40178190 were collected by CH2M/Jacobs from the Munger Landing site locations between 10/15-18/2018 and shipped to Pace Analytical Laboratory in Green Bay, Wisconsin for Mercury (SW-846 7471B); Aroclor (SW-846 8082A); and Total Organic Carbon (TOC) (SW-846 9060A) analysis.

The organic fraction was validated/verified by the QATS Program in accordance with the National Functional Guidelines for Organic Superfund Methods Data Review, January 2017, and the inorganic fractions by the National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. Tier 2 review was applied to the Aroclor fraction and Tier 1+(*) review was applied to the Mercury and TOC fractions. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Listed in the tables below are summaries of the data qualified in each fraction.

DATA QUALIFICATION SUMMARY TABLES

Mercury Fraction

Criteria Exceeded	Compounds	Validation Qualifier	Samples Impacted
Technical holding time exceeded	Mercury	J- Detect	ML-SD-02-2.0/3.0
Technical holding time exceeded	Mercury	R Non-detects	ML-SD-02-3.0/4.0 ML-SD-02-4.0/4.7

Aroclor Fraction

Criteria Exceeded	Compounds	Validation Qualifier	Samples Impacted
No required opening 1016/1260 CCV analysis	Aroclor-1016, Aroclor-1221 Aroclor-1232, Aroclor-1248 Aroclor-1254, Aroclor-1260 Aroclor-1262, Aroclor-1268	UJ Non-detects	1 Sample
Low surrogate recovery	All	UJ Non-detects	1 Sample

Total Organic Carbon Fraction

Criteria Exceeded	Compounds	Validation Qualifier	Samples Impacted
Holding time criteria exceeded	TOC	J Detects	ML-SD-01-2.0/3.0, ML-SD-02-2.0/3.0 ML-SD-02-3.0/4.0, ML-SD-02-4.0/4.7 ML-SD-14-2.0/3.0, ML-SD-27-1.0/2.0 ML-SD-16-2.0/3.0, ML-SD-23-2.0/3.0 ML-SD-23-2.0/3.0-FD, ML-SD-23-3.0/4.0 ML-SD-24-2.0/3.0, ML-SD-24-2.0/3.0-FD ML-SD-24-3.0/4.0, ML-SD-26-2.0/3.0 ML-SD-26-3.0/4.0, ML-SD-27-2.0/3.0 ML-SD-27-3.0/3.7

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930 SDG Number: 40178190
Site Name: Munger Landing Laboratory: Pace Analytical

AROCLOR ANALYSIS

1. HOLDING TIME AND PRESERVATION

No problems were found.

2. GC PERFORMANCE

No problems were found.

3. CALIBRATION - BOTH INITIAL AND CONTINUING CALIBRATION

One sample in this SDG was not bracketed by the method-required Aroclor-1016/1260 continuing calibration verification (CCV) analysis. For one sample (ML-SD-02-3.0/4.0), and one Method Blank, LCS, and MS/MSD analysis, an Aroclor-1242 opening CCV was analyzed and submitted in lieu of an Aroclor-1016/1260 CCV. Method SW-846 8082A states, "Verify calibration each 12-hour shift by injecting calibration verification standards prior to conducting any sample analyses. A calibration standard must also be injected at intervals of not less than once every twenty samples (after every 10 samples is recommended to minimize the number of samples requiring re-injection when QC limits are exceeded) and at the end of the analysis sequence. For Aroclor analyses, the calibration verification standard should be a mixture of Aroclor 1016 and Aroclor 1260. The calibration verification process does not require analysis of the other Aroclor standards used for pattern recognition, but the analyst may wish to include a standard for one of these Aroclors after the 1016/1260 mixture used for calibration verification throughout the analytical sequence." Note that Aroclor-1242 was not detected in the sample or QC analyses. Also note that the Aroclor-1242 CCV passed percent difference (%D) criteria. No Aroclors were detected in the sample. The non-detected Aroclors, with the exception of Aroclor-1242 are qualified "UJ".

ML-SD-02-3.0/4.0 – Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1248, Aroclor-1254, Aroclor-1260, Aroclor-1262, Aroclor-1268

4. BLANKS

No problems were found.

5. SURROGATE RECOVERY

One Aroclor sample had a surrogate percent recovery that was less than the laboratory-established surrogate recovery criteria of 49%-104%. Decachlorobiphenyl failed with a recovery of 48%. No Aroclors were detected in the sample. The non-detected results in the following sample were qualified "UJ".

ML-SD-23-3.0/4.0 – Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, Aroclor-1260, Aroclor-1262, and Aroclor-1268.

6. MATRIX SPIKE AND MATRIX SPIKE DUPLICATE

The MS/MSD solution consisted of Aroclor-1260 only. No problems were found.

Case Number: 47930 SDG Number: 40178190
Site Name: Munger Landing Laboratory: Pace Analytical

7. LABORATORY CONTROL SAMPLE

The LCS solution consisted of Aroclor-1260 only. No problems were found.

8. FIELD BLANK AND FIELD DUPLICATES

Sample ML-SD-23-2.0/3.0-FD is the field duplicate of sample ML-SD-23-2.0/3.0 and ML-SD-24-2.0/3.0-FD is the field duplicate of sample ML-SD-24-2.0/3.0. No Aroclors were detected in either pair.

9. INTERNAL STANDARDS

Not applicable.

10. COMPOUND IDENTIFICATION

No problems were found.

11. COMPOUND QUANTITATION AND REPORTED DETECTION LIMITS

No problems were found.

12. SYSTEM PERFORMANCE

No problems were found.

13. ADDITIONAL INFORMATION

No problems were found.

REVIEWED BY: Rebecca Garry DATE: 01/28/2019

Case Number: 47930 SDG Number: 40178190
Site Name: Munger Landing Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

APTIM Federal Services, LLC
QATS Program
2700 Chandler Avenue
Las Vegas, Nevada 89120

RELEASE OF VALIDATED DATA

DATE: April 02, 2019

SUBJECT: Review of Data for SDG Number: 40179190
Received for Review: 02/26/2019 and 03/15/2019

LABORATORY: Pace Analytical Laboratories, Minneapolis, Minnesota

FROM: APTIM Federal Services, LLC
Quality Assurance Technical Support (QATS) Program, Las Vegas, NV

TO: Mark Loomis, Great Lakes National Program Office (GLNPO)

LEVEL OF REVIEW: Tier 1+ Validation Review

QATS has reviewed the validated data for the following project:

SITE Name: Munger Landing Sediment Characterization, St. Louis River, Minnesota and Wisconsin

Case Number: 47930

SDG Number: 40179190

Number and Type of Samples: 13 Sediment Samples for Dioxins and Furans (EPA 8290/8290A).

EPA Sample Numbers:

ML-SD-01-2.0/3.0	ML-SD-02-2.0/3.0	ML-SD-02-3.0/4.0
ML-SD-02-4.0/4.7	ML-SD-14-2.0/3.0	ML-SD-26-2.0/3.0
ML-SD-26-3.0/4.0	ML-SD-23-2.0/3.0	ML-SD-23-2.0/3.0-FD
ML-SD-23-3.0/4.0	ML-SD-24-2.0/3.0	ML-SD-24-2.0/3.0-FD
ML-SD-24-3.0/4.0		

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40179190
Laboratory: Pace Analytical

VALIDATION SUMMARY

This report summarizes the data validation results of samples from the Munger Landing Site, St. Louis River Area of Concern in Minnesota and Wisconsin, in support of EPA's Great Lakes National Program Office (GLNPO). This evaluation was performed by APTIM's Quality Assurance Technical Support Program (QATS) under Task Order 1025.

Thirteen (13) sediment samples for Case 47930, SDG 40179190 were collected by CH2M/Jacobs from the Munger Landing site locations on 10/15/2018, 10/17/2018, and 10/18/2018 and shipped to Pace Analytical Laboratory in Minneapolis, Minnesota for Dioxins and Furans (EPA 8290/8290A) analysis.

The Dioxin/Furan data were validated/verified by the QATS Program in accordance with the National Functional Guidelines for High Resolution Superfund Methods Data Review, April 2016, and in accordance with the Munger Landing Field Sampling and Quality Assurance Project Plan, Revision 0, November 2018. A Tier 1+(*) review was applied to the Dioxin data. Automated primary validation of these data were performed prior to the QATS review via GLNPO's EXES program.

Note that the laboratory is reporting non-detects and "J" value (estimated) sample concentrations based on the Estimated Detection Limit (EDL). The EXES program is reporting the non-detected results to either the Method Detection Limit (MDL) or EDL, whichever is the greater value. As a result, some laboratory-reported "J" value analyte results (between the EDL and Reporting Limit (RL)) are reported as detects by the laboratory as estimated ("J" values); however, the analyte concentration is less than the reported adjusted analyte MDL for the sample in the EDD file.

Listed in the table below is the summary of the data qualified.

DATA QUALIFICATION SUMMARY TABLES

Dioxin/Furan Fraction

Criteria Exceeded	Compounds	Validation Qualifier	Samples Impacted
Qualified "J" (EMPC) due to ion ratios not meeting criteria	2,3,4,7,8-PeCDF	J Detect	ML-SD-01-2.0/3.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,7,8,9-HxCDD	J Detect	ML-SD-02-2.0/3.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	2,3,4,7,8-PeCDF 1,2,3,7,8-PeCDD 1,2,3,4,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,6,7,8-HxCDD 1,2,3,7,8,9-HxCDD	J Detects	ML-SD-02-3.0/4.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,4,6,7,8-HpCDD	J Detects	ML-SD-02-4.0/4.7 ML-SD-26-2.0/3.0 ML-SD-23-3.0/4.0 ML-SD-24-3.0/4.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,6,7,8-HxCDF 1,2,3,6,7,8-HxCDD	J Detects	ML-SD-14-2.0/3.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,6,7,8-HxCDD	J Detect	ML-SD-26-3.0/4.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	OCDD	J Detect	ML-SD-23-2.0/3.0 ML-SD-23-2.0/3.0-FD

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40179190
Laboratory: Pace Analytical

Criteria Exceeded	Compounds	Validation Qualifier	Samples Impacted
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,7,8-PeCDD 1,2,3,4,7,8-HxCDF	J Detects	ML-SD-24-2.0/3.0
Qualified "J" (EMPC) due to ion ratios not meeting criteria	1,2,3,4,7,8-HxCDD	J Detect	ML-SD_24-2.0/3.0-FD
RPD between original sample and field duplicate result >100%	Total HxCDF 1,2,3,4,6,7,8-HpCDF OCDF	J Detects	ML-SD-24-2.0/3.0 ML-SD-24-2.0/3.0-FD
MSD %R exceeded criteria	1,2,3,7,8,9-HxCDD	J Detect	ML-SD-02-3.0/4.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD OCDF	J Detects	ML-SD-01-2.0/3.0
Sample results are between the EDL and the RL	1,2,3,6,7,8-HxCDD 1,2,3,6,7,8-HxCDF 1,2,3,7,8-PeCDD 2,3,4,7,8-PeCDF	J Detects	ML-SD-02-2.0/3.0
Sample results are between the EDL and the RL	1,2,3,6,7,8-HxCDF	J Detects	ML-SD-02-3.0/4.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDF	J Detects	ML-SD-02-4.0/4.7
Sample results are between the EDL and the RL	1,2,3,7,8,9-HxCDD 1,2,3,7,8-PeCDD	J Detects	ML-SD-14-2.0/3.0
Sample results are between the EDL and the RL	OCDF	J Detects	ML-SD-23-3.0/4.0
Sample results are between the EDL and the RL	1,2,3,4,7,8,9-HpCDF 1,2,3,7,8,9-HxCDD 1,2,3,7,8-PeCDF 2,3,4,7,8-PeCDF	J Detects	ML-SD-24-2.0/3.0
Sample results are between the EDL and the RL	1,2,3,7,8,9-HxCDD 1,2,3,7,8,9-HxCDF 2,3,4,6,7,8-HxCDF 2,3,4,7,8-PeCDF	J Detects	ML-SD-24-2.0/3.0-FD
Sample results are between the EDL and the RL	OCDF	J Detects	ML-SD-24-3.0/4.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDF	J Detects	ML-SD-26-2.0/3.0
Sample results are between the EDL and the RL	1,2,3,4,6,7,8-HpCDD 1,2,3,7,8,9-HxCDD OCDF	J Detects	ML-SD-26-3.0/4.0
Reported Homologue Totals Qualified per NFG	Total TCDF Total TCDD Total PeCDF Total PeCDD Total HxCDF Total HxCDD Total HpCDF Total HpCDD	J Detects UJ Non-detects	ML-SD-01-2.0/3.0 ML-SD-02-2.0/3.0 ML-SD-02-3.0/4.0 ML-SD-02-4.0/4.7 ML-SD-14-2.0/3.0 ML-SD-26-2.0/3.0 ML-SD-26-3.0/4.0 ML-SD-23-2.0/3.0 ML-SD-23-2.0/3.0-FD ML-SD-23-3.0/4.0 ML-SD-24-2.0/3.0 ML-SD-24-2.0/3.0-FD ML-SD-24-3.0/4.0

(*) QATS performs a Tier 1+, where all calibration and QC are evaluated as required in a Tier 2 review; however, validation results are provided in a Tier 1 Validation Report.

Case Number: 47930
Site Name: Munger Landing

SDG Number: 40179190
Laboratory: Pace Analytical

GLNPO DATA QUALIFIER SHEET

Data Qualifier	Qualifier Definitions
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J+	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased high.
J-	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte, but may be biased low.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification and the associated numerical value represents its approximate concentration.
R	The data are unusable. The compound may or may not be present.

Appendix B
Sediment Core Logs

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-01 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization — LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore — DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft — REFUSAL ELEVATION : N/A — SEDIMENT ELEVATION : 585.1 ft — NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 18.0 ft — START : 10/15/18 08:57 — END : 10/15/18 09:10 — LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 585.1	0.0		-		0.0 - 1.5 - SILTY CLAY - moist, soft, dark grayish brown (10YR 4/2), nonplastic, no odor/staining	0.0	ML-SD-01-0.0/1.0 (1620) ML-SD-01-0.0/1.0- FD (1621)
			-		1.5 - 6.1 - SANDY SILT - moist, soft to medium soft, dark grayish brown (10YR 4/2), trace organics, no odor/staining	0.0	ML-SD-01-1.0/2.0 (1625) (MS/MSD)
			-			0.0	ML-SD-01-2.0/3.0 (1630)
			-			0.0	ML-SD-01-3.0/4.0 (1635)
			-			0.0	ML-SD-01-4.0/5.0 (1640) ML-SD-01-4.0/5.0 (1640)
5 / 580.1		8.1	VC-1				
			-			0.0	ML-SD-01-5.0/6.0 (1645) (MS/MSD)
			-		6.1 - 8.1 - CLAYEY SILT - moist, medium soft, brown (10YR 5/3), some sand, no odor/staining Small shell at 6.5'	0.0	ML-SD-01-6.0/7.0 (1650)
			-			0.0	ML-SD-01-7.0/8.1 (1655)
					End of Recovery at 8.1' bss		
10 / 575.1	10.0				End of Penetration at 10.0' bss (No Refusal)		Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-02 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.0 ft | REFUSAL ELEVATION : 579.1 ft | SEDIMENT ELEVATION : 584.3 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 18.7 ft | START : 10/15/18 09:30 | END : 10/15/18 09:45 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0							
584.3	0.0				0.0 - 2.0 SILTY CLAY - soft, moist, dark grayish brown (10YR 4/2), nonplastic, no odor/staining		ML-SD-02-0.0/1.0 (1400)
			-		Black organic silt layer at 1.2' and 1.5'	0.0	
							ML-SD-02-1.0/2.0 (1405)
			-		2.0 - 3.5 - SANDY SILT - moist, soft, dark grayish brown (10YR 4/2), trace organics, no odor/staining	0.0	
		4.7	VC-1				ML-SD-02-2.0/3.0 (1410)
			-			0.0	
					3.5 - 4.7 - SAND WITH SILT - moist, loose, dark grayish brown (10YR 4/2), trace shells and organics, fine to medium grained, nonplastic, no odor/staining		ML-SD-02-3.0/4.0 (1415)
			-			0.0	
							ML-SD-02-4.0/5.0 (1420)
					End of Recovery at 4.7' bss		
5							
579.3	5.3				End of Penetration at 5.3' bss (Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-03 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 599.6 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 3.5 ft | START : 10/15/18 10:10 | END : 10/15/18 10:25 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS SAMPLE ID
0 599.6	0.0		-		0.0 - 1.5 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), no odor/staining Wood chips from 0.8 - 1.5'	0.0	ML-SD-03-0.0/1.0 (1125)
			-		1.5 - 2.0 - CLAYEY SILT - moist, soft, very dark grayish brown (10YR 3/2), some organics, no odor/staining	0.0	ML-SD-03-1.0/2.0 (1130)
			-		2.0 - 9.7 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), fine grained sand, no odor/staining	0.0	ML-SD-03-2.0/3.0 (1135) ML-SD-03-2.0/3.0-FD (1136)
			-			0.0	ML-SD-03-3.0/4.0 (1140)
			-		Embedded layers of organic silt from 4.3 - 4.8'	0.0	ML-SD-03-4.0/5.0 (1145)
5 594.6		9.7	VC-1				ML-SD-03-5.0/6.0 (1150)
			-			0.0	ML-SD-03-6.0/7.0 (1155)
			-			0.0	ML-SD-03-7.0/8.0 (1200) ML-SD-03-7.0/8.0-FD (1201)
			-			0.0	ML-SD-03-8.0/9.0 (1205) (MS/MSD)
			-			0.0	ML-SD-03-9.0/9.7 (1210)
10 589.6	10.0				End of Recovery at 9.7' bss End of Penetration at 10.0' bss (No Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-04 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 597.1 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 6.0 ft | START : 10/15/18 10:35 | END : 10/15/18 10:50 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS SAMPLE ID
0 597.1	0.0		-		0.0 - 5.5 - CLAYEY SILT - moist, medium soft, very dark grayish brown (10YR 3/2), no odor/staining	0.0	ML-SD-04-0.0/1.0 (1430)
			-			0.0	ML-SD-04-1.0/2.0 (1435)
			-			0.0	ML-SD-04-2.0/3.0 (1440)
			-			0.0	ML-SD-04-3.0/4.0 (1445)
			-			0.0	ML-SD-04-4.0/5.0 (1450)
5 592.1		8.7	VC-1				ML-SD-04-5.0/6.0 (1455)
					5.5 - 6.7 - POORLY GRADED SAND - moist, loose, very dark grayish brown (10YR 3/2), medium grained, trace silt, no odor/staining		
			-			0.0	ML-SD-04-6.0/7.0 (1500)
					6.7 - 8.7 SANDY SILT - moist, stiff, very dark grayish brown (10YR 3/2), trace clay, medium grained, no odor/staining		
			-			0.0	ML-SD-04-7.0/8.0 (1505)
			-			0.0	ML-SD-04-8.0/8.7 (1510)
					End of Recovery at 8.7' bss		
			-				
10 587.1	10.0				End of Penetration at 10.0' bss (No Refusal)		Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-05 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 598.0 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 5.1 ft | START : 10/15/18 11:20 | END : 10/15/18 11:45 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 598.0	0.0		-		0.0 - 2.4 - CLAYEY SILT - moist, soft, dark gray (10YR 4/1), trace fine grained sand, nonplastic, no odor/staining	0.0	ML-SD-05-0.0/1.0 (1500) ML-SD-05-0.0/1.0-FD (1501)
			-			0.0	ML-SD-05-1.0/2.0 (1505) (MS/MSD)
			-		2.4 - 7.0 - SAND - moist, loose, dark gray (10YR 4/1), nonplastic, trace gravel, no odor/staining	0.0	ML-SD-05-2.0/3.0 (1510)
			-			0.0	ML-SD-05-3.0/4.0 (1515)
			-		Silt seams at 4.2', 4.8', and 5.9'	0.0	ML-SD-05-4.0/5.0 (1520) ML-SD-05-4.0/5.0-FD (1521)
5 / 593.0		7.0	VC-1			0.0	ML-SD-05-5.0/6.0 (1525) (MS/MSD)
			-			0.0	ML-SD-05-6.0/7.0 (1530)
			-		End of Recovery at 7.0' bss		
			-				
			-				
			-				
10 / 588.0	10.0				End of Penetration at 10.0' bss (No Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-06 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 602.9 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 594.8 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 8.1 ft | START : 10/15/18 13:55 | END : 10/15/18 14:05 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	SAMPLE ID	COMMENTS
0 / 594.8	0.0		-		0.0 - 2.1 - SILT - wet, very soft, very dark grayish brown (10YR 3/2), black organic silt seams and organics throughout, no odor/staining	0.0	ML-SD-06-0.0/1.0 (1625)	
			-			0.0	ML-SD-06-1.0/2.0 (1630)	
			-		2.1 - 5.9 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), medium grained sand lenses throughout, no odor/staining	0.0	ML-SD-06-2.0/3.0 (1635)	
			-			0.0	ML-SD-06-3.0/4.0 (1640)	
			-			0.0	ML-SD-06-4.0/5.0 (1645)	
5 / 589.8		7.0	VC-1					
			-			0.0	ML-SD-06-5.0/6.0 (1650)	
			-		5.9 - 7.0 - POORLY GRADED SAND - moist, loose, very dark grayish brown (10YR 3/2), trace silt, no odor/staining Silt seam from 6.4 - 6.5'	0.0	ML-SD-06-6.0/7.0 (1655)	
			-		End of Recovery at 7.0' bss			
			-					
			-					
10 / 584.8	10.0				End of Penetration at 10.0' bss (No Refusal)			Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-07 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 602.9 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 593.7 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 9.2 ft | START : 10/15/18 14:30 | END : 10/15/18 14:35 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION (SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE)	PID (ppm)	COMMENTS (SAMPLE ID)
0 / 593.7	0.0		-		0.0 - 1.5 - CLAYEY SILT - moist, soft, very dark grayish brown (10YR 3/2), dark organic silt seams from 0.0 - 0.8', no odor, slight sheen	0.0	ML-SD-07-0.0/1.0 (1030)
			-		1.5 - 2.6 - SANDY SILT - moist, soft, dark grayish brown (10YR 4/2), no odor/staining	0.0	ML-SD-07-1.0/2.0 (1035)
			-		2.6 - 7.0 - SAND - moist, loose, brown (10YR 4/3), some silt, fine to medium grained	0.0	ML-SD-07-2.0/3.0 (1040)
			-			0.0	ML-SD-07-3.0/4.0 (1045) ML-SD-07-3.0/4.0-FD (1046)
			-			0.0	ML-SD-07-4.0/5.0 (1050)
5 / 588.7		8.7	VC-1				
			-			0.0	ML-SD-07-5.0/6.0 (1055) (MS/MSD)
			-			0.0	ML-SD-07-6.0/7.0 (1100)
			-		7.0 - 8.9 - SANDY SILT - wet, soft, dark grayish brown (10YR 4/2), no odor/staining	0.0	ML-SD-07-7.0/8.0 (1105)
			-			0.0	ML-SD-07-8.0/8.9 (1110)
			-		End of Recovery at 8.9' bss		
10 / 583.7	10.0				End of Penetration at 10.0' bss (No Refusal)		Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-08 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 602.9 ft | REFUSAL ELEVATION : 592.8 ft | SEDIMENT ELEVATION : 600.0 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 2.9 ft | START : 10/15/18 15:02 | END : 10/15/18 15:05 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 600.0	0.0		-		0.0 - 1.7 - POORLY GRADED SAND WITH SILT - moist, soft, very dark grayish brown (10YR 3/2), medium grained, no odor/staining	0.0	ML-SD-08-0.0/1.0 (0950)
			-			0.0	ML-SD-08-1.0/2.0 (0955)
			-		1.7 - 6.2 - SILT WITH SAND - moist, medium soft, dark grayish brown (10YR 4/2), trace clay, no odor/staining Organic peat and shell layer from 2.5 - 3.0' bss	0.0	ML-SD-08-2.0/3.0 (1000)
		7.2	- VC-1			0.0	ML-SD-08-3.0/4.0 (1005)
			-			0.0	ML-SD-08-4.0/5.0 (1010)
5 / 595.0					Peat and shells at 4.8' bss		
			-			0.0	ML-SD-08-5.0/6.0 (1015) ML-SD-08-5.0/6.0-FD (1016)
			-		6.2 - 7.2 - SAND WITH SILT - moist, soft, very dark grayish brown (10YR 3/2), no odor/staining	0.0	ML-SD-08-6.0/7.0 (1020)
7.2					End of Recovery and Penetration at 7.0' bss (Refusal)		
10 / 590.0							

