SAMPLING AND ANALYSIS PLAN

ABANDONED MINING WASTES
TORCH LAKE NON-SUPERFUND SITE

QUINCY MINING COMPANY MASON OPERATIONS AREA
HOUGHTON COUNTY, MICHIGAN
SITE ID# 31000098

MAY 2017

PREPARED FOR:

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
REMEDIATION AND REDEVELOPMENT DIVISION
CALUMET FIELD OFFICE
CALUMET, MICHIGAN

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1.0 INTRODUCTION

The Mannik & Smith Group, Inc. (MSG) has prepared this Sampling and Analysis Plan (SAP) to identify data collection activities and associated quality assurance/quality control (QA/QC) measures specific to the Quincy Mining Company Mason Operations Area (QMCM) of the Abandoned Mining Wastes – Torch Lake non-Superfund Site (Project) in Houghton County, Michigan.

The SAP has been prepared in accordance with the *Indefinite Scope Indefinite Delivery (ISID) Discretionary Proposal for Site Investigation Activities* (25 October 2016) prepared by MSG in response to a request from the Michigan Department of Environmental Quality (DEQ), Remediation and Redevelopment Division (RRD), Calumet Field Office under MSG's 2015 Environmental Services ISID Contract Number 00538 with the State of Michigan.

The SAP has been developed to detail the Project's organization and operational responsibilities of key MDEQ and MSG personnel working on the Project. The SAP also describes the design and implementation of measurement systems that will be used during the collection of environmental samples for the Project. The document describes the sampling procedures, analytical methods/procedures, data quality objectives (DQOs), data handling, and documentation procedures.

Section 1 of the SAP defines the objectives of the investigation and the organizational structure of the Project team. Section 2 provides the Project background including a description and a brief account of the previous investigative activities implemented in the QMCM. Section 3 provides an outline of the proposed implementation schedule. Section 4 provides a summary of the sampling rationale and environmental media to be sampled during the field activities. Section 5 provides a summary of field procedures, sampling protocols, and laboratory analyses necessary to complete the field activities, Section 6 includes a list of the proposed analytical laboratories, and Section 7 outlines the QA/QC protocols that will be implemented to assess the overall reproducibility of the laboratory analytical results.

1.1 Problem Definition

The Project is characterized by the risks posed by chemical containers and residues historically discarded in or near Torch Lake. These concerns are distinct and separate from the risks historically addressed under the U.S. Environmental Protection Agency's (EPA's) Superfund program. The EPA defines the Torch Lake Superfund Site as the upper six inches of stamp sand and slag in certain areas of Houghton County and any soil cap and vegetative cover applied to such areas.

The remaining concerns at Torch Lake and the surrounding areas identified by the MDEQ include known or suspected impacts to groundwater, surface water, sediments, and upland media that were not addressed under the Superfund program. Environmental impacts that will be evaluated under this SAP include, but are not limited to the assessment of the following:

- Unidentified, significant in-lake and/or terrestrial sources of contamination including polychlorinated biphenyls (PCBs);
- Uncharacterized waste deposits, including more than 750 uncharacterized drums, reportedly, on the lake bottom;
- Bulk disposal areas, including stamp sand deposits, slag dumps, and landfills; and,
- Industrial ruins including coal storage areas, underground storage tanks (USTs), asbestos containing materials (ACM), residual process materials (RPM), and any other waste materials identified during future investigations.

The risks posed to environmental media by these waste deposits and continuing sources of contamination contribute to the limited recovery of the Torch Lake ecosystem and present uncertainty over beneficial reuse of the land. As such, the investigation will be largely driven by documented observations of drums, ACM, RPM, and/or other debris locations on land and in the lake as well as consideration related to historic operations and detected PCB concentrations.

The objectives of the Project are to support a comprehensive management approach that will guide MDEQ's decision making process in addressing risks present in the QMCM. The primary focus of the Project is to ascertain the source, nature, and extent of contaminants (including PCBs) in all affected environmental media (soil, groundwater, surface water, sediments, and soil gas) within Torch Lake, including former industrial areas along the shoreline, which includes the former Quincy Mining Company (QMC) copper mining and processing operations in Mason, Michigan and a former residential/commercial property along the south shore of Torch Lake, north of Dollar Bay, Michigan.