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-09 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.0 ft | REFUSAL ELEVATION : 587.5 ft | SEDIMENT ELEVATION : 595.0 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 8.0 ft | START : 10/15/18 15:34 | END : 10/15/18 15:45 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 595.0	0.0		-		0.0 - 2.3 - POORLY GRADED SAND - moist, loose, dark brown (10YR 3/3), little silt, no odor/staining	0.0	ML-SD-09-0.0/1.0 (1400)
			-			0.0	ML-SD-09-1.0/2.0 (1405)
			-		2.3 - 4.0 - CLAYEY SILT - moist, soft, very dark grayish brown (10YR 3/2), no odor/staining	0.0	ML-SD-09-2.0/3.0 (1410)
		5.2	- VC-1			0.0	ML-SD-09-3.0/4.0 (1415) ML-SD-09-3.0/4.0-FD (1416)
			-		4.0 - 5.2 - SANDY SILT - moist, loose, dark brown (10YR 3/3), no odor/staining	0.0	ML-SD-09-4.0/5.2 (1420) (MS/MSD)
5 / 590.0			-		End of Recovery at 5.2' bss		
	7.5				End of Penetration at 7.5' bss (Refusal)		Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable
10 / 585.0							

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-10 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.0 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 595.4 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 7.6 ft | START : 10/15/18 16:20 | END : 10/15/18 16:25 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION (SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE)	PID (ppm)	COMMENTS (SAMPLE ID)
0 / 595.4	0.0		-		0.0 - 1.8 - SILT - moist, soft, very dark grayish brown (10YR 3/2), some clay, no odor/staining	0.0	ML-SD-10-0.0/1.0 (1545) ML-SD-10-0.0/1.0-FD (1546)
			-			0.0	ML-SD-10-1.0/2.0 (1550)
			-		1.8 - 5.8 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), trace organics, no odor/staining	0.0	ML-SD-10-2.0/3.0 (1555)
			-			0.0	ML-SD-10-3.0/4.0 (1600)
			-			0.0	ML-SD-10-4.0/5.0 (1605) ML-SD-10-4.0/5.0-FD (1606)
5 / 590.4		8.6	VC-1				
			-			0.0	ML-SD-10-5.0/6.0 (1610) (MS/MSD)
			-		5.8 - 7.2 - SILTY SAND - moist, loose, brown (10YR 4/3), no odor/staining	0.0	ML-SD-10-6.0/7.0 (1615)
			-		7.2 - 8.6 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), no odor/staining	0.0	ML-SD-03-7.0/8.0 (1620)
			-			0.0	ML-SD-03-8.0/8.6 (1625)
			-		End of Recovery at 8.6' bss		
10 / 585.4	10.0				End of Penetration at 10.0' bss (No Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-11 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft | REFUSAL ELEVATION : 592.5 ft | SEDIMENT ELEVATION : 598.5 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 4.6 ft | START : 10/15/18 17:00 | END : 10/15/18 17:05 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS SAMPLE ID
0 / 598.5	0.0		-		0.0 - 0.8 - CLAYEY SILT - moist, soft, very dark gray (10YR 3/1), thin organic black silt seams throughout, no odor/staining	0.0	ML-SD-11-0.0/1.0 (1510)
			-		0.8 - 4.7 - SILT - moist, medium soft, very dark grayish brown (10YR 3/2), trace clay, no odor/staining	0.0	ML-SD-11-1.0/2.0 (1515)
			-			0.0	ML-SD-11-2.0/3.0 (1520)
		6.0	VC-1				
			-			0.0	ML-SD-11-3.0/4.0 (1525)
			-			0.0	ML-SD-11-4.0/5.0 (1530) ML-SD-11-4.0/5.0-FD (1531)
5 / 593.5			-		4.7 - 6.0 - SILT with ORGANICS - moist, soft to medium soft, very dark gray (10YR 3/1), no odor/staining	0.0	ML-SD-11-5.0/6.0 (1535) (MS/MSD)
6.0					End or Recovery and Penetration at 6.0' bss (Refusal)		
10							

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-12 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 600.6 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 2.5 ft | START : 10/16/18 08:28 | END : 10/16/18 08:30 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 600.6	0.0				0.0 - 0.5 - SILT - wet, soft, very dark grayish brown (10YR 3/2), some fine grained sand trace organics	0.0	ML-SD-12-0.0/1.0 (1440)
			-		0.5 - 1.7 - SANDY SILT - wet, soft, very dark grayish brown (10YR 3/2), trace organics	0.0	ML-SD-12-1.0/2.0 (1445)
			-		1.7 - 1.9 - CLAYEY SILT - very dark grayish brown (10YR 3/2), trace organics	0.0	ML-SD-12-2.0/3.0 (1450)
			-		1.9 - 10.0 - SANDY SILT Wood debris at 2.7', 3.1' and 3.6'	0.0	ML-SD-12-3.0/4.0 (1455)
			-			0.0	ML-SD-12-4.0/5.0 (15:00)
5 / 595.6		10.0	VC-1			0.0	ML-SD-12-5.0/6.0 (1505)
			-		Organic black silt seam at 5.7'	0.0	ML-SD-12-6.0/7.0 (1510)
			-		Clayey silt lense from 7.0 - 7.2'	0.0	ML-SD-12-7.0/8.0 (1515)
			-			0.0	ML-SD-12-8.0-9.0 (1520)
			-			0.0	ML-SD-12-9.0/10.0 (1525)
10 / 590.6	10.0				End of Recovery and Penetration at 10.0' bss (No Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-13 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.2 ft | REFUSAL ELEVATION : 593.7 ft | SEDIMENT ELEVATION : 598.7 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 4.5 ft | START : 10/15/18 17:32 | END : 10/15/18 17:35 | LOGGER : R. Kaliappan

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 598.7	0.0		-		0.0 - 4.9 SILT WITH SAND - moist, medium soft, increasing soft with depth, very dark grayish brown (10YR 3/2),	0.0	ML-SD-13-0.0/1.0 (0920) ML-SD-13-0.0/1.0-FD (0921)
			-			0.0	ML-SD-13-1.0/2.0 (0925) (MS/MSD)
		4.9	VC-1 -			0.0	ML-SD-13-2.0/3.0 (0930)
			-			0.0	ML-SD-13-3.0/4.0 (0935)
			-			0.0	ML-SD-13-4.0/5.0 (0940)
5 / 593.7	5.0				End of Recovery at 4.9' bss End of Penetration at 5.0' bss (Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-14 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.2 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 594.8 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 8.4 ft | START : 10/16/18 11:01 | END : 10/16/18 11:02 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS SAMPLE ID
0							
594.8	0.0		-		0.0 - 2.4 - ORGANIC SILT - wet, soft, very dark gray (10YR 3/1), trace organics and fine sand	0.0	ML-SD-14-0.0/1.0 (1540)
			-		Color change at 1.4' to very dark grayish brown (10YR 3/2)	0.0	ML-SD-14-1.0/2.0 (1545)
			-		2.4 - 6.3 - SANDY SILT -moist, soft, very dark grayish brown (10YR 3/2) Organic layer (wood chips) from 2.9 - 3.1'	0.0	ML-SD-14-2.0/3.0 (1550)
			-			0.0	ML-SD-14-3.0/4.0 (1555)
			-		Medium sand lenses from 2.4 - 2.5', 4.4 - 4.5', 5.7 - 5.9'	0.0	ML-SD-14-4.0/5.0 (1600)
5 589.8		9.4	VC-1				
			-			0.0	ML-SD-14-5.0/6.0 (1605)
			-		6.3 - 8.0 - POORLY GRADED SAND WITH SILT - wet, loose, very dark grayish brown (10YR 3/2), trace organics	0.0	ML-SD-14-6.0/7.0 (1610)
			-			0.0	ML-SD-14-7.0/8.0 (1615)
			-		8.0 - 9.4 - SANDY SILT WITH CLAY - wet, loose, very dark grayish brown (10YR 3/2)	0.0	ML-SD-14-8.0-9.4 (1620)
					Medium sand lense at 9.4' End of Recovery at 9.4' bss		
10 584.8	10.0				End of Penetration at 10.0' bss (No Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-15 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization — LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore — DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.0 ft — REFUSAL ELEVATION : 589.8 ft — SEDIMENT ELEVATION : 599.0 ft — NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 4.0 ft — START : 10/16/18 12:00 — END : 10/16/18 12:01 — LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 599.0	0.0		-		0.0 - 3.0 - CLAYEY SILT - moist, medium soft, very dark grayish brown (10YR 3/2), trace sand and organics	0.0	ML-SD-15-0.0/1.0 (0800)
			-			0.0	ML-SD-15-1.0/2.0 (0805)
			-			0.0	ML-SD-15-2.0/3.0 (0810)
			-		3.0 - 5.7 - SILT - moist, medium soft, very dark grayish brown (10YR 3/2), trace sand and clay Organic black silt seam at 3.0', 3.9', 4.1', and 4.9'	0.0	ML-SD-15-3.0/4.0 (0815)
		9.0	- VC-1			0.0	ML-SD-15-4.0/5.0 (0820) ML-SD-15-4.0/5.0-FD (0820)
5 / 594.0			-			0.0	ML-SD-15-5.0/6.0 (0825)
					5.7 - 6.2 - CLAYEY SILT -moist, medium soft, very dark grayish brown (10YR 3/2), trace sand and organics		
			-		6.2 - 9.0 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2)	0.0	ML-SD-15-6.0/7.0 (0830)
			-			0.0	ML-SD-15-7.0/8.0 (0835)
			-		Organic black silt seam at 8.6'	0.0	ML-SD-15-8.0-9.4 (0840)
	9.3				End of Recovery at 9.0' bss End of Penetration at 9.3' bss (Refusal)		
10 / 589.0							Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-16 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 602.9 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 597.7 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 5.2 ft | START : 10/16/18 15:32 | END : 10/16/18 15:34 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 597.7	0.0		-		0.0 - 6.5 - SILT WITH FINE SAND AND ORGANICS - moist, soft, very dark grayish brown (10YR 3/2)	0.0	ML-SD-16-0.0/1.0 (0940)
			-			0.0	ML-SD-16-1.0/2.0 (0945)
			-			0.0	ML-SD-16-2.0/3.0 (0950)
			-			0.0	ML-SD-16-3.0/4.0 (0955)
			-			0.0	ML-SD-16-4.0/5.0 (1000)
5 / 592.7		10.0	VC-1				ML-SD-16-5.0/6.0 (1005)
			-		6.5 - 10.0 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2)	0.0	ML-SD-16-6.0/7.0 (1010)
			-		Organic silt seam at 7.2'	0.0	ML-SD-16-7.0/8.0 (1015)
			-		Clayey silt seam at 8.4' and 9.3'	0.0	ML-SD-16-8.0-9.0 (1020)
			-			0.0	ML-SD-16-9.0-10.0 (1025)
10 / 587.7	10.0				End of Recovery and Penetration at 10.0' bss (No Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-17 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft | REFUSAL ELEVATION : 595.6 ft | SEDIMENT ELEVATION : 598.6 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 4.5 ft | START : 10/16/18 10:23 | END : 10/16/18 10:25 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 598.6	0.0				0.0 - 0.5 - CLAYEY SILT - wet, soft, very dark grayish brown (10YR 3/2), plastic trash from 0.2 - 0.4'		
			-		0.5 - 3.0 - SILT - medium soft, moist, very dark grayish brown (10YR 3/2), some sand, trace organics	0.0	ML-SD-17-0.0/1.0 (0800)
		3.0	VC-1 -			0.0	ML-SD-17-1.0/2.0 (0805)
			-			0.0	ML-SD-17-2.0/3.0 (0810)
	3.0				End of Recovery and Penetration at 3.0' bss (Refusal)		
5 / 593.6							

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-18 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 602.9 ft | REFUSAL ELEVATION : 590.3 ft | SEDIMENT ELEVATION : 599.5 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 3.4 ft | START : 10/16/18 16:06 | END : 10/16/18 16:08 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION (SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE)	PID (ppm)	COMMENTS (SAMPLE ID)
0 / 599.5	0.0		-		0.0 - 1.7 - SANDY SILT WITH ORGANICS - moist, soft, very dark grayish brown (10YR 3/2)	1.1	ML-SD-18-0.0/1.0 (0845)
			-			1.0	ML-SD-18-1.0/2.0 (0850)
					1.7 - 6.8 - CLAYEY SILT - moist, soft, very dark grayish brown, some fine sand		
			-			0.0	ML-SD-18-2.0/3.0 (0855)
					Organic wood seams at 3.0', 3.8', and 5.0'		
			-			0.0	ML-SD-18-3.0/4.0 (0900)
			-			0.0	ML-SD-18-4.0/5.0 (0905)
5 / 594.5		9.2	VC-1				
			-			0.0	ML-SD-18-5.0/6.0 (0910)
			-			0.0	ML-SD-18-6.0/7.0 (0915)
					6.8 - 9.2 - SILT - moist, loose, very dark grayish brown (10YR 3/2), medium sand seams and trace organics throughout		
			-			0.0	ML-SD-18-7.0/8.0 (0920)
			-			0.0	ML-SD-18-8.0-9.2 (0925)
					Wood seam at 8.9'		
	9.5				End of Recovery at 9.2' bss		
					End of Penetration at 9.5' bss (Refusal)		
10 / 589.5							

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-19 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization — LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore — DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 602.9 ft — REFUSAL ELEVATION : N/A — SEDIMENT ELEVATION : 599.6 ft — NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 3.3 ft — START : 10/16/18 16:37 — END : 10/16/18 16:39 — LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 599.6	0.0		-		0.0 - 0.8 - SILT - moist, soft, very dark grayish brown (10YR 3/2), some organics	0.9	ML-SD-19-0.0/1.0 (1130)
			-		0.8 - 4.2 - SILT WITH MEDIUM SAND - moist, soft, very dark grayish brown (10YR 3/2), trace clay	0.5	ML-SD-19-1.0/2.0 (1135) ML-SD-19-1.0/2.0-FD (1136)
			-			0.0	ML-SD-19-2.0/3.0 (1140)
			-			0.0	ML-SD-19-3.0/4.0 (1145)
			-		4.2 - 5.2 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), trace organics	0.0	ML-SD-19-4.0/5.0 (1150)
5 / 594.6		10.0	VC-1		5.2 - 8.1 - SILT WITH SAND - moist, soft, very dark grayish brown (10YR 3/2), trace clay and organics	0.0	ML-SD-19-5.0/6.0 (1155)
			-			0.0	ML-SD-19-6.0/7.0 (1200)
			-			0.0	ML-SD-19-7.0/8.0 (1205)
			-		8.1 - 10.0 - SAND WITH SILT - moist, loose, very drak grayish brown (10YR 3/2)	0.0	ML-SD-19-8.0-9.0 (1210)
			-		Silt clay seam at 9.2'	0.0	ML-SD-19-9.0-10.0 (1215)
10 / 589.6	10.0				End of Recovery and Penetration at 10.0' bss (No Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-20 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.2 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 600.8 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 2.4 ft | START : 10/16/18 08:56 | END : 10/16/18 08:57 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 600.8	0.0		-		0.0 - 1.5 - CLAYEY SILT WITH ORGANICS - moist, soft, very dark grayish brown (10YR 3/2)	0.0	ML-SD-20-0.0/1.0 (1630)
			-		1.5 - 6.5 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), some clay	0.0	ML-SD-20-1.0/2.0 (1635)
			-			0.0	ML-SD-20-2.0/3.0 (1640)
			-			0.0	ML-SD-20-3.0/4.0 (1645)
			-			0.0	ML-SD-20-4.0/5.0 (1650)
5 / 595.8		10.0	VC-1				
			-			0.0	ML-SD-20-5.0/6.0 (1655) ML-SD-20-5.0/6.0-FD (1656)
			-		6.5 - 10.0 - CLAYEY SILT - moist, soft, very dark grayish brown (10YR 3/2)	0.0	ML-SD-20-6.0/7.0 (1700)
			-			0.0	ML-SD-20-7.0/8.0 (1705) (MS/MSD)
			-		Alternating bands of black organic silt and clayey silt from 8.6 - 9.0' and 9.5 - 9.6'	0.0	ML-SD-20-8.0-9.0 (1710)
							ML-SD-20-9.0-10.0 (1715)
10 / 590.8	10.0				End of Recovery and Penetration at 10.0' bss (No Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-21 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization — LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore — DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft — REFUSAL ELEVATION : N/A — SEDIMENT ELEVATION : 600.1 ft — NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 3.0 ft — START : 10/16/18 09:36 — END : 10/16/18 09:37 — LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 600.1	0.0		-		0.0 - 2.5 - CLAYEY SILT - moist, soft, very dark grayish brown (10YR 3/2), low plasticity, trace organics	0.0	ML-SD-21-0.0/1.0 (1350)
			-			0.0	ML-SD-21-1.0/2.0 (1355)
			-			0.0	ML-SD-21-2.0/3.0 (1400)
			-		2.5 - 10.0 - SANDY SILT - wet, soft, very dark grayish brown (10YR 3/2), trace organics throughout, some clay	0.0	ML-SD-21-3.0/4.0 (1405)
			-			0.0	ML-SD-21-4.0/5.0 (1410)
5 / 595.1		10.0	VC-1			0.0	ML-SD-21-5.0/6.0 (1415)
			-			0.0	ML-SD-21-6.0/7.0 (1420)
			-			0.0	ML-SD-21-7.0/8.0 (1425)
			-			0.0	ML-SD-21-8.0-9.0 (1430)
			-			0.0	ML-SD-21-9.0-10.0 (1435)
10 / 590.1	10.0				End of Recovery and Penetration at 10.0' bss (No Refusal)		Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-22 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization — LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore — DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.0 ft — REFUSAL ELEVATION : 590.4 ft — SEDIMENT ELEVATION : 599.4 ft — NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 3.6 ft — START : 10/16/18 17:06 — END : 10/16/17 17:08 — LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION (SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE)	PID (ppm)	COMMENTS (SAMPLE ID)
0 (599.4)	0.0		-		0.0 - 0.8 - SILT - moist, soft, very dark grayish brown (10YR 3/2), trace sand and organics	0.0	ML-SD-22-0.0/1.0 (1050)
			-		0.8 - 5.9 - SANDY SILT WITH ORGANICS - moist, soft, very dark grayish brown (10YR 3/2)	0.0	ML-SD-22-1.0/2.0 (1055)
			-		Organic silt seam at 1.9 and 5.3'	0.0	ML-SD-22-2.0/3.0 (1100)
			-			0.0	ML-SD-22-3.0/4.0 (1105)
		9.0	VC-1			0.0	ML-SD-22-4.0/5.0 (1110)
5 (594.4)			-				
			-			0.0	ML-SD-22-5.0/6.0 (1115)
			-		5.9 - 6.7 - POORLY GRADED SAND WITH SILT - most, loose, very dark grayish brown (10YR 3/2), medium grained, some organics	0.0	ML-SD-22-6.0/7.0 (1120)
			-		6.7 - 9.0 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), trace organics	0.0	ML-SD-22-7.0/8.0 (1125)
			-			0.0	ML-SD-22-8.0-9.0 (1130)
9.0					End of Recovery and Penetration at 9.0' bss (Refusal)		
10 (589.4)							

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-23 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 596.9 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 6.2 ft | START : 10/17/18 09:13 | END : 10/17/18 09:15 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 596.9	0.0		-		0.0 - 2.3 - SILT - moist, very soft, black (10YR 2/1), trace organics, slight odor, no staining	0.0	ML-SD-23-0.0/1.0 (1200)
			-			0.0	ML-SD-23-1.0/2.0 (1205)
			-		2.3 - 6.8 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), little clay	0.0	ML-SD-23-2.0/3.0 (1210) ML-SD-23-2.0/3.0-FD (1211)
			-		Organic seam at 3.2 - 3.3', 3.7', 4.1', and 4.5'	0.0	ML-SD-23-3.0/4.0 (1215)
			-			0.0	ML-SD-23-4.0/5.0 (1220) ML-SD-23-4.0/5.0-FD (1221)
5 / 591.9		9.8	VC-1				
			-			0.0	ML-SD-23-5.0/6.0 (1225)
			-			0.0	ML-SD-23-6.0/7.0 (1230)
			-		6.8 - 7.6 - SILTY SAND - moist, loose, very dark grayish brown (10YR 3/2), little organics	0.0	ML-SD-23-7.0/8.0 (1235)
			-		7.6 - 9.8 - SANDY SILT - moist, soft, very dark grayish brown (10YR 3/2), trace clay, some organics	0.0	ML-SD-23-8.0-9.0 (1240)
			-			0.0	ML-SD-23-9.0-10.0 (1245)
10 / 586.9	10.0				End of Recovery at 9.8' bss End of Penetration at 10.0' bss (No Refusal)		Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-24 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.2 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 594.6 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 8.6 ft | START : 10/17/18 09:47 | END : 10/17/18 09:49 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 594.6	0.0		-		0.0 - 4.5 - SILT - wet, soft to medium soft with depth, black (10YR 2/1), trace fine grained sand and organics	0.0	ML-SD-24-0.0/1.0 (1000)
			-		Organic black silt seam from 1.6 - 1.7'	0.0	ML-SD-24-1.0/2.0 (1005)
			-		Color change to very dark grayish brown (10YR 3/2) from 2.5 - 4.5'	0.0	ML-SD-24-2.0/3.0 (1010) ML-SD-24-2.0/3.0-FD (1015)
			-			0.0	ML-SD-24-3.0/4.0 (1015)
			-			0.0	ML-SD-24-4.0/5.0 (1020)
5 / 589.6		9.4	VC-1		4.5 - 9.4 - SANDY SILT - moist, medium soft, very dark grayish brown (10YR 3/2), no odor/staining		
			-		Poorly graded medium sand lense from 5.3 - 5.8'	0.0	ML-SD-24-5.0/6.0 (1025)
			-			0.0	ML-SD-24-6.0/7.0 (1030)
			-			0.0	ML-SD-24-7.0/8.0 (1035)
			-			0.0	ML-SD-24-8.0-9.4 (1040)
					End of Recovery at 9.4' bss		
10 / 584.6	10.0				End of Penetration at 10.0' bss		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-25 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 602.9 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 595.4 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 7.5 ft | START : 10/17/18 08:08 | END : 10/17/18 08:10 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 595.4	0.0		-		0.0 - 1.5 - SILT WITH ORGANICS - wet, soft, very dark grayish brown (10YR 3/2), black organic silt seam from 0.0 - 0.3'	0.0	ML-SD-25-0.0/1.0 (0930)
			-		1.5 - 5.1 - SANDY SILT WITH CLAY - moist, soft, very dark grayish brown (10YR 3/2), increasing medium sand with depth	0.0	ML-SD-25-1.0/2.0 (0935)
			-			0.0	ML-SD-25-2.0/3.0 (0940)
			-			0.0	ML-SD-25-3.0/4.0 (0945)
			-			0.0	ML-SD-25-4.0/5.0 (0950)
5 / 590.4		7.8	VC-1		5.1 - 6.1 - SAND WITH SILT - moist, loose, very dark grayish brown (10YR 3/2), poorly sorted	0.0	ML-SD-25-5.0/6.0 (0955)
			-		6.1 - 7.0 - SILT WITH LITTLE SAND - moist, medium, very dark grayish brown (10YR 3/2)	0.0	ML-SD-25-6.0/7.0 (1000)
			-		7.0 - 7.8 - SAND WITH SILT - moist, loose, very dark grayish brown (10YR 3/2), poorly sorted, medium grained	0.0	ML-SD-25-7.0/7.8 (1005)
					End of Recovery at 7.8' bss		
10 / 585.4	10.0				End of Penetration at 10.0' bss (No Refusal)		Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-26 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.0 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 595.0 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 8.0 ft | START : 10/17/18 08:43 | END : 10/17/18 08:45 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 595.0	0.0		-		0.0 - 2.3 - CLAYEY SILT - wet, soft, very dark grayish brown (10YR 3/2), trace organics, no odor/staining	0.0	ML-SD-26-0.0/1.0 (1400)
			-			0.0	ML-SD-26-1.0/2.0 (1405) ML-SD-26-1.0/2.0-FD (1406)
			-		2.3 - 10.0 - SANDY SILT - moist, medium soft, very dark grayish brown (10YR 3/2), trace organics, no odor/staining	0.0	ML-SD-26-2.0/3.0 (1410)
			-			0.0	ML-SD-26-3.0/4.0 (1415)
			-			0.0	ML-SD-26-4.0/5.0 (1420)
5 / 590.0		10.0	VC-1				
			-			0.0	ML-SD-26-5.0/6.0 (1425)
			-			0.0	ML-SD-26-6.0/7.0 (1430)
			-			0.0	ML-SD-26-7.0/8.0 (1435) (MS/MSD)
			-			0.0	ML-SD-26-8.0-9.0 (1440)
			-			0.0	ML-SD-26-9.0-10.0 (1445) ML-SD-26-9.0-10.0-FD (1446)
10 / 585.0	10.0				End of Recovery and Penetration at 10.0' bss		Abbreviations: VC - Vibracore bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-27 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.2 ft | REFUSAL ELEVATION : 594.7 ft | SEDIMENT ELEVATION : 599.9 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 3.3 ft | START : 10/17/18 11:18 | END : 10/17/18 11:20 | LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 599.9	0.0		-		0.0 - 3.7 - SILT WITH ORGANICS (ROOTS) - moist, soft, very dark brown (10YR 2/2), trace clay	0.0	ML-SD-27-0.0/1.0 (1705)
			-			0.0	ML-SD-27-1.0/2.0 (1710)
		3.7	- VC-1			0.0	ML-SD-27-2.0/3.0 (1715)
			-			0.0	ML-SD-27-3.0/3.7 (1720)
					End of Recovery at 3.7' bss		
5 / 594.9	5.3				End of Penetration at 5.3' bss (Refusal)		

Abbreviations:
VC - Vibracore
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:	
EG1693SC	ML-SD-28	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization — LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Vibracore — DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft — REFUSAL ELEVATION : 589.6 ft — SEDIMENT ELEVATION : 598.8 ft — NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 4.3 ft — START : 10/17/18 11:52 — END : 10/17/18 11:53 — LOGGER : USEPA

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0 / 598.8	0.0		-		0.0 - 4.6 - POORLY GRADED SAND - wet, loose, very dark grayish brown (10YR 3/2), little silt	0.0	ML-SD-28-0.0/1.0 (0845)
			-			0.0	ML-SD-28-1.0/2.0 (0850)
			-			0.0	ML-SD-28-2.0/3.0 (0855)
			-			0.0	ML-SD-28-3.0/4.0 (0900) ML-SD-28-3.0/4.0-FD (0901)
			-			0.0	ML-SD-28-4.0/5.0 (0905)
5 / 593.8		8.4	VC-1		4.6 - 5.3 - SILTY SAND - wet, soft, very dark grayish brown (10YR 3/2), trace clay		
			-		5.3 - 8.4 - POORY GRADED SAND - wet, loose, very dark grayish brown (10YR 3/2), little silt	0.0	ML-SD-28-5.0/6.0 (0910)
			-			0.0	ML-SD-28-6.0/7.0 (0915)
			-			0.0	ML-SD-28-7.0/8.4 (0920)
					End of Recovery at 8.4' bss		
	9.3				End of Penetration at 9.3' bss (Refusal)		
10 / 588.8							Abbreviations: PN - Ponar bss - Below Sediment Surface N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-29 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Ponar | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.2 ft | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : 602.2 ft | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 1.0 ft | START : 10/15/18 10:15 | END : 10/15/18 10:25 | LOGGER : S. Bigda

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0							
602.2	0.0 0.3	0.3	PN-1		0.0 - 0.25 - ORGANIC SILT - wet, soft, very dark grayish brown (10YR 3/2), organics throughout, no odor	0.0	ML-SD-29-0.0/0.25 (1140)
					End of Recovery and Penetration at 0.25' bss		

Abbreviations:
PN - Ponar
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-30 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization — LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Ponar — DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft — REFUSAL ELEVATION : N/A — SEDIMENT ELEVATION : 599.0 ft — NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 4.1 ft — START : 10/15/18 10:35 — END : 10/15/18 10:45 — LOGGER : S. Bigda

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0							
599.0	0.0 0.3	0.3	PN-1		0.0 - 0.25 -ORGANIC SILT - wet, soft, very dark grayish brown (10YR 3/2), nonplastic	0.0	ML-SD-30-0.0/0.25 (1115)
					End of Recovery and Penetration at 0.25' bss		

Abbreviations:
PN - Ponar
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:	
EG1693SC	ML-SD-31	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization — LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Ponar — DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.0 ft — REFUSAL ELEVATION : N/A — SEDIMENT ELEVATION : 599.0 ft — NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 4.0 ft — START : 10/15/18 10:45 — END : 10/15/18 10:50 — LOGGER : S. Bigda

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0							
599.0	0.0 0.3	0.3	PN-1		0.0 - 0.25 - ORGANIC SILT - wet, soft, very dark grayish brown (10YR 3/2), trace shells, nonplastic	0.0	ML-SD-31-0.0/0.25 (1210)
					End of Recovery and Penetration at 0.25' bss		

Abbreviations:
PN - Ponar
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-32 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization — LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : R/V Mudpuppy, Ponar — DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : 603.1 ft — REFUSAL ELEVATION : N/A — SEDIMENT ELEVATION : 599.9 ft — NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 3.2 ft — START : 10/15/18 10:50 — END : 10/15/18 10:55 — LOGGER : S. Bigda

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0							
599.9	0.0 0.3	0.3	PN-1		0.0 - 0.25 - ORGANIC SILT - wet, soft, very dark grayish brown (10YR 3/2), nonplastic, no odor	0	ML-SD-32-0.0/0.25 (1220)
					End of Recovery and Penetration at 0.25' bss		

Abbreviations:
PN - Ponar
bss - Below Sediment Surface
N/A - Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-33 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : Manual Core | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : N/A | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : N/A | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 0.2 ft | START : 10/18/18 12:00 | END : 10/18/18 12:40 | LOGGER : K. Ma

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION (SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE)	PID (ppm)	COMMENTS (SAMPLE ID)
0	0.0				0.0 - 0.3 - SAND - moist, loose, dark reddish brown (5YR 3/3), little silt, trace gravel		
			-		0.3 - 0.6 - SMALL GRAVEL - moist, loose, dark reddish brown (5Y 3/3, some silt	0.0	
		1.2	PC-1		0.6 - 1.2 - SANDY SILT - moist, medium soft, dark reddish brown (5Y 3/4), trace organics		ML-SD-33-0.0/1.2 (1700)
					End of Recovery at 1.2' bss		
	1.9				End of Penetration at 1.9' bss (Refusal)		
5							Abbreviations: PC - Push Core bss - Below Sediment Surface N/A Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-34 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : Manual Core | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : N/A | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : N/A | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 0.2 ft | START : 10/18/18 11:00 | END : 10/18/18 12:00 | LOGGER : K. Ma

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS SAMPLE ID
0	0.0						
			-		0.0 - 0.7 - POORLY SAND WITH GRAVEL - moist, loose, very dark grayish brown (10YR 3/2), trace silt, trace glass debris	0.0	ML-SD-34-0.0/1.0 (1625) ML-SD-34-0.0/1.0-FD (1626)
		1.8	PC-1		0.7 - 1.8 CLAYEY SILT - moist, soft, dark brown (7.5YR 3/3), little medium grained sand, trace organics, layers of dark reddish brown (2.5YR 3/3) sandy silt throughout		
			-			0.0	ML-SD-34-1.0/1.8 (1630) (MS/MSD)
					End of Recovery at 1.8' bss		
	2.2				End of Penetration at 2.2' bss (Refusal)		
5							Abbreviations: PC - Push Core bss - Below Sediment Surface N/A Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-35 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : Manual Core | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : N/A | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : N/A | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 0.5 ft | START : 10/18/18 15:00 | END : 10/18/18 15:30 | LOGGER : K. Ma

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS SAMPLE ID
0	0.0				0.0 - 0.2 - POORLY GRADED SAND - moist, loose, yellowish red (5YR 4/6), medium to coarse grained		
					0.2 - 0.4 - SILTY SAND - moist, loose, yelowish red (5YR 4/6), trace coarse sand		
			-		0.4 - 1.3 - CLAYEY SILT - moist, medium soft, yellowish red (5YR 4/6), little sand, trace organics, possible copper oxidation at 0.8' and 1.1'	0.0	ML-SD-35-0.0/1.3 (0840)
		1.3	PC-1				
					End of Recovery at 1.3' bss		
	2.0				End of Penetration at 2.0' bss (Refusal)		
5							

Abbreviations:
PC - Push Core
bss - Below Sediment Surface
N/A Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-36 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : Manual Core | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : N/A | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : N/A | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 2.1 ft | START : 10/18/18 14:30 | END : 10/18/18 15:05 | LOGGER : K. Ma

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0	0.0				0.0 - 1.6 - SANDY SILT - moist, soft to medium soft with depth, reddish brown (5YR 4/4), trace organics, no odor/staining		
			-			0.0	ML-SD-36-0.0/1.0 (0855)
		1.6	PC-1				
			-			0.0	ML-SD-36-1.0/2.0 (0900)
	1.9				End of Recovery at 1.6' bss		
					End of Penetration at 1.9' bss (Refusal)		Abbreviations: PC - Push Core bss - Below Sediment Surface N/A Not Applicable
5							

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-37 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : Manual Core | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : N/A | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : N/A | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 0.5 ft | START : 10/19/18 10:20 | END : 10/19/18 11:00 | LOGGER : K. Ma

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS SAMPLE ID
0	0.0				0.0 - 0.5 - SILTY SAND WITH GRAVEL - wet, loose, yellowish red (5YR 4/6), trace organics, small to large gravel		
		1.2	- PC-1		0.5 - 1.2 - CLAYEY SILT - wet, soft, yellowish red (5YR 4/6), trace organics Large gravel from 0.7 - 0.8' Wood chunk from 1.1 - 1.2'	0.0	ML-SD-37-0.0/1.2 (1210)
	1.4				End of Recovery at 1.2' bss End of Penetration at 1.4' bss (Refusal)		Abbreviations: PC - Push Core bss - Below Sediment Surface N/A Not Applicable
5							

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-38 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : Manual Core | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : N/A | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : N/A | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 0.3 ft | START : 10/19/18 09:50 | END : 10/19/18 10:15 | LOGGER : K. Ma

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION (SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE)	PID (ppm)	COMMENTS (SAMPLE ID)
0	0.0		-		0.0 - 0.9 - SAND WITH SILT - wet, loose, yellowish red (5Y 4/6), trace small gravel	0.0	ML-SD-38-0.0/1.0 (1200)
		1.7	PC-1		0.9 - 1.7 - SANDY SILT - moist, soft, yellowish red (5Y 4/6), trace clay, medium sand, and organics		ML-SD-38-1.0/1.7 (1205)
			-		organic black seam at 1.4'	0.0	
			-		slight odor and staining at 1.7'	0.4	
					End of Recovery at 1.7' bss		
	2.5				End of Penetration at 2.5' bss (Refusal)		
5							

Abbreviations:
PC - Push Core
bss - Below Sediment Surface
N/A Not Applicable

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-39 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : Manual Core | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : N/A | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : N/A | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 0.2 ft | START : 10/19/18 11:30 | END : 10/19/18 12:20 | LOGGER : K. Ma

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS SAMPLE ID
0	0.0						
			-		0.0 - 0.6 - POORTLY GRADED SAND - moist, loose, yellowish red (5YR 4/6), little silt, trace small to large gravel	0.0	ML-SD-39-0.0/1.0 (1215)
					0.6 - 1.0 SANDY SILT - moist, soft, yellowish red (5YR 4/6), little medium grained sand, trace organics, black organic seam at 1.0'		
		1.9	PC-1		1.0 - 1.9 - CLAYEY SILT - moist, soft, yellowish red (5YR 4/6), trace fine grained sand, black organic seam at 1.2'	0.0	ML-SD-39-1.0/1.9 (1220)
			-				
					End of Recovery at 1.9' bss		
	2.4				End of Penetration at 2.4' bss (Refusal)		Abbreviations: PC - Push Core bss - Below Sediment Surface N/A Not Applicable
5							

PROJECT NUMBER:	CORE NUMBER:
EG1693SC	ML-SD-40 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Munger Landing Sediment Characterization | LOCATION : Duluth, MN

DRILLING EQUIPMENT AND METHOD : Manual Core | DRILLING CONTRACTOR : Jacobs/USEPA

WATER ELEVATION : N/A | REFUSAL ELEVATION : N/A | SEDIMENT ELEVATION : N/A | NATIVE CLAY ELEVATION : N/A

WATER DEPTH : 0.3 ft | START : 10/18/18 15:30 | END : 10/18/18 16:10 | LOGGER : K. Ma

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SEDIMENT DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & STRUCTURE	PID (ppm)	COMMENTS: SAMPLE ID
0	0.0		-		0.0 - 2.3 - SILTY SAND - wet, medium soft, yellowish brown (10YR 5/6), trace small gravel, trace organics, medium sand lense from 0.0 - 0.4' and 1.0 - 1.4'	0.0	ML-SD-40-0.0/1.0 (0820)
		2.3	- PC-1			0.0	ML-SD-40-1.0/2.3 (0825)
					End of Recovery at 2.3' bss		
	3.5				End of Penetration at 3.5' bss (Refusal)		Abbreviations: PC - Push Core bss - Below Sediment Surface N/A Not Applicable
5							

Appendix C
Photograph Log

Sediment Processing Photolog

ML-SD-01 from 0.0-8.1 ft bss photo 1.JPG

ML-SD-01 from 0.0-8.1 ft bss photo 3.JPG

ML-SD-01 from 0.0-8.1 ft bss photo 2.JPG

ML-SD-01 from 0.0-8.1 ft bss photo 4.JPG

ML-SD-01 from 0.0-8.1 ft bss photo 5.JPG

ML-SD-02 from 0.0-4.7 ft bss photo 2.JPG

ML-SD-02 from 0.0-4.7 ft bss photo 1.JPG

ML-SD-02 from 0.0-4.7 ft bss photo 3.JPG

ML-SD-03 from 0.0-9.7 ft bss photo 1.JPG

ML-SD-03 from 0.0-9.7 ft bss photo 3.JPG

ML-SD-03 from 0.0-9.7 ft bss photo 2.JPG

ML-SD-03 from 0.0-9.7 ft bss photo 4.JPG

ML-SD-03 from 0.0-9.7 ft bss photo 5.JPG

ML-SD-04 from 0.0-8.7 ft bss photo 1.JPG

ML-SD-03 from 0.0-9.7 ft bss photo 6.JPG

ML-SD-04 from 0.0-8.7 ft bss photo 2.JPG

ML-SD-04 from 0.0-8.7 ft bss photo 3.JPG

ML-SD-04 from 0.0-8.7 ft bss photo 5.JPG

ML-SD-04 from 0.0-8.7 ft bss photo 4.JPG

ML-SD-04 from 0.0-8.7 ft bss photo 6.JPG

ML-SD-05 from 0.0-7.0 ft bss photo 1.JPG

ML-SD-05 from 0.0-7.0 ft bss photo 3.JPG

ML-SD-05 from 0.0-7.0 ft bss photo 2.JPG

ML-SD-05 from 0.0-7.0 ft bss photo 4.JPG

ML-SD-06 from 0.0-7.0 ft bss photo 1.JPG

ML-SD-06 from 0.0-7.0 ft bss photo 3.JPG

ML-SD-06 from 0.0-7.0 ft bss photo 2.JPG

ML-SD-06 from 0.0-7.0 ft bss photo 4.JPG

ML-SD-06 from 0.0-7.0 ft bss photo 5.JPG

ML-SD-07 from 0.0-8.9 ft bss photo 2.JPG

ML-SD-07 from 0.0-8.9 ft bss photo 1.JPG

ML-SD-07 from 0.0-8.9 ft bss photo 3.JPG

ML-SD-07 from 0.0-8.9 ft bss photo 4.JPG

ML-SD-08 from 0.0-7.2 ft bss photo 1.JPG

ML-SD-07 from 0.0-8.9 ft bss photo 5.JPG

ML-SD-08 from 0.0-7.2 ft bss photo 2.JPG

ML-SD-08 from 0.0-7.2 ft bss photo 3.JPG

ML-SD-09 from 0.0-5.2 ft bss photo 1.JPG

ML-SD-08 from 0.0-7.2 ft bss photo 4.JPG

ML-SD-09 from 0.0-5.2 ft bss photo 2.JPG

ML-SD-09 from 0.0-5.2 ft bss photo 3.JPG

ML-SD-10 from 0.0-8.6 ft bss photo 2.JPG

ML-SD-10 from 0.0-8.6 ft bss photo 1.JPG

ML-SD-10 from 0.0-8.6 ft bss photo 3.JPG

ML-SD-10 from 0.0-8.6 ft bss photo 4.JPG

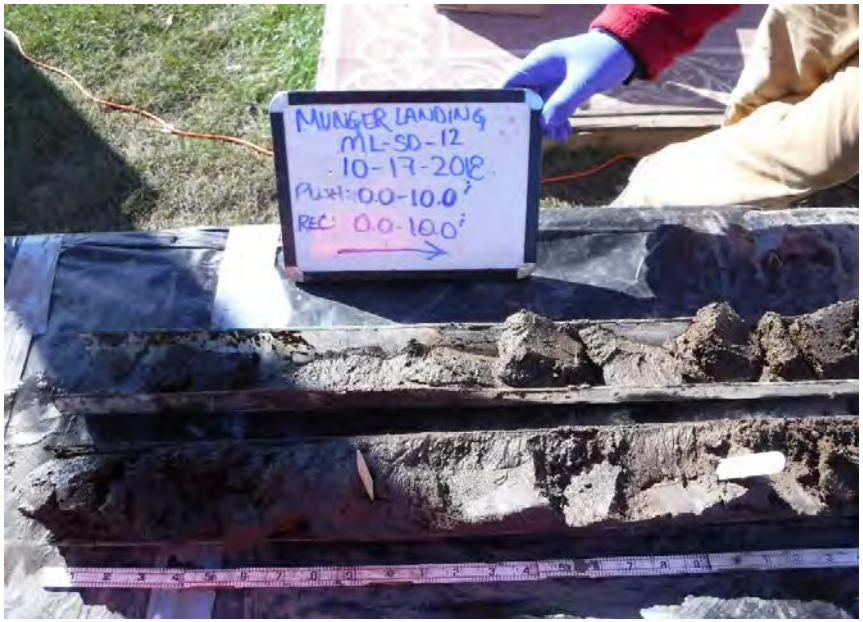
ML-SD-11 from 0.0-6.0 ft bss photo 1.JPG