The activities, operations, and wastes related to the former industrial areas was researched and preliminary terrestrial and underwater surveys were conducted to further identify drums, ACM, RPM, and waste deposits as described in the MSG prepared document entitled *Historical Data Review and Compilation Technical Memorandum* dated February 2017. Representative sediment, surface water, groundwater, soil, soil gas, and waste samples near these previously uncharacterized debris and waste deposits will be collected and analyzed. Further, the sample intervals will be spaced horizontally and vertically to accurately characterize the extent of any identified contamination in the vicinity of the identified wastes.

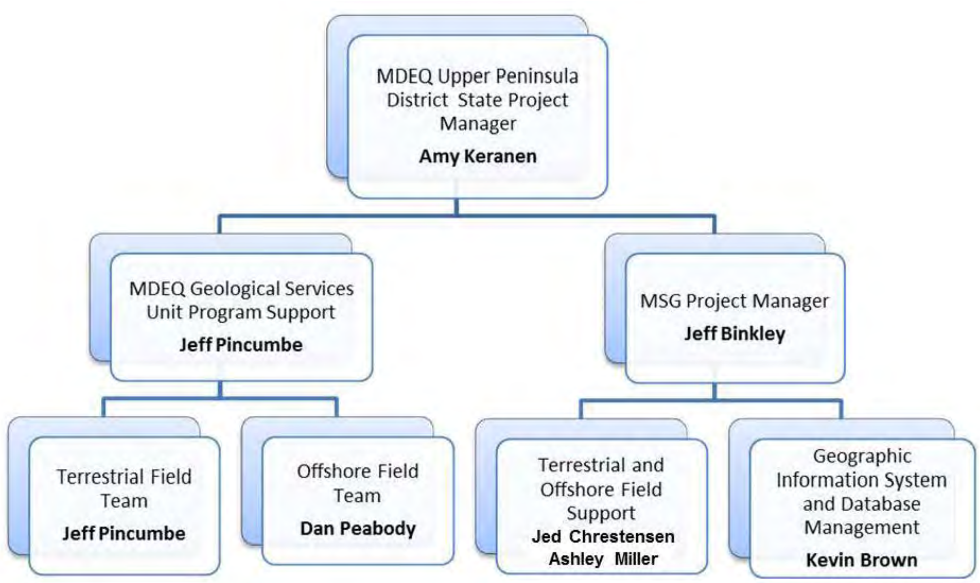
1.2 Project Management

The Project is built upon partnerships and stakeholder engagement. Engagement among team members requires regular communication and is often driven by updated and additional information as well as shifting Project priorities. The management approach, dictated by the MDEQ SPM will be supported by the MSG Project Manager. Additionally, investigative activities will be supported by the MDEQ Geological Services Unit (GSU), which will provide the tools, equipment, and resources to facilitate the investigative work within the QMCM.

Coordination of multiple team members will be facilitated by establishing the Project goals, building consensus, exchanging and integrating ideas, and setting a path forward with all team members. This approach will allow for team members to discuss scope and objectives, clarify issues, and learn individual goals, success factors, and ideas. The kick off meeting will establish the foundation for the development and execution of the remainder of the Project.

The general Project organization is presented on Figure 1-1.

FIGURE 1-1: PROJECT ORGANIZATION



The following key Project personnel will be involved in planning and/or technical activities performed during the various phases of data collection. Each will receive a copy of the draft SAP for review and the approved SAP prior to field mobilization. A copy will also be retained in the Project file.

TABLE 1-1: KEY PROJECT PERSONNEL

Personnel	Title	Organization	Phone Number	Email
Amy Keranen	State Project Manager	MDEQ-RRD	(906)-337-0389	KeranenA@michigan.gov
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Jeff Pincumbe	Field Team Leader	MDEQ-GSU	(517) 243-3171	pincumbej@michigan.gov
Dan Peabody	Field Team Leader	MDEQ-GSU	(517) 335-6436	PeabodyD@michigan.gov
Jed Chrestensen	Field Team Leader	MSG	(906) 281-4726	JChrestensen@manniksmithgroup.com
Ashley Miller	Field Team Support	MSG	(330) 646-7870	AMiller@manniksmithgroup.com
Kevin Brown	Geographic Information System/Database Manager	MSG	(517) 316-9232	KBrown@manniksmithgroup.com

2.0 PROJECT DESCRIPTION

Hard rock mining operations were prevalent throughout Houghton and Keweenaw Counties for nearly a century, primarily spanning an era between the mid-1800's and the mid-1900's. As mining activities declined in the region, a majority of the mine holdings, including surface and underground operations were abandoned, scrapped, and remnants otherwise left in-place.