ML-SD-10 from 0.0-8.6 ft bss photo 5.JPG

ML-SD-11 from 0.0-6.0 ft bss photo 2.JPG

ML-SD-11 from 0.0-6.0 ft bss photo 3.JPG

ML-SD-12 from 0.0-10.0 ft bss photo 2.JPG



ML-SD-12 from 0.0-10.0 ft bss photo 1.JPG

ML-SD-12 from 0.0-10.0 ft bss photo 3.JPG

ML-SD-12 from 0.0-10.0 ft bss photo 4.JPG

ML-SD-13 from 0.0-4.9 ft bss photo 2.JPG

ML-SD-13 from 0.0-4.9 ft bss photo 1.JPG

ML-SD-13 from 0.0-4.9 ft bss photo 3.JPG

ML-SD-14 from 0.0-9.4 ft bss photo 1.JPG

ML-SD-14 from 0.0-9.4 ft bss photo 3.JPG

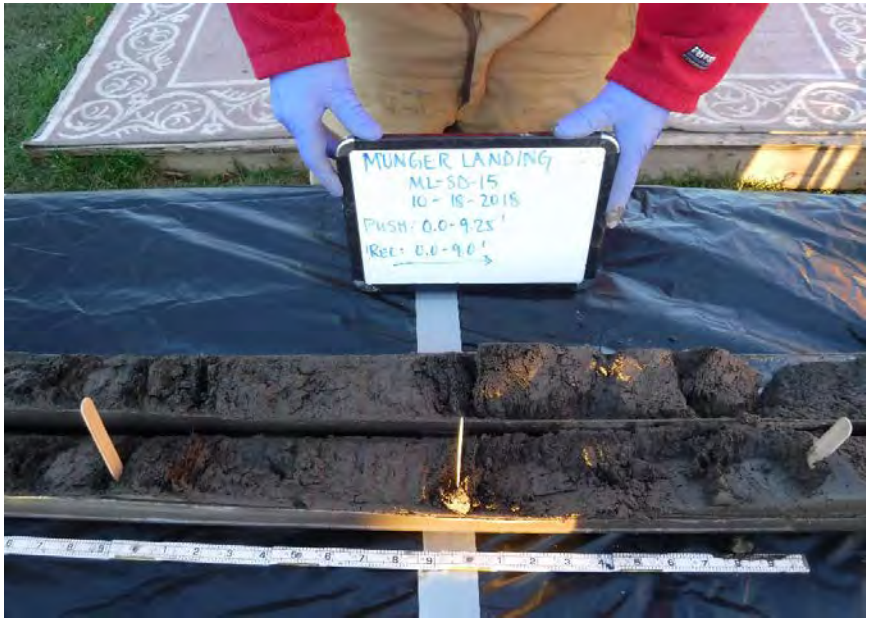
ML-SD-14 from 0.0-9.4 ft bss photo 2.JPG

ML-SD-14 from 0.0-9.4 ft bss photo 4.JPG

ML-SD-14 from 0.0-9.4 ft bss photo 5.JPG

ML-SD-15 from 0.0-9.0 ft bss photo 2.JPG

ML-SD-15 from 0.0-9.0 ft bss photo 1.JPG



ML-SD-15 from 0.0-9.0 ft bss photo 3.JPG

ML-SD-15 from 0.0-9.0 ft bss photo 4.JPG

ML-SD-16 from 0.0-10.0 ft bss photo 1.JPG

ML-SD-15 from 0.0-9.0 ft bss photo 5.JPG

ML-SD-16 from 0.0-10.0 ft bss photo 2.JPG

ML-SD-16 from 0.0-10.0 ft bss photo 3.JPG

ML-SD-16 from 0.0-10.0 ft bss photo 5.JPG

ML-SD-16 from 0.0-10.0 ft bss photo 4.JPG

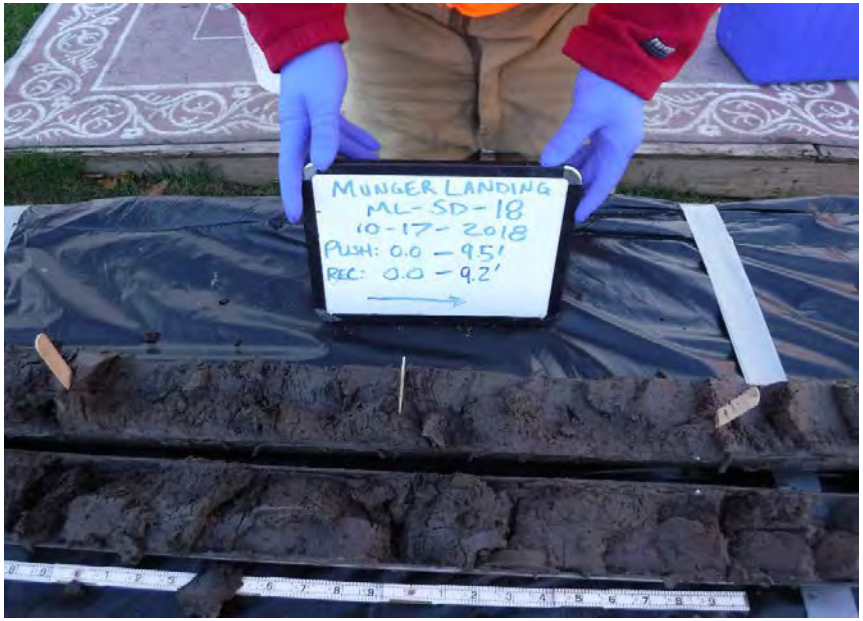
ML-SD-17 from 0.0-3.0 ft bss photo 1.JPG

ML-SD-17 from 0.0-3.0 ft bss photo 2.JPG

ML-SD-18 from 0.0-9.2 ft bss photo 1.JPG

ML-SD-17 from 0.0-3.0 ft bss photo 3.JPG

ML-SD-18 from 0.0-9.2 ft bss photo 2.JPG



ML-SD-18 from 0.0-9.2 ft bss photo 3.JPG

ML-SD-18 from 0.0-9.2 ft bss photo 5.JPG

ML-SD-18 from 0.0-9.2 ft bss photo 4.JPG

ML-SD-19 from 0.0-10.0 ft bss photo 1.JPG

ML-SD-19 from 0.0-10.0 ft bss photo 2.JPG

ML-SD-19 from 0.0-10.0 ft bss photo 4.JPG

ML-SD-19 from 0.0-10.0 ft bss photo 3.JPG

ML-SD-19 from 0.0-10.0 ft bss photo 5.JPG

ML-SD-20 from 0.0-10.0 ft bss photo 1.JPG

ML-SD-20 from 0.0-10.0 ft bss photo 3.JPG

ML-SD-20 from 0.0-10.0 ft bss photo 2.JPG

ML-SD-20 from 0.0-10.0 ft bss photo 4.JPG

ML-SD-20 from 0.0-10.0 ft bss photo 5.JPG

ML-SD-21 from 0.0-10 ft bss photo 2.JPG

ML-SD-21 from 0.0-10 ft bss photo 1.JPG

ML-SD-21 from 0.0-10 ft bss photo 3.JPG

ML-SD-21 from 0.0-10 ft bss photo 4.JPG

ML-SD-22 from 0.0-9.0 ft bss photo 1.JPG

ML-SD-21 from 0.0-10 ft bss photo 5.JPG

ML-SD-22 from 0.0-9.0 ft bss photo 2.JPG

ML-SD-22 from 0.0-9.9.0 ft bss photo 3.JPG

ML-SD-22 from 0.0-9.0 ft bss photo 5.JPG

ML-SD-22 from 0.0-9.0 ft bss photo 4.JPG

ML-SD-23 from 0.0-9.8 ft bss photo 1.JPG

ML-SD-23 from 0.0-9.8 ft bss photo 2.JPG

ML-SD-23 from 0.0-9.8 ft bss photo 4.JPG

ML-SD-23 from 0.0-9.8 ft bss photo 3.JPG

ML-SD-23 from 0.0-9.8 ft bss photo 5.JPG

ML-SD-23 from 0.0-9.8 ft bss photo 6.JPG

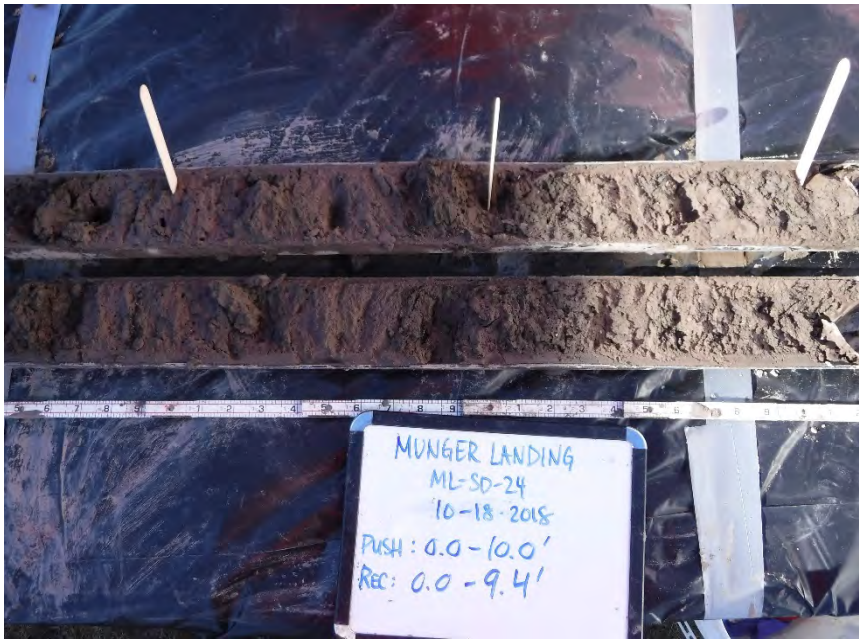
ML-SD-24 from 0.0-9.4 ft bss photo 2.JPG

ML-SD-24 from 0.0-9.4 ft bss photo 1.JPG

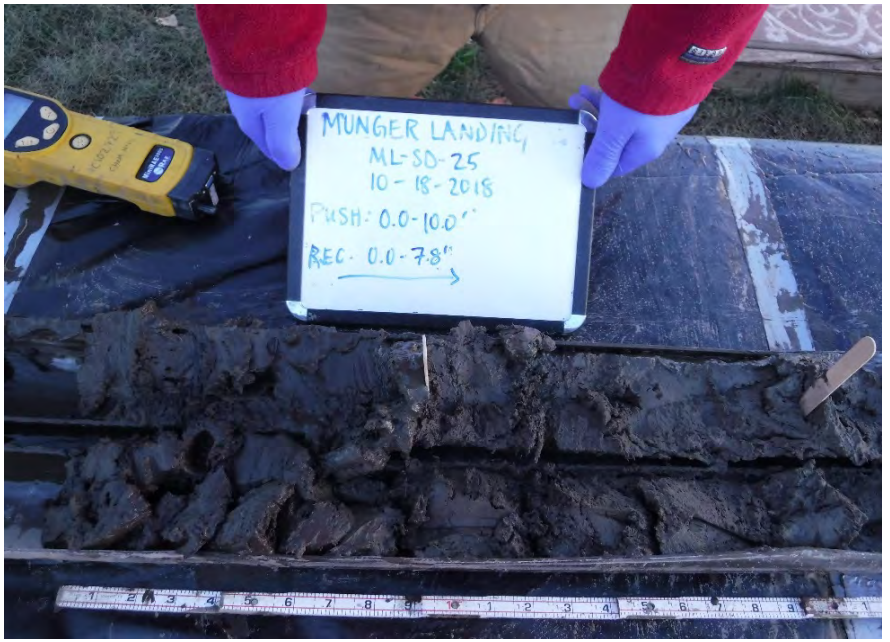
ML-SD-24 from 0.0-9.4 ft bss photo 3.JPG

ML-SD-24 from 0.0-9.4 ft bss photo 4.JPG

ML-SD-24 from 0.0-9.4 ft bss photo 6.JPG



ML-SD-24 from 0.0-9.4 ft bss photo 5.JPG



ML-SD-25 from 0.0-7.8 ft bss photo 1.JPG

ML-SD-25 from 0.0-7.8 ft bss photo 2.JPG

ML-SD-25 from 0.0-7.8 ft bss photo 4.JPG

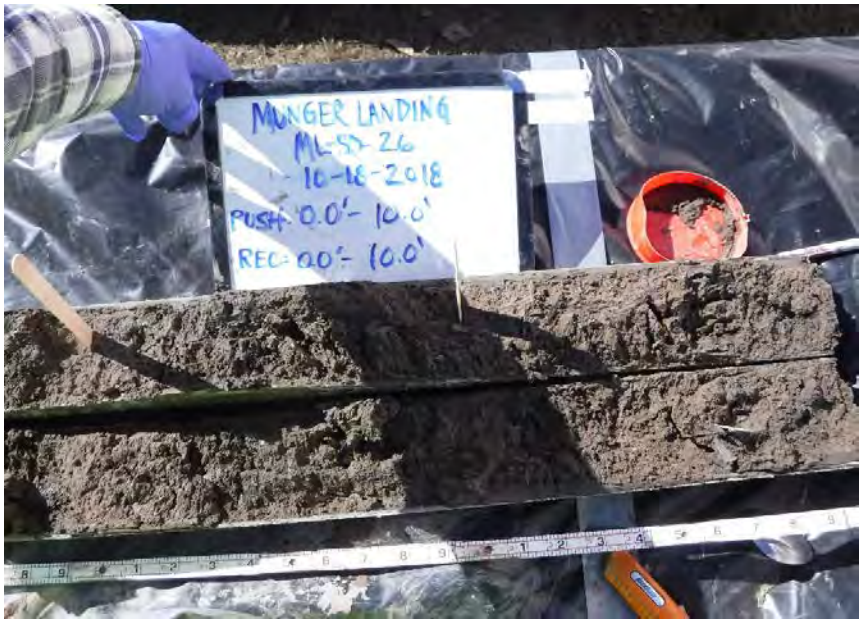
ML-SD-25 from 0.0-7.8 ft bss photo 3.JPG

ML-SD-26 from 0.0-10.0 ft bss photo 1.JPG

ML-SD-26 from 0.0-10.0 ft bss photo 2.JPG

ML-SD-26 from 0.0-10.0 ft bss photo 4.JPG

ML-SD-26 from 0.0-10.0 ft bss photo 3.JPG



ML-SD-26 from 0.0-10.0 ft bss photo 5.JPG

ML-SD-27 from 0.0-3.7 ft bss photo 1.JPG

ML-SD-27 from 0.0-3.7 ft bss photo 3.JPG

ML-SD-27 from 0.0-3.7 ft bss photo 2.JPG

ML-SD-28 from 0.0-8.4 ft bss photo 1.JPG

ML-SD-28 from 0.0-8.4 ft bss photo 2.JPG

ML-SD-28 from 0.0-8.4 ft bss photo 4.JPG

ML-SD-28 from 0.0-8.4 ft bss photo 3.JPG

ML-SD-28 from 0.0-8.4 ft bss photo 5.JPG

ML-SD-28 from 0.0-8.4 ft bss photo 6.JPG

ML-SD-30 from 0.0-0.25 ft bss.JPG

ML-SD-29 from 0.0-0.25 ft bss.JPG

ML-SD-31 from 0.0-0.25 ft bss.JPG

ML-SD-32 from 0.0-0.25 ft bss.JPG

ML-SD-34 from 0.0-1.8 ft bss photo 1.JPG

ML-SD-33 from 0.0-1.2 ft bss photo 1.JPG

ML-SD-34 from 0.0-1.8 ft bss photo 2.JPG

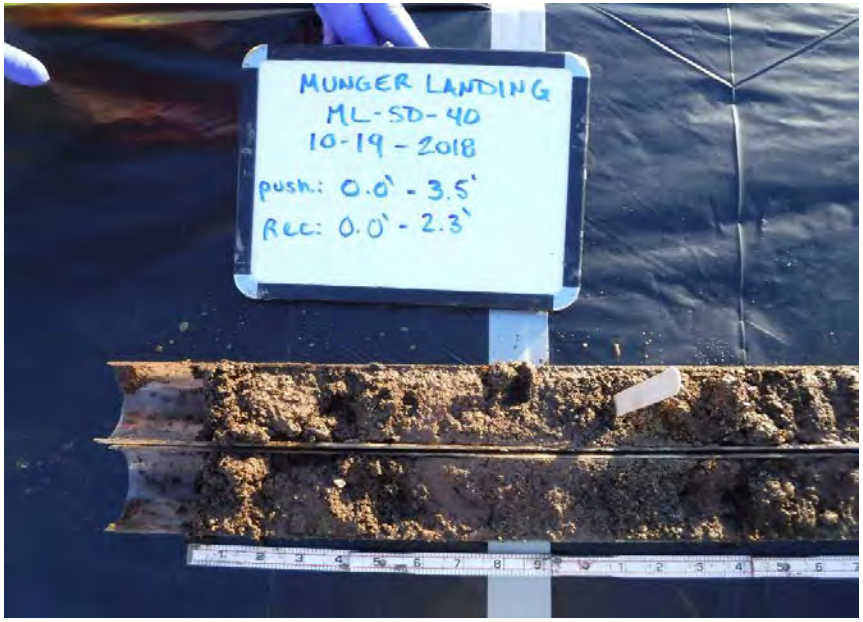
ML-SD-34 from 0.0-1.8 ft bss photo 3.JPG

ML-SD-36-0.0-1.6 ft bss photo 1.JPG

ML-SD-35-0.0-1.3 ft bss photo 1.JPG

ML-SD-37-0.0-1.2 ft bss photo 1.JPG

ML-SD-38-0.0-1.7 ft bss photo 1.JPG



ML-SD-40-0.0-2.3 ft bss photo 1.JPG

ML-SD-39-0.0-1.9 ft bss photo 1.JPG

ML-SD-40-0.0-2.3 ft bss photo 2.JPG

Sediment Sampling Photolog

Filling core with water at ML-SD-38.JPG

Manual coring at ML-SD-38 photo 2.JPG

Manual coring at ML-SD-38 photo 1.JPG

Manual coring at ML-SD-39.JPG

Sediment probing at ML-SD-37.JPG

Vibracore operations photo 1.JPG

Vibracore operations photo 2.JPG

Vibracore operations photo 3.JPG

View from ML-SD-37 photo 1.JPG

View from ML-SD-37 photo 3.JPG

View from ML-SD-37 photo 2.JPG

View from ML-SD-38 photo 1.JPG

View from ML-SD-38 photo 2.JPG

View from ML-SD-39 photo 2.JPG

View from ML-SD-39 photo 1.JPG

Appendix D
Investigative Derived Waste Results and Waste Manifest

WASTE MATERIAL PROFILE SHEET

Clean Harbors Profile No. CH1752988

A. GENERAL INFORMATION

GENERATOR EPA ID #/REGISTRATION # ***CESQG*** GENERATOR NAME: ***Great Lakes National Program Office***

GENERATOR CODE (Assigned by Clean Harbors) ***GE28627*** CITY ***Chicago*** STATE/PROVINCE ***IL*** ZIP/POSTAL CODE ***60604***

ADDRESS ***77 West Jackson Boulevard*** PHONE: **(404) 414-2505**

CUSTOMER CODE (Assigned by Clean Harbors) ***CH20618*** CUSTOMER NAME: ***CH2M Hill***

ADDRESS ***6600 Peachtree Dunwoody Road Embassy Row - Building 400 Suite 600*** CITY ***Atlanta*** STATE/PROVINCE ***GA*** ZIP/POSTAL CODE ***30328***

B. WASTE DESCRIPTION

WASTE DESCRIPTION: ***Munger Landing Nonhazardous nonTSCA sediment***

PROCESS GENERATING WASTE: **Sampling of river sediment locations for contamination**

IS THIS WASTE CONTAINED IN SMALL PACKAGING CONTAINED WITHIN A LARGER SHIPPING CONTAINER ? **No**

C. PHYSICAL PROPERTIES (at 25C or 77F)

PHYSICAL STATE

- SOLID WITHOUT FREE LIQUID
- POWDER
- MONOLITHIC SOLID
- [x] LIQUID WITH NO SOLIDS
- LIQUID/SOLID MIXTURE

% FREE LIQUID ***0.00 - 10.00***
% SETTLED SOLID ***90.00 - 100.00***
% TOTAL SUSPENDED SOLID ***0.00 - 0.00***

- SLUDGE
- GAS/AEROSOL

NUMBER OF PHASES/LAYERS

1 [x] 2 3

% BY VOLUME (Approx.)

TOP ***10.00***
MIDDLE ***0.00***
BOTTOM ***90.00***

VISCOSITY (If liquid present)

- 1 - 100 (e.g. Water)
- 101 - 500 (e.g. Motor Oil)
- 501 - 10,000 (e.g. Molasses)
- [x] > 10,000

COLOR

brown/black

ODOR

- [x] NONE
- MILD
- STRONG

Describe:

BOILING POINT °F (°C)

- <= 95 (<=35)
- 95 - 100 (35-38)
- 101 - 129 (38-54)
- [x] >= 130 (>54)

MELTING POINT °F (°C)

- < 140 (<60)
- 140-200 (60-93)
- [x] > 200 (>93)

TOTAL ORGANIC CARBON

- [x] <= 1%
- 1-9%
- >= 10%

FLASH POINT °F (°C)

- < 73 (<23)
- 73 - 100 (23-38)
- 101 -140 (38-60)
- 141 -200 (60-93)
- [x] > 200 (>93)

pH

- <= 2
- [x] 2.1 - 6.9
- 7 (Neutral)
- 7.1 - 12.4
- >= 12.5

SPECIFIC GRAVITY

- < 0.8 (e.g. Gasoline)
- 0.8-1.0 (e.g. Ethanol)
- [x] 1.0 (e.g. Water)
- 1.0-1.2 (e.g. Antifreeze)
- > 1.2 (e.g. Methylene Chloride)

ASH

- < 0.1
- 0.1 - 1.0
- 1.1 - 5.0
- 5.1 - 20.0
- > 20
- [x] Unknown

BTU/LB (MJ/kg)

- [x] < 2,000 (<4.6)
- 2,000-5,000 (4.6-11.6)
- 5,000-10,000 (11.6-23.2)
- > 10,000 (>23.2)

Actual:

D. COMPOSITION (List the complete composition of the waste, include any inert components and/or debris. Ranges for individual components are acceptable. If a trade name is used, please supply an MSDS. Please do not use abbreviations.)

CHEMICAL	MIN	--	MAX	UOM
2-BUTANONE	211.0000000	--	211.0000000	PPB
BARIUM	0.4700000	--	0.4700000	PPM
OCDD	38.0000000	--	38.0000000	PPB
OCDF	4.0000000	--	4.0000000	PPB
PCBS	38.0000000	--	38.0000000	PPB
PPE, LINER, SAMPLING EQUIPMENT	0.0000000	--	5.0000000	%
SEDIMENT	95.0000000	--	100.0000000	%
TOTAL HPCDD	10.0000000	--	10.0000000	PPB
TOTAL HPCDF	19.0000000	--	19.0000000	PPB
TOTAL HXCDD	2.0000000	--	2.0000000	PPB

DOES THIS WASTE CONTAIN ANY HEAVY GAUGE METAL DEBRIS OR OTHER LARGE OBJECTS (EX., METAL PLATE OR PIPING >1/4" THICK OR >12" LONG, METAL REINFORCED HOSE >12" LONG, METAL WIRE >12" LONG, METAL VALVES, PIPE FITTINGS, CONCRETE REINFORCING BAR OR PIECES OF CONCRETE >3")? YES [x] NO

If yes, describe, including dimensions:

DOES THIS WASTE CONTAIN ANY METALS IN POWDERED OR OTHER FINELY DIVIDED FORM? YES [x] NO

DOES THIS WASTE CONTAIN OR HAS IT CONTACTED ANY OF THE FOLLOWING; ANIMAL WASTES, HUMAN BLOOD, BLOOD PRODUCTS, BODY FLUIDS, MICROBIOLOGICAL WASTE, PATHOLOGICAL WASTE, HUMAN OR ANIMAL DERIVED SERUMS OR PROTEINS OR ANY OTHER POTENTIALLY INFECTIOUS MATERIAL? YES [x] NO

I acknowledge that this waste material is neither infectious nor does it contain any organism known to be a threat to human health. This certification is based on my knowledge of the material. Select the answer below that applies:

The waste was never exposed to potentially infectious material. YES NO

Chemical disinfection or some other form of sterilization has been applied to the waste. YES NO

I ACKNOWLEDGE THAT THIS PROFILE MEETS THE CLEAN HARBORS BATTERY PACKAGING REQUIREMENTS. YES NO

I ACKNOWLEDGE THAT MY FRIABLE ASBESTOS WASTE IS DOUBLE BAGGED AND WETTED. YES NO

SPECIFY THE SOURCE CODE ASSOCIATED WITH THE WASTE. ***G49*** SPECIFY THE FORM CODE ASSOCIATED WITH THE WASTE. ***W301***

Site Address : 121 Spring Street
Duluth,MN 55808

SC PPW 7/12/2018

WORK ORDER NO 1806062128

1117114

DOCUMENT NO.

STRAIGHT BILL OF LADING

TRANSPORTER 1 Clean Harbors Environmental Services, Inc. VEHICLE ID # 5577

EPA ID # MAD039822250 TRANS. 1 PHONE (781)792-5000

TRANSPORTER 2 Pioneer Tank Lines VEHICLE ID #

EPA ID # MNB044176113 TRANS. 2 PHONE (612) 488-8200

DESIGNATED FACILITY	SHIPPER
Spring Grove Resource Recovery Inc.	ATTN:Heather Williams Great Lakes National Program Office
FACILITY EPA ID #	SHIPPER EPA ID #
OHD000816629	CESQG
ADDRESS 4879 Spring Grove Avenue	ADDRESS 77 West Jackson Boulevard USEPA Mail Code: G-17J
CITY Cincinnati STATE OH ZIP 45232	CITY Chicago STATE IL ZIP 60604

CONTAINERS NO. & SIZE	TYPE	HM	DESCRIPTION OF MATERIALS	TOTAL QUANTITY	UNIT WT/VOL
6 X 55	DM		A. NON HAZARDOUS, NON D.O.T. REGULATED	01500	P
			B.		
			C.		
			D.		
			E.		
			F.		
			G.		
			H.		

SPECIAL HANDLING INSTRUCTIONS EMERGENCY PHONE #: (800) 483-3718 GENERATOR: Great Lakes National Program Office

A.CH1752988

SHIPPERS CERTIFICATION: This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

	PRINT	SIGN	DATE
SHIPPER	-PA		
TRANSPORTER 1	Brian Nelson		11-20-18
TRANSPORTER 2			
RECEIVED BY			

4

CHI 107

E. CONSTITUENTS

Are these values based on testing or knowledge? Knowledge ☑ Testing

If constituent concentrations are based on analytical testing, analysis must be provided. Please attach document(s) using the link on the Submit tab.

Please indicate which constituents below apply. Concentrations must be entered when applicable to assist in accurate review and expedited approval of your waste profile. Please note that the total regulated metals and other constituents sections require answers.

RCRA	REGULATED METALS	REGULATORY LEVEL (mg/l)	TCLP mg/l	TOTAL	UOM	NOT APPLICABLE
D004	ARSENIC	5.0				☑
D005	BARIUM	100.0				☑
D006	CADMIUM	1.0				☑
D007	CHROMIUM	5.0				☑
D008	LEAD	5.0				☑
D009	MERCURY	0.2				☑
D010	SELENIUM	1.0				☑
D011	SILVER	5.0				☑

	VOLATILE COMPOUNDS	
D018	BENZENE	0.5
D019	CARBON TETRACHLORIDE	0.5
D021	CHLOROBENZENE	100.0
D022	CHLOROFORM	6.0
D028	1,2-DICHLOROETHANE	0.5
D029	1,1-DICHLOROETHYLENE	0.7
D035	METHYL ETHYL KETONE	200.0
D039	TETRACHLOROETHYLENE	0.7
D040	TRICHLOROETHYLENE	0.5
D043	VINYL CHLORIDE	0.2

	SEMI-VOLATILE COMPOUNDS	
D023	o-CRESOL	200.0
D024	m-CRESOL	200.0
D025	p-CRESOL	200.0
D026	CRESOL (TOTAL)	200.0
D027	1,4-DICHLOROBENZENE	7.5
D030	2,4-DINITROTOLUENE	0.13
D032	HEXACHLOROBENZENE	0.13
D033	HEXACHLOROBUTADIENE	0.5
D034	HEXACHLOROETHANE	3.0
D036	NITROBENZENE	2.0
D037	PENTACHLOROPHENOL	100.0
D038	PYRIDINE	5.0
D041	2,4,5-TRICHLOROPHENOL	400.0
D042	2,4,6-TRICHLOROPHENOL	2.0

	PESTICIDES AND HERBICIDES	
D012	ENDRIN	0.02
D013	LINDANE	0.4
D014	METHOXYCHLOR	10.0
D015	TOXAPHENE	0.5
D016	2,4-D	10.0
D017	2,4,5-TP (SILVEX)	1.0
D020	CHLORDANE	0.03
D031	HEPTACHLOR (AND ITS EPOXIDE)	0.008

OTHER CONSTITUENTS	MAX	UOM	NOT APPLICABLE
BROMINE			☑
CHLORINE			☑
FLUORINE			☑
IODINE			☑
SULFUR			☑
POTASSIUM			☑
SODIUM			☑
AMMONIA			☑
CYANIDE AMENABLE			☑
CYANIDE REACTIVE			☑
CYANIDE TOTAL			☑
SULFIDE REACTIVE			☑

HOCs

☑ NONE
< 1000 PPM
>= 1000 PPM

PCBs

NONE
☑ < 50 PPM
>=50 PPM

IF PCBS ARE PRESENT, IS THE WASTE REGULATED BY TSCA 40 CFR 761?

YES ☑ NO

ADDITIONAL HAZARDS

DOES THIS WASTE HAVE ANY UNDISCLOSED HAZARDS OR PRIOR INCIDENTS ASSOCIATED WITH IT, WHICH COULD AFFECT THE WAY IT SHOULD BE HANDLED?

YES ☑ NO (If yes, explain)

CHOOSE ALL THAT APPLY

DEA REGULATED SUBSTANCES | EXPLOSIVE | FUMING | OSHA REGULATED CARCINOGENS
POLYMERIZABLE | RADIOACTIVE | REACTIVE MATERIAL | ☑ NONE OF THE ABOVE

F. REGULATORY STATUS

YES ☑ NO USEPA HAZARDOUS WASTE?

YES ☑ NO DO ANY STATE WASTE CODES APPLY?

Texas Waste Code

YES ☑ NO DO ANY CANADIAN PROVINCIAL WASTE CODES APPLY?

YES ☑ NO IS THIS WASTE PROHIBITED FROM LAND DISPOSAL WITHOUT FURTHER TREATMENT PER 40 CFR PART 268?

LDR CATEGORY: ***Not subject to LDR***
VARIANCE INFO:

YES ☑ NO IS THIS A UNIVERSAL WASTE?

YES ☑ NO IS THE GENERATOR OF THE WASTE CLASSIFIED AS VERY SMALL QUANTITY GENERATOR (VSQG) OR A STATE EQUIVALENT DESIGNATION?

YES NO IS THIS MATERIAL GOING TO BE MANAGED AS A RCRA EXEMPT COMMERCIAL PRODUCT, WHICH IS FUEL (40 CFR 261.2 (C)(2)(II))?

YES ☑ NO DOES TREATMENT OF THIS WASTE GENERATE A F006 OR F019 SLUDGE?

YES NO IS THIS WASTE STREAM SUBJECT TO THE INORGANIC METAL BEARING WASTE PROHIBITION FOUND AT 40 CFR 268.3(C)?

YES ☑ NO DOES THIS WASTE CONTAIN VOC'S IN CONCENTRATIONS >=500 PPM?

YES NO DOES THE WASTE CONTAIN GREATER THAN 20% OF ORGANIC CONSTITUENTS WITH A VAPOR PRESSURE >= .3KPA (.044 PSIA)?

YES ☑ NO DOES THIS WASTE CONTAIN AN ORGANIC CONSTITUENT WHICH IN ITS PURE FORM HAS A VAPOR PRESSURE > 77 KPA (11.2 PSIA)?

YES ☑ NO IS THIS CERCLA REGULATED (SUPERFUND) WASTE ?

YES ☑ NO IS THE WASTE SUBJECT TO ONE OF THE FOLLOWING NESHAP RULES?

Hazardous Organic NESHAP (HON) rule (subpart G) Pharmaceuticals production (subpart GGG)

YES NO IF THIS IS A US EPA HAZARDOUS WASTE, DOES THIS WASTE STREAM CONTAIN BENZENE?

YES NO Does the waste stream come from a facility with one of the SIC codes listed under benzene NESHAP or is this waste regulated under the benzene NESHAP rules because the original source of the waste is from a chemical manufacturing, coke by-product recovery, or petroleum refinery process?

YES NO Is the generating source of this waste stream a facility with Total Annual Benzene (TAB) >10 Mg/year?

What is the TAB quantity for your facility? Megagram/year (1 Mg = 2,200 lbs)

The basis for this determination is: Knowledge of the Waste Or Test Data Knowledge Testing

Describe the knowledge :

G. DOT/TDG INFORMATION

DOT/TDG PROPER SHIPPING NAME:

NON HAZARDOUS, NON D.O.T. REGULATED

H. TRANSPORTATION REQUIREMENTS

ESTIMATED SHIPMENT FREQUENCY ONE TIME WEEKLY MONTHLY QUARTERLY YEARLY ☑ OTHER ***as needed***

☑ **CONTAINERIZED**

1-25 CONTAINERS/SHIPMENT

STORAGE CAPACITY:
CONTAINER TYPE:

PORTABLE TOTE TANK BOX|CARTON|CASE
CUBIC YARD BOX ☑ DRUM
OTHER:
DRUM SIZE: ***55***

BULK LIQUID

GALLONS/SHIPMENT: ***0 Min -0 Max*** GAL.

BULK SOLID

SHIPMENT UOM: TON YARD

TONS/YARDS/SHIPMENT: ***0 Min - 0 Max***

I. SPECIAL REQUEST

COMMENTS OR REQUESTS:

Pickup address: Spirit Lake Marina & Rv- 121 Spring St, Duluth, MN 55808; Generator is USEPA Great Lakes National Progra

GENERATOR'S CERTIFICATION

I certify that I am authorized to execute this document as an authorized agent. I hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge.I also certify that any samples submitted are representative of the actual waste.If Clean Harbors discovers a discrepancy during the approval process, Generator grants Clean Harbors the authority to amend the profile, as Clean Harbors deems necessary, to reflect the discrepancy.

AUTHORIZED SIGNATURE	NAME (PRINT)	TITLE	DATE
lisa.schwan@jacobs.com			

This waste profile has been submitted using Clean Harbors' electronic signature system.

*40 CFR Sec. 264.12 required notice:

As required by Federal Resource Conservation and Recovery Act regulations found in 40 CFR Part 264.12(b) and all equivalent State hazardous waste regulations, notice is hereby provided that all Clean Harbors facilities that may be used to treat, store, and /or dispose of the hazardous waste described on this waste profile have the appropriate permits and the capacity to manage these wastes.

Please note this profile must be submitted for re-evaluation if there has been a change in the waste generating process or when there have been changes in the chemical composition or physical characteristics of the material.

Addendum

D. COMPOSITION

CHEMICAL	MIN	--	MAX	UOM
TOTAL HXCDF	4.000000	--	4.000000	PPB
TOTAL PECDF	0.000000	--	0.000000	PPB
TOTAL TCDD	1.000000	--	1.000000	PPB
WATER	0.000000	--	10.000000	%

G. DOT/TDG INFORMATION

Appendix E
Analytical Data

Appendix E-1. Total Organic Carbon and Percent Moisture

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-01-0.0/1.0 10/15/2018	ML-SD-01-0.0/1.0-FD 10/15/2018	ML-SD-01-1.0/2.0 10/15/2018	ML-SD-01-2.0/3.0 10/15/2018	ML-SD-02-0.0/1.0 10/15/2018	ML-SD-02-1.0/2.0 10/15/2018	ML-SD-02-2.0/3.0 10/15/2018	ML-SD-02-3.0/4.0 10/15/2018	ML-SD-02-4.0/4.7 10/15/2018	ML-SD-03-0.0/1.0 10/16/2018	ML-SD-03-1.0/2.0 10/16/2018
Percent Moisture	-	%	40.03	40.72	31.26	32.09	55.37	55.76	31.47	23.96	18.82	27.74	38.68
Total Organic Carbon	-	mg/kg	23800	-	13300	15000 J	35400	53900	14200 J	6710 J	2100 J	15000	22700

Analyte	CAS No.	Unit	ML-SD-04-0.0/1.0 10/16/2018	ML-SD-04-1.0/2.0 10/16/2018	ML-SD-05-0.0/1.0 10/15/2018	ML-SD-05-0.0/1.0-FD 10/15/2018	ML-SD-05-1.0/2.0 10/15/2018	ML-SD-06-0.0/1.0 10/16/2018	ML-SD-06-1.0/2.0 10/16/2018	ML-SD-07-0.0/1.0 10/16/2018	ML-SD-07-1.0/2.0 10/16/2018	ML-SD-08-0.0/1.0 10/16/2018	ML-SD-08-1.0/2.0 10/16/2018
Percent Moisture	-	%	36.1	26.45	34.7	33.04	27.71	39.39	40.19	41.75	36.1	29.31	30.11
Total Organic Carbon	-	mg/kg	11400	3750	15700	-	12800	17500	19600	20000	12200	11700	14300

Analyte	CAS No.	Unit	ML-SD-09-0.0/1.0 10/16/2018	ML-SD-09-1.0/2.0 10/16/2018	ML-SD-10-0.0/1.0 10/16/2018	ML-SD-10-0.0/1.0-FD 10/16/2018	ML-SD-10-1.0/2.0 10/16/2018	ML-SD-11-0.0/1.0 10/16/2018	ML-SD-11-1.0/2.0 10/16/2018	ML-SD-12-0.0/1.0 10/17/2018	ML-SD-12-1.0/2.0 10/17/2018	ML-SD-13-0.0/1.0 10/16/2018	ML-SD-13-0.0/1.0-FD 10/16/2018
Percent Moisture	-	%	22.78	21.59	42.12	39.88	41.28	47.17	26.27	37.96	30.71	25.53	28.5
Total Organic Carbon	-	mg/kg	672	660	24400	-	21300	36200	10300	19800	14100	15500	16500

Analyte	CAS No.	Unit	ML-SD-13-1.0/2.0 10/16/2018	ML-SD-14-0.0/1.0 10/17/2018	ML-SD-14-1.0/2.0 10/17/2018	ML-SD-14-2.0/3.0 10/17/2018	ML-SD-15-0.0/1.0 10/18/2018	ML-SD-15-1.0/2.0 10/18/2018	ML-SD-16-0.0/1.0 10/17/2018	ML-SD-16-1.0/2.0 10/17/2018	ML-SD-16-2.0/3.0 10/17/2018	ML-SD-17-0.0/1.0 10/17/2018	ML-SD-17-1.0/2.0 10/17/2018
Percent Moisture	-	%	25.21	60.88	49.56	33.49	40.4	37.98	57.53	67.51	49.76	42.33	26.75
Total Organic Carbon	-	mg/kg	12600	47800	37300	17000 J	32500	45700	50700	89300	34100 J	28500	11800

Analyte	CAS No.	Unit	ML-SD-18-0.0/1.0 10/17/2018	ML-SD-18-1.0/2.0 10/17/2018	ML-SD-19-0.0/1.0 10/17/2018	ML-SD-19-1.0/2.0 10/17/2018	ML-SD-19-1.0/2.0-FD 10/17/2018	ML-SD-20-0.0/1.0 10/17/2018	ML-SD-20-1.0/2.0 10/17/2018	ML-SD-21-0.0/1.0 10/17/2018	ML-SD-21-1.0/2.0 10/17/2018	ML-SD-22-0.0/1.0 10/17/2018	ML-SD-22-1.0/2.0 10/17/2018
Percent Moisture	-	%	42.69	34.32	38.54	34.28	35.73	46.49	40.94	36.73	37.12	39.86	27.37
Total Organic Carbon	-	mg/kg	25000	23500	27200	25100		40900	35300	24400	30500	24900	12100

Notes:

mg/kg = milligrams per kilogram; % = percent; J = Estimated

Appendix E-1. Total Organic Carbon and Percent Moisture

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-23-0.0/1.0 10/18/2018	ML-SD-23-1.0/2.0 10/18/2018	ML-SD-23-2.0/3.0 10/18/2018	ML-SD-23-2.0/3.0-FD 10/18/2018	ML-SD-23-3.0/4.0 10/18/2018	ML-SD-24-0.0/1.0 10/18/2018	ML-SD-24-1.0/2.0 10/18/2018	ML-SD-24-2.0/3.0 10/18/2018	ML-SD-24-2.0/3.0-FD 10/18/2018	ML-SD-24-3.0/4.0 10/18/2018	ML-SD-25-0.0/1.0 10/18/2018
Percent Moisture	-	%	60.18	56.95	32.82	37.22	35.61	62.84	59.23	50.32	48.24	28.23	56.18
Total Organic Carbon	-	mg/kg	47100	52800	16800 J	21900 J	17900 J	45700	59900	32500 J	30400 J	9060 J	46900

Analyte	CAS No.	Unit	ML-SD-25-1.0/2.0 10/18/2018	ML-SD-26-0.0/1.0 10/18/2018	ML-SD-26-1.0/2.0 10/18/2018	ML-SD-26-1.0/2.0-FD 10/18/2018	ML-SD-26-2.0/3.0 10/18/2018	ML-SD-26-3.0/4.0 10/18/2018	ML-SD-27-0.0/1.0 10/17/2018	ML-SD-27-1.0/2.0 10/17/2018	ML-SD-27-2.0/3.0 10/17/2018	ML-SD-27-3.0/3.7 10/17/2018	ML-SD-28-0.0/1.0 10/18/2018
Percent Moisture	-	%	35	56.82	50.57	52.36	25.83	32.7	82.96	71.42	74.36	70.17	23.76
Total Organic Carbon	-	mg/kg	16700	51200	39200	-	13800 J	10700 J	287000	134000 J	184000 J	115000 J	5920

Analyte	CAS No.	Unit	ML-SD-29-0.0/0.25 10/15/2018	ML-SD-30-0.0/0.25 10/15/2018	ML-SD-31-0.0/0.25 10/15/2018	ML-SD-32-0.0/0.25 10/15/2018	ML-SD-33-0.0/1.2 10/18/2018	ML-SD-34-0.0/1.0 10/18/2018	ML-SD-34-0.0/1.0-FD 10/18/2018	ML-SD-34-1.0/1.8 10/18/2018	ML-SD-35-0.0/1.3 10/19/2018	ML-SD-36-0.0/1.0 10/19/2018	ML-SD-36-1.0/1.6 10/19/2018
Percent Moisture	-	%	90.23	88.31	75.19	87.4	16.06	8.47	23.12	28.8	24.98	33.74	24.45
Total Organic Carbon	-	mg/kg	226000	223000	102000	187000	11300	6220	-	10700	10200	18700	18400

Analyte	CAS No.	Unit	ML-SD-37-0.0/1.2 10/19/2018	ML-SD-38-0.0/1.0 10/19/2018	ML-SD-38-1.0/1.7 10/19/2018	ML-SD-39-0.0/1.0 10/19/2018	ML-SD-39-1.0/1.9 10/19/2018	ML-SD-40-0.0/1.0 10/19/2018	ML-SD-40-1.0/2.3 10/19/2018
Percent Moisture	-	%	22.14	11.51	18.13	13.89	25.76	17.65	18.96
Total Organic Carbon	-	mg/kg	8920	2860	7670	6720	18400	7720	8400

Notes:

mg/kg = milligrams per kilogram; % = percent; J = Estimated

Appendix E-2. Analytical Results Mercury and Methyl Mercury

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-01-0.0/1.0 10/15/2018	ML-SD-01-0.0/1.0-FD 10/15/2018	ML-SD-01-1.0/2.0 10/15/2018	ML-SD-02-0.0/1.0 10/15/2018	ML-SD-02-1.0/2.0 10/15/2018	ML-SD-02-2.0/3.0 10/15/2018	ML-SD-02-3.0/4.0 10/15/2018	ML-SD-02-4.0/4.7 10/15/2018	ML-SD-03-0.0/1.0 10/16/2018	ML-SD-03-1.0/2.0 10/16/2018	ML-SD-07-0.0/1.0 10/16/2018
Mercury	7439-97-6	mg/kg	0.38	0.57	0.05 U	0.2 J	0.89	0.31 J-	0.15 R	0.13 R	0.047 U	0.052 U	0.11 J
Methyl Mercury	22967-92-6	µg/kg	1.46 U	1.45 U	1.6 U	2.52 U	3 J	-	-	-	1.2 U	1.16 U	-

Analyte	CAS No.	Unit	ML-SD-07-1.0/2.0 10/16/2018	ML-SD-08-0.0/1.0 10/16/2018	ML-SD-08-1.0/2.0 10/16/2018	ML-SD-09-0.0/1.0 10/16/2018	ML-SD-09-1.0/2.0 10/16/2018	ML-SD-10-0.0/1.0 10/16/2018	ML-SD-10-0.0/1.0-FD 10/16/2018	ML-SD-10-1.0/2.0 10/16/2018	ML-SD-11-0.0/1.0 10/16/2018	ML-SD-11-1.0/2.0 10/16/2018	ML-SD-12-0.0/1.0 10/17/2018
Mercury	7439-97-6	mg/kg	0.051 U	0.088 J	0.044 U	0.043 U	0.042 U	0.057 U	0.058 U	0.055 U	0.53	0.044 U	0.059 J
Methyl Mercury	22967-92-6	µg/kg	-	1.06 U	1.4 U	-	-	-	-	-	-	-	1.34 U