In addition to the western shoreline of Torch Lake, the Project includes properties remote from Torch Lake proper, such as the 270+ acre Centennial Mine just north of Calumet, the Michigan Smelter, Freda/Redridge and other areas congruent with the Torch Lake Superfund Site where the response action has been limited to the application of the vegetative cover or eliminating the area from further consideration.

The vast distribution of these former mining operations throughout the region (spanning several townships, villages and cities in Houghton County along the Portage Canal, Lake Superior, Slaughterhouse Creek, and Torch Lake) required that operational areas of the mining companies be divided into geographic subsets, allowing for prioritization of the geographic subsets and establishing a phased approach for assessing and addressing environmental concerns regionally.

The QMCM encompasses the former Quincy Mining Company (QMC) copper mining and processing operations in and a former residential/commercial property along the south shore of Torch Lake in Osceola Township, Houghton County, Michigan. The QMCM consists of approximately 680 acres of land extending approximately 5.6 miles along the shoreline of Torch Lake and incorporates over 64 different parcels with multiple property owners. The QMCM is located along both sides of Highway M-26 with the east side of the highway generally characterized as an in-lake stamp sand deposit associated with the industrial operations conducted on the east and west sides of the highway, as well as the residential/commercial/vacant properties southwest of Torch Lake between the shoreline and Montroal Road. Residential (single-family residences), undeveloped forested lands, industrial (capped stamp sands) properties, and Torch Lake border the QMCM. **Figure 2-1**, *Area Features Map,* depicts the area and Project features.

2.1 Project Background

Copper mining was extensive in the Keweenaw and formed the backbone of the regional economy and society. Copper ore milling and smelting operations conducted from the mid-1860s to the 1960s, including the importation, reprocessing, and smelting of various scrap metals in the later years of operation. Consistent with past industrial practices, Torch Lake served as dumping grounds for virtually all mining industry related waste products produced, including tailings, slag, and various chemicals. At least 20 percent of the Torch Lake's volume is estimated to be filled with tailings and other waste products.

The environmental legacy resulting from over 100 years of mining and reclamation led to Torch Lake and its western shoreline to be designated as a Superfund site by the United States Environmental Protection Agency (EPA) https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0503034 and a Great Lakes Area of Concern by the U.S./Canada Great Lakes Water Quality Agreement https://www.epa.gov/torch-lake-aoc. The EPA undertook cleanup activities to address some of the byproducts of the mining industry, while others were not addressed or left to recover through natural processes.

2.1.1 QMC

With the construction of several facilities between 1892 and 1943, the QMCM was industrialized and continued operations until circa 1967. As summarized from Michigan Technological University's (MTU) February 2015 document entitled *Quincy Mining Facilities on Torch Lake, Narratives and Supporting Documents, Part 1, Phase 3: Building Narratives, Maps, and Documentation Torch Lake Industrial Waterfront, From Mason/Quincy Property to Torch Lake South End (Quincy historic properties, Task 3: Historical Archive Research & Mapping,* QMC built its steam-powered Mill No. 1 on the Torch Lake shore, at Mason, in 1892, and Mill No. 2 about a decade later. In these mills, Quincy processed amygdaloid ore from its mines north of Hancock. Over the course of decades, these mills deposited stamp sand, the waste product of the milling process, in Torch Lake. Early milling technologies were inefficient, and significant copper values remained in the stamp sand. In the early decades of the 20th century, improvements in milling technology, most significantly the introduction of the flotation process, made it possible to reclaim the copper that was in the stamp sand. QMC's Reclamation Plant went into operation in 1943 at a newly constructed location south of the mill locations to re-process stamps sands generated during mill operations and disposed of in Torch Lake.