Analyte	CAS No.	Unit	ML-SD-12-1.0/2.0 10/17/2018	ML-SD-16-0.0/1.0 10/17/2018	ML-SD-16-1.0/2.0 10/17/2018	ML-SD-18-0.0/1.0 10/17/2018	ML-SD-18-1.0/2.0 10/17/2018	ML-SD-19-0.0/1.0 10/17/2018	ML-SD-19-1.0/2.0 10/17/2018	ML-SD-19-1.0/2.0-FD 10/17/2018	ML-SD-21-0.0/1.0 10/17/2018	ML-SD-21-1.0/2.0 10/17/2018	ML-SD-22-0.0/1.0 10/17/2018
Mercury	7439-97-6	mg/kg	0.048 U	0.077 U	0.1 U	0.095 J	0.049 U	0.05 U	0.052 U	0.052 U	0.052 U	0.05 U	0.094 J
Methyl Mercury	22967-92-6	µg/kg	1.37 U	2.02 U	2.89 U	1.39 U	1.21 U	1.58 U	1.17 U	1.23 U	1.72 U	1.62 U	1.6 U

Analyte	CAS No.	Unit	ML-SD-22-1.0/2.0 10/17/2018	ML-SD-33-0.0/1.2 10/18/2018	ML-SD-34-0.0/1.0 10/18/2018	ML-SD-34-0.0/1.0-FD 10/18/2018	ML-SD-34-1.0/1.8 10/18/2018	ML-SD-35-0.0/1.3 10/19/2018	ML-SD-36-0.0/1.0 10/19/2018	ML-SD-36-1.0/1.6 10/19/2018	ML-SD-37-0.0/1.2 10/19/2018	ML-SD-38-0.0/1.0 10/19/2018	ML-SD-38-1.0/1.7 10/19/2018
Mercury	7439-97-6	mg/kg	0.043 U	0.041 U	0.034 U	0.043 U	0.049 U	0.048 J	0.046 U	0.042 U	0.044 U	0.035 U	0.041 U
Methyl Mercury	22967-92-6	µg/kg	1.01 U	-	-	-	-	-	-	-	-	-	-

Analyte	CAS No.	Unit	ML-SD-39-0.0/1.0 10/19/2018	ML-SD-39-1.0/1.9 10/19/2018	ML-SD-40-0.0/1.0 10/19/2018	ML-SD-40-1.0/2.3 10/19/2018
Mercury	7439-97-6	mg/kg	0.04 U	0.054 J	0.04 U	0.042 U
Methyl Mercury	22967-92-6	µg/kg	-	-	-	-

Notes:

mg/kg = milligrams per kilogram; µg/kg = microgram per kilogram

J = Estimated; R = Rejected; U = Nondetect

Appendix E-3. Analytical Results Polychlorinated Biphenyls

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-01-0.0/1.0 10/15/2018	ML-SD-01-0.0/1.0-FD 10/15/2018	ML-SD-01-1.0/2.0 10/15/2018	ML-SD-01-2.0/3.0 10/15/2018	ML-SD-02-0.0/1.0 10/15/2018	ML-SD-02-1.0/2.0 10/15/2018	ML-SD-02-2.0/3.0 10/15/2018	ML-SD-02-3.0/4.0 10/15/2018	ML-SD-02-4.0/4.7 10/15/2018	ML-SD-03-0.0/1.0 10/16/2018	ML-SD-03-1.0/2.0 10/16/2018
Aroclor 1016	12674-11-2	µg/kg	41.7 U	42.2 U	36.4 U	36.8 U	56 U	56.5 U	36.5 U	32.9 UJ	30.8 U	34.6 U	40.8 UJ
Aroclor 1221	11104-28-2	µg/kg	41.7 U	42.2 U	36.4 U	36.8 U	56 U	56.5 U	36.5 U	32.9 UJ	30.8 U	34.6 U	40.8 UJ
Aroclor 1232	11141-16-5	µg/kg	41.7 U	42.2 U	36.4 U	36.8 U	56 U	56.5 U	36.5 U	32.9 UJ	30.8 U	34.6 U	40.8 UJ
Aroclor 1242	53469-21-9	µg/kg	41.7 U	42.2 U	36.4 U	36.8 U	56 U	56.5 U	36.5 U	32.9 U	30.8 U	34.6 U	40.8 UJ
Aroclor 1248	12672-29-6	µg/kg	41.7 U	42.2 U	36.4 U	36.8 U	56 U	56.5 U	36.5 U	32.9 UJ	30.8 U	34.6 U	40.8 UJ
Aroclor 1254	11097-69-1	µg/kg	41.7 U	42.2 U	36.4 U	36.8 U	56 U	56.5 U	36.5 U	32.9 UJ	30.8 U	34.6 U	40.8 UJ
Aroclor 1260	11096-82-5	µg/kg	382	491	36.4 U	36.8 U	178	805	36.5 U	32.9 UJ	30.8 U	34.6 U	40.8 UJ
Aroclor 1262	37324-23-5	µg/kg	41.7 U	42.2 U	36.4 U	36.8 U	56 U	56.5 U	36.5 U	32.9 UJ	30.8 U	34.6 U	40.8 UJ
Aroclor 1268	11100-14-4	µg/kg	41.7 U	42.2 U	36.4 U	36.8 U	56 U	56.5 U	36.5 U	32.9 UJ	30.8 U	34.6 U	40.8 UJ

Analyte	CAS No.	Unit	ML-SD-05-0.0/1.0 10/15/2018	ML-SD-05-0.0/1.0-FD 10/15/2018	ML-SD-05-1.0/2.0 10/15/2018	ML-SD-08-0.0/1.0 10/16/2018	ML-SD-08-1.0/2.0 10/16/2018	ML-SD-10-0.0/1.0 10/16/2018	ML-SD-10-0.0/1.0-FD 10/16/2018	ML-SD-10-1.0/2.0 10/16/2018	ML-SD-11-0.0/1.0 10/16/2018	ML-SD-11-1.0/2.0 10/16/2018	ML-SD-12-0.0/1.0 10/17/2018
Aroclor 1016	12674-11-2	µg/kg	38.3 U	37.3 U	34.6 U	35.4 U	35.8 U	43.2 U	41.6 U	42.6 U	47.3 U	33.9 U	40.3 U
Aroclor 1221	11104-28-2	µg/kg	38.3 U	37.3 U	34.6 U	35.4 U	35.8 U	43.2 U	41.6 U	42.6 U	47.3 U	33.9 U	40.3 U
Aroclor 1232	11141-16-5	µg/kg	38.3 U	37.3 U	34.6 U	35.4 U	35.8 U	43.2 U	41.6 U	42.6 U	47.3 U	33.9 U	40.3 U
Aroclor 1242	53469-21-9	µg/kg	38.3 U	37.3 U	34.6 U	35.4 U	35.8 U	43.2 U	41.6 U	42.6 U	47.3 U	33.9 U	40.3 U
Aroclor 1248	12672-29-6	µg/kg	38.3 U	37.3 U	34.6 U	35.4 U	35.8 U	43.2 U	41.6 U	42.6 U	47.3 U	33.9 U	40.3 U
Aroclor 1254	11097-69-1	µg/kg	38.3 U	37.3 U	34.6 U	35.4 U	35.8 U	43.2 U	41.6 U	42.6 U	47.3 U	33.9 U	40.3 U
Aroclor 1260	11096-82-5	µg/kg	38.3 U	37.3 U	34.6 U	52.2 J	35.8 U	43.2 U	41.6 U	42.6 U	80.3 J	33.9 U	190
Aroclor 1262	37324-23-5	µg/kg	38.3 U	37.3 U	34.6 U	35.4 U	35.8 U	43.2 U	41.6 U	42.6 U	47.3 U	33.9 U	40.3 U
Aroclor 1268	11100-14-4	µg/kg	38.3 U	37.3 U	34.6 U	35.4 U	35.8 U	43.2 U	41.6 U	42.6 U	47.3 U	33.9 U	40.3 U

Analyte	CAS No.	Unit	ML-SD-12-1.0/2.0 10/17/2018	ML-SD-13-0.0/1.0 10/16/2018	ML-SD-13-0.0/1.0-FD 10/16/2018	ML-SD-13-1.0/2.0 10/16/2018	ML-SD-14-0.0/1.0 10/17/2018	ML-SD-14-1.0/2.0 10/17/2018	ML-SD-14-2.0/3.0 10/17/2018	ML-SD-15-0.0/1.0 10/18/2018	ML-SD-15-1.0/2.0 10/18/2018	ML-SD-16-0.0/1.0 10/17/2018	ML-SD-16-1.0/2.0 10/17/2018
Aroclor 1016	12674-11-2	µg/kg	36.1 U	33.6 U	35 U	33.4 U	128 U	49.6 U	37.6 U	41.9 U	40.3 U	58.9 U	76.9 U
Aroclor 1221	11104-28-2	µg/kg	36.1 U	33.6 U	35 U	33.4 U	128 U	49.6 U	37.6 U	41.9 U	40.3 U	58.9 U	76.9 U
Aroclor 1232	11141-16-5	µg/kg	36.1 U	33.6 U	35 U	33.4 U	128 U	49.6 U	37.6 U	41.9 U	40.3 U	58.9 U	76.9 U
Aroclor 1242	53469-21-9	µg/kg	36.1 U	33.6 U	35 U	33.4 U	128 U	49.6 U	37.6 U	41.9 U	40.3 U	58.9 U	76.9 U
Aroclor 1248	12672-29-6	µg/kg	36.1 U	33.6 U	35 U	33.4 U	128 U	49.6 U	37.6 U	41.9 U	40.3 U	58.9 U	76.9 U
Aroclor 1254	11097-69-1	µg/kg	36.1 U	33.6 U	35 U	33.4 U	128 U	49.6 U	37.6 U	41.9 U	40.3 U	58.9 U	76.9 U
Aroclor 1260	11096-82-5	µg/kg	36.1 U	33.6 U	35 U	33.4 U	1450	55.5 J	37.6 U	114	40.3 U	58.9 U	76.9 U
Aroclor 1262	37324-23-5	µg/kg	36.1 U	33.6 U	35 U	33.4 U	128 U	49.6 U	37.6 U	41.9 U	40.3 U	58.9 U	76.9 U
Aroclor 1268	11100-14-4	µg/kg	36.1 U	33.6 U	35 U	33.4 U	128 U	49.6 U	37.6 U	41.9 U	40.3 U	58.9 U	76.9 U

Notes:

µg/kg = micrograms per kilogram; J = Estimated; U = Nondetect

Appendix E-3. Analytical Results Polychlorinated Biphenyls

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-16-2.0/3.0 10/17/2018	ML-SD-17-0.0/1.0 10/17/2018	ML-SD-17-1.0/2.0 10/17/2018	ML-SD-18-0.0/1.0 10/17/2018	ML-SD-18-1.0/2.0 10/17/2018	ML-SD-19-0.0/1.0 10/17/2018	ML-SD-19-1.0/2.0 10/17/2018	ML-SD-19-1.0/2.0-FD 10/17/2018	ML-SD-20-0.0/1.0 10/17/2018	ML-SD-20-1.0/2.0 10/17/2018	ML-SD-21-0.0/1.0 10/17/2018
Aroclor 1016	12674-11-2	µg/kg	49.8 U	86.7 U	34.1 U	43.6 U	38.1 U	40.7 U	38 U	38.9 U	46.7 U	42.3 U	39.5 U
Aroclor 1221	11104-28-2	µg/kg	49.8 U	86.7 U	34.1 U	43.6 U	38.1 U	40.7 U	38 U	38.9 U	46.7 U	42.3 U	39.5 U
Aroclor 1232	11141-16-5	µg/kg	49.8 U	86.7 U	34.1 U	43.6 U	38.1 U	40.7 U	38 U	38.9 U	46.7 U	42.3 U	39.5 U
Aroclor 1242	53469-21-9	µg/kg	49.8 U	86.7 U	34.1 U	43.6 U	38.1 U	40.7 U	38 U	38.9 U	46.7 U	42.3 U	39.5 U
Aroclor 1248	12672-29-6	µg/kg	49.8 U	86.7 U	34.1 U	43.6 U	38.1 U	40.7 U	38 U	38.9 U	46.7 U	42.3 U	39.5 U
Aroclor 1254	11097-69-1	µg/kg	49.8 U	86.7 U	34.1 U	43.6 U	38.1 U	40.7 U	38 U	38.9 U	46.7 U	42.3 U	39.5 U
Aroclor 1260	11096-82-5	µg/kg	49.8 U	1000	34.1 U	113	38.1 U	40.7 U	38 U	38.9 U	50.8 J	42.3 U	39.5 U
Aroclor 1262	37324-23-5	µg/kg	49.8 U	86.7 U	34.1 U	43.6 U	38.1 U	40.7 U	38 U	38.9 U	46.7 U	42.3 U	39.5 U
Aroclor 1268	11100-14-4	µg/kg	49.8 U	86.7 U	34.1 U	43.6 U	38.1 U	40.7 U	38 U	38.9 U	46.7 U	42.3 U	39.5 U

Analyte	CAS No.	Unit	ML-SD-21-1.0/2.0 10/17/2018	ML-SD-22-0.0/1.0 10/17/2018	ML-SD-22-1.0/2.0 10/17/2018	ML-SD-23-0.0/1.0 10/18/2018	ML-SD-23-1.0/2.0 10/18/2018	ML-SD-23-2.0/3.0 10/18/2018	ML-SD-23-2.0/3.0-FD 10/18/2018	ML-SD-23-3.0/4.0 10/18/2018	ML-SD-24-0.0/1.0 10/18/2018	ML-SD-24-1.0/2.0 10/18/2018	ML-SD-24-2.0/3.0 10/18/2018
Aroclor 1016	12674-11-2	µg/kg	39.8 U	41.6 U	34.4 U	62.8 U	58.1 U	37.2 U	39.8 U	38.8 UJ	67.3 U	123 U	50.3 U
Aroclor 1221	11104-28-2	µg/kg	39.8 U	41.6 U	34.4 U	62.8 U	58.1 U	37.2 U	39.8 U	38.8 UJ	67.3 U	123 U	50.3 U
Aroclor 1232	11141-16-5	µg/kg	39.8 U	41.6 U	34.4 U	62.8 U	58.1 U	37.2 U	39.8 U	38.8 UJ	67.3 U	123 U	50.3 U
Aroclor 1242	53469-21-9	µg/kg	39.8 U	41.6 U	34.4 U	62.8 U	58.1 U	37.2 U	39.8 U	38.8 UJ	67.3 U	123 U	50.3 U
Aroclor 1248	12672-29-6	µg/kg	39.8 U	41.6 U	34.4 U	62.8 U	58.1 U	37.2 U	39.8 U	38.8 UJ	67.3 U	123 U	50.3 U
Aroclor 1254	11097-69-1	µg/kg	39.8 U	41.6 U	34.4 U	62.8 U	58.1 U	37.2 U	39.8 U	38.8 UJ	67.3 U	123 U	50.3 U
Aroclor 1260	11096-82-5	µg/kg	39.8 U	74.3 J	34.4 U	400	171	37.2 U	39.8 U	38.8 UJ	163	1730	50.3 U
Aroclor 1262	37324-23-5	µg/kg	39.8 U	41.6 U	34.4 U	62.8 U	58.1 U	37.2 U	39.8 U	38.8 UJ	67.3 U	123 U	50.3 U
Aroclor 1268	11100-14-4	µg/kg	39.8 U	41.6 U	34.4 U	62.8 U	58.1 U	37.2 U	39.8 U	38.8 UJ	67.3 U	123 U	50.3 U

Analyte	CAS No.	Unit	ML-SD-24-2.0/3.0-FD 10/18/2018	ML-SD-24-3.0/4.0 10/18/2018	ML-SD-25-0.0/1.0 10/18/2018	ML-SD-25-1.0/2.0 10/18/2018	ML-SD-26-0.0/1.0 10/18/2018	ML-SD-26-1.0/2.0 10/18/2018	ML-SD-26-1.0/2.0-FD 10/18/2018	ML-SD-26-2.0/3.0 10/18/2018	ML-SD-26-3.0/4.0 10/18/2018	ML-SD-27-0.0/1.0 10/17/2018	ML-SD-27-1.0/2.0 10/17/2018
Aroclor 1016	12674-11-2	µg/kg	48.3 U	34.8 U	57.1 U	38.5 U	116 U	50.6 U	52.5 U	33.7 U	37.1 U	147 U	87.5 U
Aroclor 1221	11104-28-2	µg/kg	48.3 U	34.8 U	57.1 U	38.5 U	116 U	50.6 U	52.5 U	33.7 U	37.1 U	147 U	87.5 U
Aroclor 1232	11141-16-5	µg/kg	48.3 U	34.8 U	57.1 U	38.5 U	116 U	50.6 U	52.5 U	33.7 U	37.1 U	147 U	87.5 U
Aroclor 1242	53469-21-9	µg/kg	48.3 U	34.8 U	57.1 U	38.5 U	116 U	50.6 U	52.5 U	33.7 U	37.1 U	147 U	87.5 U
Aroclor 1248	12672-29-6	µg/kg	48.3 U	34.8 U	57.1 U	38.5 U	116 U	50.6 U	52.5 U	33.7 U	37.1 U	147 U	87.5 U
Aroclor 1254	11097-69-1	µg/kg	48.3 U	34.8 U	57.1 U	38.5 U	116 U	50.6 U	52.5 U	33.7 U	37.1 U	147 U	87.5 U
Aroclor 1260	11096-82-5	µg/kg	48.3 U	34.8 U	205	38.5 U	958	50.6 U	52.5 U	33.7 U	37.1 U	147 U	230
Aroclor 1262	37324-23-5	µg/kg	48.3 U	34.8 U	57.1 U	38.5 U	116 U	50.6 U	52.5 U	33.7 U	37.1 U	147 U	87.5 U
Aroclor 1268	11100-14-4	µg/kg	48.3 U	34.8 U	57.1 U	38.5 U	116 U	50.6 U	52.5 U	33.7 U	37.1 U	147 U	87.5 U

Notes:

µg/kg = micrograms per kilogram; J = Estimated; U = Nondetect

Appendix E-3. Analytical Results Polychlorinated Biphenyls

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-27-2.0/3.0 10/17/2018	ML-SD-27-3.0/3.7 10/17/2018	ML-SD-28-0.0/1.0 10/18/2018	ML-SD-33-0.0/1.2 10/18/2018	ML-SD-34-0.0/1.0 10/18/2018	ML-SD-34-0.0/1.0-FD 10/18/2018	ML-SD-34-1.0/1.8 10/18/2018	ML-SD-35-0.0/1.3 10/19/2018	ML-SD-36-0.0/1.0 10/19/2018	ML-SD-36-1.0/1.6 10/19/2018	ML-SD-37-0.0/1.2 10/19/2018
Aroclor 1016	12674-11-2	µg/kg	97.5 U	83.8 U	32.8 U	29.8 U	27.3 U	32.5 U	35.1 U	33.3 U	37.7 U	33.1 U	32.1 U
Aroclor 1221	11104-28-2	µg/kg	97.5 U	83.8 U	32.8 U	29.8 U	27.3 U	32.5 U	35.1 U	33.3 U	37.7 U	33.1 U	32.1 U
Aroclor 1232	11141-16-5	µg/kg	97.5 U	83.8 U	32.8 U	29.8 U	27.3 U	32.5 U	35.1 U	33.3 U	37.7 U	33.1 U	32.1 U
Aroclor 1242	53469-21-9	µg/kg	97.5 U	83.8 U	32.8 U	29.8 U	27.3 U	32.5 U	35.1 U	33.3 U	37.7 U	33.1 U	32.1 U
Aroclor 1248	12672-29-6	µg/kg	97.5 U	83.8 U	32.8 U	29.8 U	27.3 U	32.5 U	35.1 U	33.3 U	37.7 U	33.1 U	32.1 U
Aroclor 1254	11097-69-1	µg/kg	97.5 U	83.8 U	32.8 U	29.8 U	27.3 U	32.5 U	35.1 U	33.3 U	37.7 U	33.1 U	32.1 U
Aroclor 1260	11096-82-5	µg/kg	97.5 U	83.8 U	32.8 U	29.8 U	27.3 U	32.5 U	35.1 U	33.3 U	37.7 U	33.1 U	32.1 U
Aroclor 1262	37324-23-5	µg/kg	97.5 U	83.8 U	32.8 U	29.8 U	27.3 U	32.5 U	35.1 U	33.3 U	37.7 U	33.1 U	32.1 U
Aroclor 1268	11100-14-4	µg/kg	97.5 U	83.8 U	32.8 U	29.8 U	27.3 U	32.5 U	35.1 U	33.3 U	37.7 U	33.1 U	32.1 U

Analyte	CAS No.	Unit	ML-SD-38-0.0/1.0 10/19/2018	ML-SD-38-1.0/1.7 10/19/2018	ML-SD-39-0.0/1.0 10/19/2018	ML-SD-39-1.0/1.9 10/19/2018	ML-SD-40-0.0/1.0 10/19/2018	ML-SD-40-1.0/2.3 10/19/2018
Aroclor 1016	12674-11-2	µg/kg	28.3 U	61.1 U	29 U	33.7 U	30.4 U	30.8 U
Aroclor 1221	11104-28-2	µg/kg	28.3 U	61.1 U	29 U	33.7 U	30.4 U	30.8 U
Aroclor 1232	11141-16-5	µg/kg	28.3 U	61.1 U	29 U	33.7 U	30.4 U	30.8 U
Aroclor 1242	53469-21-9	µg/kg	28.3 U	61.1 U	29 U	33.7 U	30.4 U	30.8 U
Aroclor 1248	12672-29-6	µg/kg	28.3 U	61.1 U	29 U	33.7 U	30.4 U	30.8 U
Aroclor 1254	11097-69-1	µg/kg	28.3 U	61.1 U	29 U	33.7 U	30.4 U	30.8 U
Aroclor 1260	11096-82-5	µg/kg	447	554	505	186	303	408
Aroclor 1262	37324-23-5	µg/kg	28.3 U	61.1 U	29 U	33.7 U	30.4 U	30.8 U
Aroclor 1268	11100-14-4	µg/kg	28.3 U	61.1 U	29 U	33.7 U	30.4 U	30.8 U

Notes:

µg/kg = micrograms per kilogram; J = Estimated; U = Nondetect

Appendix E-4. Analytical Results Dioxin and Furan Congeners

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-01-0.0/1.0 10/15/2018	ML-SD-01-0.0/1.0-FD 10/15/2018	ML-SD-01-1.0/2.0 10/15/2018	ML-SD-01-2.0/3.0 10/15/2018	ML-SD-02-0.0/1.0 10/15/2018	ML-SD-02-1.0/2.0 10/15/2018	ML-SD-02-2.0/3.0 10/15/2018	ML-SD-02-3.0/4.0 10/15/2018	ML-SD-02-4.0/4.7 10/15/2018	ML-SD-03-0.0/1.0 10/16/2018	ML-SD-03-1.0/2.0 10/16/2018
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	630	670	3.9 J	4.7 J	380	1600	23	8.4	0.94 J	0.57 J	0.56 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	960	820	13	16	460	1000	160	32	1.3 J	0.63 J	0.41 U
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	12	18	0.47 U	0.44 U	6.8 J	27	0.44 U	0.44 U	0.44 U	0.46 U	0.54 U
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	7.8	7.7	0.38 U	0.35 U	3.9 J	12	0.35 U	0.35 U	0.35 U	0.37 U	0.43 U
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	16 J	19 J	0.21 U	0.2 U	5.3 J	24	0.2 U	0.41 J	0.2 U	0.21 U	0.24 U
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	46	46	0.59 J	0.22 U	20	86	3.5 J	1.2 J	0.22 U	0.24 U	0.28 U
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	22	21	0.54 J	0.21 U	15	32	2.4 J	0.85 J	0.21 U	0.22 U	0.25 U
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	40	30	0.4 J	0.47 U	11	46	1.5 J	0.56 J	0.47 U	0.49 U	0.57 U
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	3.2 J	3 J	0.28 U	0.26 U	1.9 J	5.3 J	0.26 U	0.26 U	0.26 U	0.27 U	0.32 U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	6.9 J	6.1 J	0.17 U	0.16 U	2.3 J	7.8 J	0.64 J	0.21 J	0.15 U	0.16 U	0.19 U
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	1.8 J	0.21 U	0.2 U	0.19 U	1.3 J	3.8 J	0.19 U	0.19 U	0.19 U	0.2 U	0.23 U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	6.3 J	5.5 J	0.29 U	0.27 U	2.7 J	8.5 J	0.27 U	0.38 J	0.27 U	0.28 U	0.33 U
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	6.6 J	6 J	0.16 U	0.22 J	3.4 J	10	0.88 J	0.23 J	0.14 U	0.15 U	0.18 U
2,3,7,8-TCDD	1746-01-6	ng/kg	3.4	4.2	0.33 U	0.31 U	2.2	7.5	0.31 U	0.31 U	0.31 U	0.32 U	0.38 U
2,3,7,8-TCDF	51207-31-9	ng/kg	6.4	7.9	0.15 U	0.14 U	5.7	22	0.14 U	0.14 U	0.14 U	0.15 U	0.17 U
OCDD	3268-87-9	ng/kg	5600	7100	31	41	3900	17000 J	240	75	14	2 J	0.89 U
OCDF	39001-02-0	ng/kg	540	600	3.9 J	5.7 J	260	1100	54	12	1.1 U	1.2 U	1.4 U
Total HpCDD[a]	37871-00-4	ng/kg	1200 J	1500 J	7.7 J	9.7 J	760 J	3200 J	50 J	17 J	0.45 UJ	0.57 J	0.56 UJ
Total HpCDF[a]	38998-75-3	ng/kg	2000 J	1700 J	25 J	31 J	930 J	1100 J	280 J	61 J	1.3 J	1.5 J	0.95 UJ
Total HxCDD[a]	34465-46-8	ng/kg	380 J	420 J	1.7 J	1 J	150 J	710 J	21 J	7.4 J	1 UJ	1.1 UJ	1.3 UJ
Total HxCDF[a]	55684-94-1	ng/kg	350 J	390 J	3.5 J	2 J	190 J	300 J	48 J	12 J	0.93 UJ	0.98 UJ	1.1 UJ
Total PeCDD[a]	36088-22-9	ng/kg	34 J	46 J	0.17 UJ	0.16 UJ	20 J	63 J	1.5 J	0.16 UJ	0.15 UJ	0.16 UJ	0.19 UJ
Total PeCDF[a]	30402-15-4	ng/kg	67 J	79 J	0.86 J	0.33 UJ	42 J	140 J	6.2 J	1.6 J	0.33 UJ	0.42 J	0.41 UJ
Total TCDD[a]	41903-57-5	ng/kg	19 J	18 J	0.33 UJ	0.31 UJ	9.3 J	36 J	0.31 UJ	0.31 UJ	0.31 UJ	0.27 J	0.38 UJ
Total TCDF[a]	55722-27-5	ng/kg	25 J	33 J	0.15 UJ	0.14 UJ	30 J	83 J	0.14 UJ	0.14 UJ	0.14 UJ	0.15 UJ	0.17 UJ

Notes:

ng/kg = nanograms per kilogram; J = Estimated; U = Nondetect; UJ = Estimated nondetect

[a] Total dioxin and furan congener homolog groups calculated by analytical laboratory

Appendix E-4. Analytical Results Dioxin and Furan Congeners

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-04-0.0/1.0 10/16/2018	ML-SD-04-1.0/2.0 10/16/2018	ML-SD-05-0.0/1.0 10/15/2018	ML-SD-05-0.0/1.0-FD 10/15/2018	ML-SD-05-1.0/2.0 10/15/2018	ML-SD-06-0.0/1.0 10/16/2018	ML-SD-06-1.0/2.0 10/16/2018	ML-SD-07-0.0/1.0 10/16/2018	ML-SD-07-1.0/2.0 10/16/2018	ML-SD-08-0.0/1.0 10/16/2018	ML-SD-08-1.0/2.0 10/16/2018
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	1.2 J	0.47 U	0.51 U	0.7 J	0.46 U	5.6 J	1.8 J	190	2.8 J	16	0.52 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	3.1 J	0.34 U	0.37 UJ	1.1 J	0.34 U	16	3.5 J	950	8.7	50	0.38 U
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.49 U	0.45 U	0.49 U	0.48 U	0.45 U	0.5 U	0.54 U	4.8	0.5 U	0.48 U	0.51 U
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.39 U	0.36 U	0.4 UJ	0.39 U	0.36 U	0.4 U	0.44 U	3.3 J	0.41 U	0.39 U	0.41 U
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.22 U	0.2 U	0.22 U	0.22 U	0.2 U	0.21 J	0.24 U	8.8	0.23 U	0.22 U	0.23 U
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.25 U	0.23 U	0.25 U	0.25 U	0.23 U	0.26 U	0.28 U	22	0.26 U	1.6 J	0.26 U
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.23 U	0.21 U	0.23 U	0.23 U	0.21 U	0.45 J	0.21 J	21	0.24 U	3.5 J	0.24 U
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.52 U	0.48 U	0.52 U	0.51 U	0.48 U	0.53 U	0.58 U	11	0.54 U	0.52 U	0.54 U
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.29 U	0.27 U	0.29 U	0.28 U	0.27 U	0.29 U	0.32 U	2.8 J	0.3 U	0.29 U	0.3 U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	0.17 U	0.16 U	0.17 U	0.17 U	0.16 U	0.18 U	0.19 U	3.5 J	0.18 U	0.17 U	0.18 U
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.21 U	0.19 U	0.21 U	0.21 U	0.19 U	0.21 U	0.23 U	1 J	0.22 U	0.21 U	0.22 U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.3 U	0.28 U	0.3 U	0.3 U	0.28 U	0.31 U	0.34 U	5.1	0.31 U	0.3 U	0.31 U
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.16 U	0.15 U	0.16 U	0.16 U	0.15 U	0.16 U	0.18 U	3.9 J	0.17 U	0.16 U	0.17 U
2,3,7,8-TCDD	1746-01-6	ng/kg	0.34 U	0.32 U	0.35 U	0.34 U	0.32 U	0.35 U	0.38 U	1.1	0.36 U	0.34 U	0.36 U
2,3,7,8-TCDF	51207-31-9	ng/kg	0.24 J	0.14 U	0.16 U	0.15 U	0.14 U	0.27 J	0.13 J	1.1	0.16 U	0.15 U	0.16 U
OCDD	3268-87-9	ng/kg	12	0.75 U	1.5 J	4.7 J	0.45 J	54	20	1600	23	140	4.3 J
OCDF	39001-02-0	ng/kg	0.55 J	1.2 U	1.3 U	0.43 J	1.2 U	3.7 J	1.1 J	220	2.9 J	15	1.3 U
Total HpCDD[a]	37871-00-4	ng/kg	3.4 J	0.47 UJ	0.51 UJ	0.7 J	0.46 UJ	16 J	4.5 J	510 J	2.8 J	38 J	0.52 UJ
Total HpCDF[a]	38998-75-3	ng/kg	5.2 J	0.8 UJ	0.87 UJ	1.3 J	0.79 UJ	29 J	6.1 J	1700 J	16 J	95 J	0.89 UJ
Total HxCDD[a]	34465-46-8	ng/kg	2.7 J	1.8 J	1.2 UJ	0.86 J	1.1 UJ	6.4 J	2.4 J	230 J	2.9 J	13 J	1.2 UJ
Total HxCDF[a]	55684-94-1	ng/kg	1.2 J	0.96 UJ	1 UJ	0.27 J	0.96 UJ	7.5 J	2.4 J	520 J	4.1 J	40 J	1.1 UJ
Total PeCDD[a]	36088-22-9	ng/kg	2.7 J	0.16 UJ	0.17 UJ	0.46 J	0.16 UJ	3.7 J	2.7 J	43 J	0.18 UJ	0.17 UJ	0.18 UJ
Total PeCDF[a]	30402-15-4	ng/kg	0.58 J	0.34 UJ	0.37 UJ	0.37 UJ	0.34 UJ	2.2 J	0.67 J	86 J	1 J	7.2 J	0.38 UJ
Total TCDD[a]	41903-57-5	ng/kg	4 J	1.4 J	0.35 UJ	0.39 J	0.32 UJ	2.5 J	3.9 J	21 J	0.36 UJ	0.34 UJ	0.36 UJ
Total TCDF[a]	55722-27-5	ng/kg	0.42 J	0.14 UJ	0.16 UJ	0.15 UJ	0.14 UJ	0.48 J	0.87 J	15 J	0.16 UJ	0.15 UJ	0.16 UJ

Notes:

ng/kg = nanograms per kilogram; J = Estimated; U = Nondetect; UJ = Estimated nondetect

[a] Total dioxin and furan congener homolog groups calculated by analytical laboratory

Appendix E-4. Analytical Results Dioxin and Furan Congeners

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-09-0.0/1.0 10/16/2018	ML-SD-09-1.0/2.0 10/16/2018	ML-SD-10-0.0/1.0 10/16/2018	ML-SD-10-0.0/1.0-FD 10/16/2018	ML-SD-10-1.0/2.0 10/16/2018	ML-SD-11-0.0/1.0 10/16/2018	ML-SD-11-1.0/2.0 10/16/2018	ML-SD-12-0.0/1.0 10/17/2018	ML-SD-12-1.0/2.0 10/17/2018	ML-SD-13-0.0/1.0 10/16/2018	ML-SD-13-0.0/1.0-FD 10/16/2018
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	0.49 U	1.9 J	0.54 U	1.5 J	0.54 U	660	2 J	3.4 J	0.94 J	0.96 J	5.7 J
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	2.8 J	2.4 J	3.6 J	2.5 J	0.99 J	2400	6.4	4.8 J	1.3 J	1.4 J	12
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.47 U	0.47 U	0.52 U	0.49 U	0.52 U	19	0.46 U	0.53 U	0.49 U	0.46 U	0.48 U
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.38 U	0.38 U	0.42 U	0.39 U	0.42 U	7.7	0.37 U	0.43 U	0.39 U	0.37 U	0.38 U
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.21 U	0.21 U	0.23 U	0.22 U	0.23 U	24 J	0.21 U	0.24 U	0.22 U	0.21 U	0.21 U
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.24 U	0.24 U	0.27 U	0.25 U	0.27 U	66	0.23 U	0.27 U	0.25 U	0.24 U	0.58 J
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.22 U	0.22 U	0.25 U	0.23 U	0.25 U	54	0.22 U	0.46 J	0.23 U	0.22 U	0.58 J
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.51 U	0.5 U	0.56 U	0.52 U	0.55 U	37	0.49 U	0.57 U	0.52 U	0.49 U	0.51 U
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.28 U	0.28 U	0.31 U	0.29 U	0.31 U	4.9 J	0.27 U	0.31 U	0.29 U	0.27 U	0.28 U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	0.17 U	0.16 U	0.18 U	0.17 U	0.18 U	10	0.16 U	0.19 U	0.17 U	0.16 U	0.17 U
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.2 U	0.2 U	0.22 U	0.21 U	0.22 U	3 J	0.2 U	0.23 U	0.21 U	0.2 U	0.2 U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.29 U	0.29 U	0.32 U	0.3 U	0.32 U	12	0.28 U	0.33 U	0.3 U	0.28 U	0.29 U
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.16 U	0.15 U	0.17 U	0.16 U	0.17 U	8.3 J	0.15 U	0.17 U	0.16 U	0.15 U	0.16 U
2,3,7,8-TCDD	1746-01-6	ng/kg	0.33 U	0.33 U	0.37 U	0.34 U	0.37 U	4.1	0.32 U	0.37 U	0.34 U	0.32 U	0.33 U
2,3,7,8-TCDF	51207-31-9	ng/kg	0.15 U	0.15 U	0.17 U	0.15 U	0.16 U	3.7	0.15 U	0.17 U	0.15 U	0.15 U	0.15 U
OCDD	3268-87-9	ng/kg	13	7.1 J	7.3 J	12	3.2 J	5500	15	25	7.8 J	6.1 J	52
OCDF	39001-02-0	ng/kg	1.2 U	1.2 U	1.3 U	1.3 U	1.3 U	780	1.8 J	3.1 J	0.51 J	0.65 J	4.5 J
Total HpCDD[a]	37871-00-4	ng/kg	0.49 UJ	3.4 J	0.54 UJ	3.8 J	1.1 J	1600 J	4.8 J	7.8 J	2.2 J	0.96 J	15 J
Total HpCDF[a]	38998-75-3	ng/kg	3.8 J	2.4 J	3.6 J	2.5 J	2.1 J	2500 J	12 J	8.8 J	2.4 J	2.9 J	23 J
Total HxCDD[a]	34465-46-8	ng/kg	1.1 UJ	1.1 UJ	2.8 J	4.3 J	1.2 UJ	590 J	1.1 J	0.63 J	1.7 J	1.1 UJ	5.3 J
Total HxCDF[a]	55684-94-1	ng/kg	1 UJ	0.99 UJ	1.1 UJ	1.4 J	1.1 UJ	530 J	3.2 J	0.46 J	0.38 J	0.65 J	9.6 J
Total PeCDD[a]	36088-22-9	ng/kg	0.17 UJ	0.16 UJ	0.18 UJ	2.5 J	0.18 UJ	130 J	1.4 J	0.19 UJ	1.2 J	0.16 UJ	1.7 J
Total PeCDF[a]	30402-15-4	ng/kg	0.36 UJ	0.35 UJ	0.4 UJ	0.37 UJ	0.39 UJ	300 J	0.22 J	1.4 J	0.37 UJ	0.32 J	2.3 J
Total TCDD[a]	41903-57-5	ng/kg	0.33 UJ	0.33 UJ	4.5 J	4.7 J	2.1 J	36 J	1 J	0.37 UJ	1.7 J	0.32 UJ	1.5 J
Total TCDF[a]	55722-27-5	ng/kg	0.15 UJ	0.15 UJ	0.17 UJ	0.15 UJ	0.16 UJ	27 J	0.37 J	0.17 UJ	0.15 UJ	0.15 UJ	1.2 J

Notes:

ng/kg = nanograms per kilogram; J = Estimated; U = Nondetect; UJ = Estimated nondetect

[a] Total dioxin and furan congener homolog groups calculated by analytical laboratory

Appendix E-4. Analytical Results Dioxin and Furan Congeners

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-13-1.0/2.0 10/16/2018	ML-SD-14-0.0/1.0 10/17/2018	ML-SD-14-1.0/2.0 10/17/2018	ML-SD-14-2.0/3.0 10/17/2018	ML-SD-15-0.0/1.0 10/18/2018	ML-SD-15-1.0/2.0 10/18/2018	ML-SD-16-0.0/1.0 10/17/2018	ML-SD-16-1.0/2.0 10/17/2018	ML-SD-17-0.0/1.0 10/17/2018	ML-SD-17-1.0/2.0 10/17/2018	ML-SD-18-0.0/1.0 10/17/2018
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	0.47 U	2100	500	12	110	3.4 J	26	11 J	130	0.49 U	10
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	0.35 U	4400 J	3500 J	32	250	6.8	99	25	370	0.36 U	15
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.45 U	55	20	0.44 U	3.2 J	0.51 U	0.76 J	0.95 U	7.9	0.48 U	0.57 U
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.37 U	36	9.2 J	0.35 U	1.6 J	0.41 U	0.58 U	0.77 U	1.8 J	0.38 U	0.46 U
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.2 U	63	35 J	0.2 U	3.8 J	0.23 U	1.3 J	0.6 J	6.8 J	0.21 U	0.26 U
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.23 U	180	75	1 J	8.3	0.26 U	2.2 J	1.2 J	11	0.24 U	0.29 U
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.21 U	110	98	1.1 J	8.4	0.46 J	3.8 J	0.69 J	11	0.22 U	0.66 J
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.49 U	93	39	1.5 J	5.3 J	0.55 U	1.4 J	1 U	6.1 J	0.51 U	0.61 U
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.27 U	17	13	0.26 U	0.65 J	0.3 U	0.63 J	0.56 U	1.4 J	0.28 U	0.34 U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	0.16 U	34	11	0.29 J	1.2 J	0.18 U	0.25 U	0.34 U	1.7 J	0.17 U	0.2 U
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.2 U	5.2 J	4.2 J	0.19 U	0.82 J	0.22 U	0.31 U	0.41 U	0.95 J	0.2 U	0.25 U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.28 U	18	13	0.27 U	2.7 J	0.32 U	0.45 J	0.5 J	3.3 J	0.29 U	0.35 U
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.15 U	14	12	0.14 U	1.4 J	0.17 U	0.67 J	0.31 U	2.4 J	0.16 U	0.27 J
2,3,7,8-TCDD	1746-01-6	ng/kg	0.32 U	14	2.4	0.31 U	0.68 J	0.36 U	0.5 U	0.67 U	0.75 J	0.33 U	0.4 U
2,3,7,8-TCDF	51207-31-9	ng/kg	0.14 U	19	1.3 J	0.14 U	0.81 J	0.16 U	0.47 J	0.3 U	1.2 J	0.15 U	0.18 U
OCDD	3268-87-9	ng/kg	0.75 U	15000 J	3300	84	1000	26	260	99	1500	0.79 U	90
OCDF	39001-02-0	ng/kg	1.2 U	2300	1300	16	110	3.1 J	38	7.6 J	190	1.2 U	6.2 J
Total HpCDD[a]	37871-00-4	ng/kg	0.47 UJ	4700 J	1200 J	23 J	260 J	8 J	64 J	27 J	330 J	0.49 UJ	24 J
Total HpCDF[a]	38998-75-3	ng/kg	0.8 UJ	8500 J	5900 J	57 J	470 J	13 J	170 J	47 J	710 J	0.84 UJ	30 J
Total HxCDD[a]	34465-46-8	ng/kg	1.1 UJ	1900 J	710 J	1.5 J	89 J	5 J	24 J	14 J	120 J	0.4 J	3.8 J
Total HxCDF[a]	55684-94-1	ng/kg	0.97 UJ	1300 J	1000 J	9.6 J	150 J	4.8 J	54 J	10 J	240 J	1 UJ	12 J
Total PeCDD[a]	36088-22-9	ng/kg	0.16 UJ	290 J	120 J	0.77 J	19 J	3.2 J	5.5 J	6 J	23 J	0.17 UJ	0.2 UJ
Total PeCDF[a]	30402-15-4	ng/kg	0.34 UJ	410 J	260 J	0.33 UJ	27 J	0.85 J	11 J	2.3 J	53 J	0.36 UJ	0.82 J
Total TCDD[a]	41903-57-5	ng/kg	0.32 UJ	120 J	37 J	0.31 UJ	7.6 J	5.8 J	5.5 J	6.7 J	6.2 J	0.33 UJ	0.4 UJ
Total TCDF[a]	55722-27-5	ng/kg	0.14 UJ	130 J	34 J	0.14 UJ	14 J	0.16 UJ	3.5 J	0.3 UJ	23 J	0.15 UJ	0.58 J

Notes:

ng/kg = nanograms per kilogram; J = Estimated; U = Nondetect; UJ = Estimated nondetect

[a] Total dioxin and furan congener homolog groups calculated by analytical laboratory