The Reclamation Plant had three principal parts: the Dredge, the Shore Plant, and the Regrinding Plant. QMC's reclamation dredge sunk in 55 feet of water on January 14, 1956 and was replaced by a second dredge. Machinery in the Shore Plant served mostly to remove water from the dredged tailings before conveyance to the Regrinding Plant where the core operations of the reclamation process took place: grinding, classification, and flotation. The conveyor dropped its dewatered stamp sand into a "surge bin," which fed the sand into ball mills. Ball mills were horizontally mounted, conical drums filled with hardened steel balls. When the drums rotated, the balls pulverized the stamp sand into a powder fine enough for treatment by flotation. The consistency was roughly that of baking flour. From the ball mills, the fine-ground slime went through a series of concentrating and classifying apparatus, which separated copper-rich material from copper-poor material. Copper-rich material proceeded to flotation machines. In one chamber of the flotation machine, agitators beat a mixture of water and pine oil into a bubbly froth. In another, the reagent xanthate mixed with "pulp" from the ball mills. A chemical reaction with the xanthate caused the copper particles to adhere to the pine oil bubbles when the pulp moved into the frothing chamber. The bubbles lifted the copper particles and a rotating paddle mechanism skimmed the copper-bearing froth off the top. Pumped through filtration and classifying machinery, then into a thickener, the copper-bearing froth was dewatered. Xanthate and pine oil were the only chemicals used in the flotation process. Before the concentrated mineral material left the Reclamation Plant, it went through a drier to remove further moisture in preparation for smelting. This drier may have been fuel oil fired. The post-reclamation tailings, which still contain copper, were disposed of in Torch Lake forming the Quincy Stamp Sands portion of the QMCM study area.

Electric lines running parallel to the Mineral Range Railroad line carried electricity produced at the C&H Power Plant in Lake Linden to power the Reclamation Plant. The power entered the Reclamation Plant through a substation located at the northwest corner of the plant. Part of the substation, including its switchgear and circuit breakers, was located inside the plant itself. There were three large, oil-filled transformers located just outside the plant, also at the northwest corner. The electrically powered Dredge(s) contained at least three oil-filled transformers in addition to a circuit breaker that held six gallons of oil. There were three small transformers associated with the Shore Plant; it is not clear whether these transformers were dry or oil-filled.

The Reclamation Plan shut down in 1967 and several years later a scrap metal company dismantled the Regrinding Plant, Shore Plant, and conveyor apparatus. Of the four major structures that were part of the facility, only the enclosed conveyor system that carried stamp sand from the Shore Plant to the regrinding plant is absent from the landscape. The Shore Plant's foundation and pilings still stand on the shore and in Torch Lake, respectively. The Regrinding Plant foundation is intact. Foundations of substation equipment remain in the northwest corner of the plant ruins, though the equipment itself is absent with the exception of a few power poles and insulators. The original dredge remains at the bottom of Torch Lake, marked by a red buoy. Quincy's second dredge rests on the bed of Torch Lake, close to shore and is mostly intact and visible above the water.

As part of the Torch Lake Superfund Site remedy, the EPA completed capping 225 acres of the QMC, including the 193 acre Quincy Stamp Sands, between the Torch Lake Shoreline and Highway M-26 in 2002. The property west of Highway M-26, however, has not been improved since the mining era and features widespread disposition of tailings and stamp sand within and proximal to the stamp mill ruins and widespread debris. The EPA delisted the QMC from the National Priorities List in 2012.

2.1.2 South Shore of Torch Lake

Review of file information for the QMCM identified a former commercial operation that conducted furniture stripping using various chemicals. The furniture stripping operation buildings are still present; however, the furniture stripping business has since discontinued operation. The facility name according to DEQ files is Furniture Stripping Dollar Bay Site (FSDB) (Site ID: 31000008). Releases at the FSDB were due to the discharge of furniture stripping waste to the ground surface over a period of seven years. Further releases may have occurred from improper operation of hazardous waste storage systems. The operators claim to have burned most of the waste prior to 1992, and to have stored the waste in buckets from 1992 to 1994. The operators reportedly used an annual average of 200 gallons of methylene chloride-based furniture stripper during the period of surface discharge from 1987 to 1994.

Methylene chloride was detected in the facility's shallow commercial well at concentrations of 141 parts per billion (ppb) in 1994. A single drilled well provides drinking water at the property. Sample analyses for this well have been non-detect for methylene chloride in the past.

Contaminated soil in the source area has not been remediated and may continue to act as a source of groundwater contamination. Groundwater leaving the operator's facility may extend to Torch Lake, which is less than ¼ mile away.

Unaccounted for is an estimated 2900+ gallons of methylene chloride-based furniture stripper reportedly purchased by the owner/operator. Throughout the entirety of the facility's operation, only one 55-gallon drum of waste stripper is recorded to have been properly removed from the premises. An adjacent landowner recounted observing the owner/operator burying unknown objects in the wetlands on his property; however, this has not been verified. The owner/operator does not have the required funds to determine the extent of contamination nor the funds to remediate contaminated soils/groundwater on the property and the DEQ project has been inactive since 1997.

2.2 Contaminants of Concern and Target Analytes

The analytical results from various historical investigative and response activities were used to assist in the characterization of the QMCM. Further, the sample locations from these events were also evaluated to assist in locating the horizontal and vertical locations of proposed sampling locations included in this SAP. The locations and respective analytical results used to develop this SAP are summarized in the MSG prepared document entitled; *Historical Data Review and Compilation Technical Memorandum* dated February 2017.

Although relevant, the MDEQ drinking water/surface water pathway criteria exceedances for metals were excluded from the soil and groundwater evaluation. The rationale for this exclusion is twofold:

- The Project investigation and anticipated response actions are being undertaken pursuant to Part 201 of Michigan's NREPA, being PA 451 of 1994, as amended. The concentrations of metals in excess of the MDEQ drinking water/surface water pathway criteria are ubiquitous in the study area and are predominantly the result of the presence of stamp sands. Stamp sands are not defined as a hazardous substance nor are subject to regulation under Part 201 unless the property otherwise contains hazardous substances in excess of concentrations that satisfy the cleanup criteria for unrestricted residential use; and,
- The study area is part of Operable Unit (OU) 2 for which the EPA Record of Decision (ROD) remedy called for No Action. The EPA's ROD OU 2 includes groundwater, surface water, submerged tailings and sediments in Torch Lake, Portage Lake, the Portage Canal, and other area water bodies. Note that EPA's No Action determination relies on the following to mitigate the effects of stamp sand to the extent practicable:
    - The reduction of stamp sand loading to surface water bodies expected because of the remedial action taken at OU 1 and OU 3;
    - Ongoing natural sedimentation and detoxification;
    - Institutional programs and practices controlling potential future exposure to site-affected drinking water that were intended to be administered at the county and state level; and,
    - The long-term monitoring and the five-year review process monitoring requirements of the remedy selected for OU 1 and OU 3 under the 1992 ROD.

2.2.1 QMC

Between 2007 and 2013, samples were collected for field screening and laboratory analysis from the following environmental media in the QMCM:

- Surface soil
- Subsurface soil
- Sediment
- Surface water
- Groundwater
- Asbestos
- Waste

The analytical and screening results indicate that inorganic contaminants, VOCs, PNAs, and PCBs are present in surface and subsurface soil in excess of Part 201 Residential and Non-Residential

Cleanup Criteria for Response Activity of Michigan's Natural Resources and Environmental Protection Act (NREPA), being Public Act (PA) 451 of 1994, as amended, including the following:

- Groundwater Surface Water Interface Protection Criteria (GSIPC)
- Residential Drinking Water Protection Criteria (DWPC)
- Residential Soil Volatilization to Indoor Air Inhalation Criteria (SVIAIC)
- Residential Infinite Source Volatile Soil Inhalation Criteria (VSIC)
- Residential Finite VSIC for 5 meter source thickness
- Residential Finite VSIC for 2 meter source thickness
- Residential Direct Contact Criteria (DCC)
- Non-residential DWPC
- Non-residential DCC

In 2013, as part of the MDEQ Site Inspection, eight temporary wells were installed in the QMC Area. Analytical results from monitoring wells sampling activities indicated elevated detections of PNAs were present in groundwater in excess of Part 201 Residential and Non-Residential Cleanup Criteria for Response Activities including the following:

- Groundwater Surface Water Interface Criteria (GSIC)

Also, in 2013, sediment and surface water was collected from Quincy Creek, the water intake pond, the bottom of the concrete value near the leach plant. Inorganics were detected exceeding Sediment Quality Guidelines, Threshold Effect Concentrations (TECs) and Probable Effect Concentrations and Surface Water Rule 57 values.