Appendix E-4. Analytical Results Dioxin and Furan Congeners

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-18-1.0/2.0 10/17/2018	ML-SD-19-0.0/1.0 10/17/2018	ML-SD-19-1.0/2.0 10/17/2018	ML-SD-19-1.0/2.0-FD 10/17/2018	ML-SD-20-0.0/1.0 10/17/2018	ML-SD-20-1.0/2.0 10/17/2018	ML-SD-21-0.0/1.0 10/17/2018	ML-SD-21-1.0/2.0 10/17/2018	ML-SD-22-0.0/1.0 10/17/2018	ML-SD-22-1.0/2.0 10/17/2018	ML-SD-23-0.0/1.0 10/18/2018
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	0.53 U	0.68 J	0.52 U	0.53 U	5.5 J	0.63 J	0.83 J	0.54 U	9.9	0.54 J	1000
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	0.39 U	1.5 J	1.2 J	0.39 U	8.3 J	0.87 J	0.65 J	0.4 U	16	1.3 J	520
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.51 U	0.52 U	0.5 U	0.51 U	0.59 U	0.55 U	0.51 U	0.52 U	0.53 U	0.47 U	24 J
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.41 U	0.42 U	0.4 U	0.41 U	0.47 U	0.45 U	0.41 U	0.42 U	0.43 U	0.38 U	7.5 J
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.23 U	0.24 U	0.22 U	0.23 U	0.26 U	0.25 U	0.23 U	0.23 U	0.26 J	0.21 U	14 J
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.26 U	0.27 U	0.25 U	0.26 U	0.75 J	0.28 U	0.26 U	0.27 U	0.51 J	0.24 U	48 J
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.24 U	0.25 U	0.24 U	0.24 U	0.45 J	0.26 U	0.24 U	0.25 U	0.93 J	0.22 U	20 J
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.54 U	0.56 U	0.53 U	0.54 U	0.63 U	0.59 U	0.54 U	0.56 U	0.57 U	0.5 U	24 J
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.3 U	0.31 U	0.29 U	0.3 U	0.35 U	0.33 U	0.3 U	0.31 U	0.31 U	0.28 U	2.1 U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	0.18 U	0.19 U	0.18 U	0.18 U	0.21 U	0.2 U	0.18 U	0.18 U	0.19 U	0.17 U	4.5 J
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.22 U	0.23 U	0.21 U	0.22 U	0.25 U	0.24 U	0.22 U	0.22 U	0.23 U	0.2 U	1.5 U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.31 U	0.32 U	0.31 U	0.31 U	0.36 U	0.34 U	0.31 U	0.32 U	0.4 J	0.29 U	6.6 J
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.17 U	0.17 U	0.16 U	0.17 U	0.19 U	0.18 U	0.17 U	0.17 U	0.17 U	0.15 U	9.5 J
2,3,7,8-TCDD	1746-01-6	ng/kg	0.36 U	0.37 U	0.35 U	0.36 U	0.41 U	0.39 U	0.36 U	0.37 U	0.37 U	0.33 U	8.6 J
2,3,7,8-TCDF	51207-31-9	ng/kg	0.16 U	0.17 U	0.16 U	0.16 U	0.19 U	0.18 U	0.16 U	0.16 U	0.17 U	0.15 U	14
OCDD	3268-87-9	ng/kg	2.2 J	5.7 J	5.6 J	0.84 U	35	5.1 J	3.1 J	0.86 U	120	3 J	12000
OCDF	39001-02-0	ng/kg	1.3 U	1.4 U	1.3 U	1.3 U	2.6 J	1.4 U	1.3 U	1.3 U	6.8 J	0.73 J	630
Total HpCDD[a]	37871-00-4	ng/kg	0.53 UJ	0.54 UJ	0.52 UJ	0.53 UJ	5.5 J	1.1 J	1.8 J	0.54 UJ	28 J	0.83 J	2500 J
Total HpCDF[a]	38998-75-3	ng/kg	0.9 UJ	3.1 J	0.88 UJ	0.9 UJ	16 J	0.87 J	1.5 J	0.92 UJ	30 J	0.83 UJ	1400 J
Total HxCDD[a]	34465-46-8	ng/kg	1.2 UJ	0.83 J	1 J	0.24 J	4.6 J	2.7 J	1.2 UJ	1.2 UJ	6.1 J	1.1 UJ	460 J
Total HxCDF[a]	55684-94-1	ng/kg	1.1 UJ	1.1 J	1.1 UJ	1.1 UJ	6.4 J	1.2 UJ	0.54 J	1.1 UJ	10 J	0.72 J	230 J
Total PeCDD[a]	36088-22-9	ng/kg	0.18 UJ	0.19 UJ	0.18 UJ	0.18 UJ	0.6 J	3.7 J	0.66 J	0.18 UJ	1.4 J	0.17 UJ	48 J
Total PeCDF[a]	30402-15-4	ng/kg	0.39 UJ	0.4 UJ	0.38 UJ	0.39 UJ	2.1 J	0.42 UJ	0.38 UJ	0.39 UJ	3 J	0.35 UJ	150 J
Total TCDD[a]	41903-57-5	ng/kg	0.36 UJ	0.37 UJ	0.35 UJ	0.36 UJ	0.41 UJ	2.3 J	0.36 UJ	0.37 UJ	0.85 J	0.33 UJ	13 J
Total TCDF[a]	55722-27-5	ng/kg	0.16 UJ	0.17 UJ	0.16 UJ	0.16 UJ	0.19 UJ	0.18 UJ	0.16 UJ	0.16 UJ	0.17 UJ	0.15 UJ	95 J

Notes:

ng/kg = nanograms per kilogram; J = Estimated; U = Nondetect; UJ = Estimated nondetect

[a] Total dioxin and furan congener homolog groups calculated by analytical laboratory

Appendix E-4. Analytical Results Dioxin and Furan Congeners

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-23-1.0/2.0 10/18/2018	ML-SD-23-2.0/3.0 10/18/2018	ML-SD-23-2.0/3.0-FD 10/18/2018	ML-SD-23-3.0/4.0 10/18/2018	ML-SD-24-0.0/1.0 10/18/2018	ML-SD-24-1.0/2.0 10/18/2018	ML-SD-24-2.0/3.0 10/18/2018	ML-SD-24-2.0/3.0-FD 10/18/2018	ML-SD-24-3.0/4.0 10/18/2018	ML-SD-25-0.0/1.0 10/18/2018	ML-SD-25-1.0/2.0 10/18/2018
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	2900	0.46 U	0.45 U	2.4 J	470	2900	69	50	1.8 J	990	17
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	10000 J	0.34 U	0.33 U	18	490	5600 J	560 J	1800 J	5.1	2700	56
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	57	0.44 U	0.44 U	0.44 U	8.3 J	51	4.4 J	14	0.44 U	25	0.34 J
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	43	0.36 U	0.35 U	0.35 U	5.6 J	40	0.41 U	0.56 J	0.35 U	13	0.26 J
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	88	0.2 U	0.2 U	0.2 U	8.6 J	46	6.6 J	25	0.2 U	32 J	0.78 J
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	320	0.23 U	0.22 U	0.22 U	24	200	7.7	5.8	0.22 U	82	1.9 J
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	150	0.21 U	0.21 U	0.21 U	14	110	12	16	0.21 U	65	1.5 J
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	180	0.47 U	0.47 U	0.47 U	12 J	76	4.7 J	2.8 J	0.47 U	48	1.1 J
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	28 J	0.26 U	0.26 U	0.26 U	0.44 U	18	0.3 U	2.8 J	0.26 U	7.6 J	0.18 J
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	63	0.16 U	0.15 U	0.16 U	3.2 J	45	1 J	0.16 U	0.16 U	13	0.37 J
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	33 J	0.19 U	0.19 U	0.19 U	2 J	53 J	0.6 J	0.2 U	0.19 U	4.2 J	0.22 U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	29	0.27 U	0.27 U	0.27 U	3.4 J	15	0.32 U	3.1 J	0.27 U	10 J	0.6 J
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	17	0.14 U	0.14 U	0.14 U	4.3 J	20	2.7 J	1.5 J	0.14 U	11 J	0.22 J
2,3,7,8-TCDD	1746-01-6	ng/kg	13	0.31 U	0.31 U	0.31 U	2.6 J	13	0.36 U	0.32 U	0.31 U	5.2	0.35 U
2,3,7,8-TCDF	51207-31-9	ng/kg	10	0.14 U	0.14 U	0.14 U	6	13	0.16 U	0.15 U	0.14 U	7.2	0.16 U
OCDD	3268-87-9	ng/kg	24000 J	3.4 J	1.3 J	23	5300	29000 J	580	470	17	8900	150
OCDF	39001-02-0	ng/kg	4200	1.1 U	1.1 U	9 J	270	2600	220 J	690 J	3.8 J	1300	23
Total HpCDD[a]	37871-00-4	ng/kg	7000 J	0.46 UJ	0.45 UJ	3.2 J	1200 J	6500 J	150 J	110 J	2.3 J	2400 J	41 J
Total HpCDF[a]	38998-75-3	ng/kg	19000 J	0.78 UJ	0.77 UJ	29 J	500 J	11000 J	1000 J	2800 J	10 J	5100 J	100 J
Total HxCDD[a]	34465-46-8	ng/kg	3100 J	1 UJ	1 UJ	1 UJ	370 J	2200 J	66 J	45 J	1 UJ	790 J	17 J
Total HxCDF[a]	55684-94-1	ng/kg	5700 J	0.94 UJ	0.93 UJ	2.1 J	160 J	2400 J	90 J	300 J	0.94 UJ	1400 J	32 J
Total PeCDD[a]	36088-22-9	ng/kg	460 J	0.16 UJ	0.15 UJ	0.16 UJ	56 J	260 J	4.4 J	0.16 UJ	0.16 UJ	140 J	2.7 J
Total PeCDF[a]	30402-15-4	ng/kg	450 J	0.33 UJ	0.33 UJ	0.33 UJ	73 J	350 J	26 J	16 J	0.33 UJ	220 J	3.9 J
Total TCDD[a]	41903-57-5	ng/kg	140 J	0.31 UJ	0.31 UJ	0.31 UJ	13 J	78 J	4.3 J	2.5 J	0.31 UJ	63 J	2.1 J
Total TCDF[a]	55722-27-5	ng/kg	75 J	0.14 UJ	0.14 UJ	0.14 UJ	63 J	89 J	6.8 J	3.9 J	0.14 UJ	65 J	0.16 UJ

Notes:

ng/kg = nanograms per kilogram; J = Estimated; U = Nondetect; UJ = Estimated nondetect

[a] Total dioxin and furan congener homolog groups calculated by analytical laboratory

Appendix E-4. Analytical Results Dioxin and Furan Congeners

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-26-0.0/1.0 10/18/2018	ML-SD-26-1.0/2.0 10/18/2018	ML-SD-26-1.0/2.0-FD 10/18/2018	ML-SD-26-2.0/3.0 10/18/2018	ML-SD-26-3.0/4.0 10/18/2018	ML-SD-27-0.0/1.0 10/17/2018	ML-SD-28-0.0/1.0 10/18/2018	ML-SD-29-0.0/0.25 10/15/2018	ML-SD-30-0.0/0.25 10/15/2018	ML-SD-31-0.0/0.25 10/15/2018	ML-SD-32-0.0/0.25 10/15/2018
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	2500	1100	860	0.99 J	3.6 J	38 J	4.5 J	460 J	230	360	560
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	1000	4600 J	3800 J	2.4 J	8.6	58	3.5 J	1100 J	500	820	900
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	25	28	25	0.44 U	0.44 U	1.2 U	0.47 U	8.8 J	4.8 J	7 J	9.4 J
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	27	17	11	0.36 U	0.35 U	0.81 J	0.38 U	6.4 J	2.8 J	4.4 J	6.9 J
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	25	47	41	0.2 U	0.2 U	0.99 J	0.21 U	17 J	8.1 J	10 J	12 J
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	91	130	89	0.23 U	0.43 J	2.8 J	0.24 U	42 J	18 J	26	36 J
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	39	100	92	0.21 U	0.21 U	2.8 J	0.22 U	52 J	22 J	43	56 J
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	51	68	44	0.47 U	0.46 J	1.3 J	0.5 U	17 J	15 J	12	25 J
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	6.6 J	12	10	0.26 U	0.26 U	0.73 U	0.28 U	3.4 J	1.5 J	2.7 J	4.1 J
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	11 J	25	11	0.16 U	0.15 U	0.44 U	0.17 U	11 J	3.4 J	4 J	5.7 J
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	4.5 J	6.1 J	4.9 J	0.19 U	0.19 U	0.53 U	0.2 U	6 J	2.3 J	3.5 J	4.9 J
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	7.1 J	16	12	0.27 U	0.27 U	1.5 J	0.29 U	9.2 J	3.5 J	6.6 J	8.9 J
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	12	15	14	0.14 U	0.14 U	0.41 U	0.15 U	8 J	4.4 J	5.5 J	8.6 J
2,3,7,8-TCDD	1746-01-6	ng/kg	5.1	6.6	4.2	0.31 U	0.31 U	0.88 U	0.33 U	3.3 J	1.6 J	2.1 J	3.1 J
2,3,7,8-TCDF	51207-31-9	ng/kg	22	6.9	5.4	0.14 U	0.14 U	1.4 J	0.15 U	6.5 J	3.7 J	4.4	5.3 J
OCDD	3268-87-9	ng/kg	27000 J	9800 J	9200 J	12	29	330	33	3500 J	1900	3100	5000
OCDF	39001-02-0	ng/kg	720	1800	1500	1.1 U	4.2 J	29 J	3.2 J	350 J	190	270	360
Total HpCDD[a]	37871-00-4	ng/kg	8800 J	2500 J	2000 J	1.3 J	3.6 J	83 J	22 J	830 J	400 J	740 J	910 J
Total HpCDF[a]	38998-75-3	ng/kg	1100 J	8400 J	6200 J	5.7 J	8.6 J	110 J	7.5 J	2000 J	890 J	1500 J	1600 J
Total HxCDD[a]	34465-46-8	ng/kg	2000 J	1000 J	800 J	0.48 J	1.9 J	16 J	1.8 J	290 J	130 J	230 J	240 J
Total HxCDF[a]	55684-94-1	ng/kg	680 J	1000 J	870 J	0.94 UJ	2.3 J	27 J	2.3 J	420 J	140 J	430 J	290 J
Total PeCDD[a]	36088-22-9	ng/kg	210 J	190 J	130 J	0.16 UJ	0.66 J	0.44 UJ	0.17 UJ	60 J	8.8 J	38 J	33 J
Total PeCDF[a]	30402-15-4	ng/kg	110 J	260 J	220 J	0.33 UJ	0.49 J	20 J	0.35 UJ	110 J	44 J	110 J	110 J
Total TCDD[a]	41903-57-5	ng/kg	22 J	43 J	53 J	0.31 UJ	0.31 UJ	0.88 UJ	0.33 UJ	17 J	14 J	24 J	24 J
Total TCDF[a]	55722-27-5	ng/kg	140 J	75 J	64 J	0.14 UJ	0.14 UJ	11 J	0.15 UJ	47 J	21 J	42 J	35 J

Notes:

ng/kg = nanograms per kilogram; J = Estimated; U = Nondetect; UJ = Estimated nondetect

[a] Total dioxin and furan congener homolog groups calculated by analytical laboratory

Appendix E-4. Analytical Results Dioxin and Furan Congeners

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-33-0.0/1.2 10/18/2018	ML-SD-34-0.0/1.0 10/18/2018	ML-SD-34-0.0/1.0-FD 10/18/2018	ML-SD-34-1.0/1.8 10/18/2018	ML-SD-35-0.0/1.3 10/19/2018	ML-SD-36-0.0/1.0 10/19/2018	ML-SD-36-1.0/1.6 10/19/2018	ML-SD-37-0.0/1.2 10/19/2018	ML-SD-38-0.0/1.0 10/19/2018	ML-SD-38-1.0/1.7 10/19/2018	ML-SD-39-0.0/1.0 10/19/2018
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	0.42 U	0.39 U	0.45 U	0.49 U	2.2 J	3.2 J	0.45 U	0.45 U	3 J	6.3	7.2
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	0.31 U	0.28 U	0.33 U	0.36 U	0.83 J	1.2 J	0.33 U	0.33 U	1.7 J	6.7	2.9 J
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.41 U	0.37 U	0.43 U	0.47 U	0.44 U	0.49 U	0.44 U	0.44 U	1.1 J	1.5 J	0.42 U
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.33 U	0.3 U	0.35 U	0.38 U	0.36 U	0.4 U	0.35 U	0.35 U	0.32 U	0.35 U	0.34 U
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.18 U	0.17 U	0.19 U	0.21 U	0.2 U	0.22 U	0.2 U	0.2 U	0.8 J	2 J	1.1 J
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.21 U	0.19 U	0.22 U	0.24 U	0.23 U	0.25 U	0.22 U	0.22 U	0.21 U	0.22 U	0.22 U
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.19 U	0.18 U	0.2 U	0.22 U	0.21 U	0.23 U	0.21 U	0.21 U	0.19 U	0.49 J	0.2 U
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.44 U	0.4 U	0.46 U	0.51 U	0.47 U	0.53 U	0.47 U	0.47 U	0.43 U	0.46 U	0.45 U
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.24 U	0.22 U	0.26 U	0.28 U	0.26 U	0.29 U	0.26 U	0.26 U	0.24 U	0.26 U	0.25 U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	0.14 U	0.13 U	0.15 U	0.17 U	0.16 U	0.17 U	0.16 U	0.16 U	0.14 U	0.15 U	0.15 U
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.18 U	0.16 U	0.19 U	0.2 U	0.19 U	0.21 U	0.19 U	0.19 U	0.17 U	0.19 U	0.18 U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.25 U	0.23 U	0.27 U	0.29 U	0.27 U	0.31 U	0.27 U	0.27 U	0.25 U	0.66 J	0.26 U
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.13 U	0.12 U	0.14 U	0.16 U	0.15 U	0.16 U	0.14 U	0.14 U	0.25 J	1.1 J	0.45 J
2,3,7,8-TCDD	1746-01-6	ng/kg	0.29 U	0.26 U	0.3 U	0.33 U	0.31 U	0.35 U	0.31 U	0.31 U	0.28 U	0.31 U	0.3 U
2,3,7,8-TCDF	51207-31-9	ng/kg	0.13 U	0.12 U	0.14 U	0.15 U	0.14 U	0.16 U	0.14 U	0.14 U	0.13 U	0.14 U	0.13 U
OCDD	3268-87-9	ng/kg	4.6 J	3.8 J	2 J	0.9 J	13	21 J	2.5 J	7.3 J	29	77	81
OCDF	39001-02-0	ng/kg	1.1 U	0.97 U	1.1 U	1.2 U	2 J	1.3 U	1.1 U	1.1 U	6.6 J	11	8 J
Total HpCDD[a]	37871-00-4	ng/kg	1.1 J	0.39 UJ	0.45 UJ	0.49 UJ	5 J	9.1 J	0.45 UJ	1.1 J	6.8 J	15 J	20 J
Total HpCDF[a]	38998-75-3	ng/kg	0.72 UJ	0.66 UJ	0.76 UJ	0.84 UJ	1.9 J	2.6 J	0.78 UJ	0.6 J	2.9 J	13 J	7.5 J
Total HxCDD[a]	34465-46-8	ng/kg	0.97 UJ	0.89 UJ	1 UJ	1.1 UJ	0.68 J	0.78 J	0.78 J	1 UJ	0.96 UJ	4.2 J	2.1 J
Total HxCDF[a]	55684-94-1	ng/kg	0.87 UJ	0.8 UJ	0.92 UJ	1 UJ	0.91 J	0.96 J	0.93 UJ	0.94 UJ	3.1 J	12 J	5.6 J
Total PeCDD[a]	36088-22-9	ng/kg	0.83 J	0.13 UJ	0.15 UJ	0.17 UJ	0.16 UJ	0.17 UJ	0.16 UJ	0.16 UJ	0.14 UJ	0.64 J	0.47 J
Total PeCDF[a]	30402-15-4	ng/kg	0.31 UJ	0.28 UJ	0.33 UJ	0.36 UJ	2.2 J	0.37 UJ	0.33 UJ	0.33 UJ	2.3 J	19 J	5.7 J
Total TCDD[a]	41903-57-5	ng/kg	0.55 J	0.26 UJ	0.3 UJ	0.33 UJ	0.31 UJ	0.35 UJ	0.31 UJ	0.31 UJ	0.28 UJ	0.31 UJ	0.3 UJ
Total TCDF[a]	55722-27-5	ng/kg	0.4 J	0.12 UJ	0.14 UJ	0.15 UJ	0.14 UJ	0.48 J	0.49 J	0.14 UJ	0.13 UJ	8.8 J	1.3 J

Notes:

ng/kg = nanograms per kilogram; J = Estimated; U = Nondetect; UJ = Estimated nondetect

[a] Total dioxin and furan congener homolog groups calculated by analytical laboratory

Appendix E-4. Analytical Results Dioxin and Furan Congeners

Munger Landing Sediment Characterization, St. Louis River AOC, Minnesota and Wisconsin

Analyte	CAS No.	Unit	ML-SD-39-1.0/1.9 10/19/2018	ML-SD-40-0.0/1.0 10/19/2018	ML-SD-40-1.0/2.3 10/19/2018
1,2,3,4,6,7,8-HpCDD	35822-46-9	ng/kg	5.2 J	5 J	2.6 J
1,2,3,4,6,7,8-HpCDF	67562-39-4	ng/kg	2.3 J	1.9 J	4.4 J
1,2,3,4,7,8,9-HpCDF	55673-89-7	ng/kg	0.65 J	0.89 J	2.6 J
1,2,3,4,7,8-HxCDD	39227-28-6	ng/kg	0.37 U	0.37 U	0.34 U
1,2,3,4,7,8-HxCDF	70648-26-9	ng/kg	0.58 J	0.67 J	2.8 J
1,2,3,6,7,8-HxCDD	57653-85-7	ng/kg	0.59 J	0.23 U	0.22 U
1,2,3,6,7,8-HxCDF	57117-44-9	ng/kg	0.22 U	0.22 U	0.75 J
1,2,3,7,8,9-HxCDD	19408-74-3	ng/kg	0.49 U	0.49 U	0.46 U
1,2,3,7,8,9-HxCDF	72918-21-9	ng/kg	0.27 U	0.27 U	0.25 U
1,2,3,7,8-PeCDD	40321-76-4	ng/kg	0.16 U	0.16 U	0.15 U
1,2,3,7,8-PeCDF	57117-41-6	ng/kg	0.2 U	0.2 U	0.18 U
2,3,4,6,7,8-HxCDF	60851-34-5	ng/kg	0.28 U	0.28 U	0.58 J
2,3,4,7,8-PeCDF	57117-31-4	ng/kg	0.67 J	0.51 J	1.1 J
2,3,7,8-TCDD	1746-01-6	ng/kg	0.32 U	0.32 U	0.3 U
2,3,7,8-TCDF	51207-31-9	ng/kg	0.15 U	0.14 U	0.14 U
OCDD	3268-87-9	ng/kg	52	37	22
OCDF	39001-02-0	ng/kg	4.8 J	6.8 J	16
Total HpCDD[a]	37871-00-4	ng/kg	13 J	11 J	5.5 J
Total HpCDF[a]	38998-75-3	ng/kg	3.1 J	5.3 J	11 J
Total HxCDD[a]	34465-46-8	ng/kg	4.1 J	0.78 J	1 UJ
Total HxCDF[a]	55684-94-1	ng/kg	4.8 J	3.8 J	9.7 J
Total PeCDD[a]	36088-22-9	ng/kg	0.92 J	0.16 UJ	0.15 UJ
Total PeCDF[a]	30402-15-4	ng/kg	8.8 J	4.5 J	15 J
Total TCDD[a]	41903-57-5	ng/kg	0.92 J	0.55 J	0.39 J
Total TCDF[a]	55722-27-5	ng/kg	3.7 J	3.2 J	6.6 J

Notes:

ng/kg = nanograms per kilogram; J = Estimated; U = Nondetect; UJ = Estimated nondetect

[a] Total dioxin and furan congener homolog groups calculated by analytical laboratory