Analytical results for inorganic contaminants exceeding applicable criteria during previous investigations in the QMC include the following:

- Arsenic
- Barium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Selenium
- Silver
- Zinc
- Cyanide

As a result surface soil, subsurface soil, groundwater, sediment, and surface water collected during implementation of the SAP in the QMC will be analyzed at a minimum for the aforementioned metals.

Based on the findings summarized above, it is anticipated that up to 108 sampling locations, including soil, groundwater, surface water, and sediment will be established in the QMC including the following target analytes:

<u>Surface Soils/Waste Deposits (0 to 6 inches below ground surface [bgs])</u>

- Inorganic COCs (Metals and Available Cyanide) by methods 6010/200.7, 6020/200.8, 7471/245.5 and ASTM D7284;
- VOCs by 8260;
- PCBs by 8081/8082;
- SVOCs by 8270; and,
- Asbestos by Polarizing Light Microscopy (PLM) – California Air Resource Board (CARB) 435 – 1,000 point count – analytical sensitivity 0.1%.

Subsurface Soils (> 6 inches bgs)

- Inorganic COCs (Metals and Available Cyanide) by methods 6010/200.7, 6020/200.8, 7471/245.5 and ASTM D7284;
- VOCs by 8260;
- PCBs by 8081/8082; and
- SVOCs by 8270

Groundwater

- Inorganic COCs (Metals) by methods 6010/200.7, 6020/200.8, and 7471/245.5;
- VOCs by 8260;
- PCBs by 8081/8082; and
- SVOCs by 8270

Sediment

- Inorganic COCs (Metals) by methods 6010/200.7, 6020/200.8, and 7471/245; and,
- PCBs by 8081/8082

Surface Water

- Inorganic COCs (Metals) by methods 6010/200.7, 6020/200.8, 7471/245.5; and,
- PCBs by 8081/8082
- SVOCs by 8270

Drums, Containers, Building Materials, Bulk Asbestos, and Waste Deposits – Not Associated with Sediment/Depositional Wastes

- Inorganic COCs (Metals) by methods 6010/200.7, 6020/200.8, 7471/245.5;
- PCBs by 8081/8082;
- Bulk Asbestos by PLM Method 600/R-93/116; and,
- Waste Characteristics by various methods

2.2.2 Quincy Stamp Sands

During 2007, surface soil samples were screened for metals using X-ray Fluorescence as part of the U.S.EPA's Torch Lake Assessment and in November 2016 soil and groundwater samples were collected as part of a baseline environmental assessment (BEA) for the Quincy Stamp Sands. The analytical results indicate the presence of VOCs throughout the area. Only one sample location, however, had results exceeding MDEQ Part 201 Residential and Non-Residential Cleanup Criteria for Response Activities. At SB-07-2_5, Methylene chloride was detected at 130 micrograms per kilogram (ug/kg); however, the author of the BEA, based on the laboratory data package case narrative, concluded that the methylene chloride, a common lab cleaner and solvent, was detected because of laboratory error and was not representative of actual soil conditions. PCBs were not detected in soil or groundwater samples.

As a result, surface soil, subsurface soil, and groundwater will be analyzed for VOCs to confirm the presence or lack thereof of VOCs in soil and groundwater. It is anticipated that up to six sampling locations will be established in the Quincy Stamp Sands and analyzed for VOCs.

2.2.3 South Shore

During 1997, MDEQ RRD conducted a limited investigation at the FSDB and collected soil, sediment, and groundwater samples with photoionization detector (PID), field gas chromatograph (GC) screening and/or laboratory analysis. Analysis of the samples did not detect the presence of contaminants at concentrations greater than the applicable Generic Cleanup Criteria of Part 201 Residential and Non-Residential Cleanup Criteria for Response Activities. Field GC analysis indicated VOCs in groundwater at two locations on either side of a 500-gallon concrete holding tank located northeast of the Barn. In addition, the Barn Well had an exceedance of methylene chloride in 1994.

As a result, surface soil, subsurface soil, groundwater and soil gas will be analyzed for VOCs to confirm the presences or lack thereof of VOCs in the soil, groundwater, and air. It is anticipated that up to four sampling locations will be established in the South Shore and analyzed for VOCs by SW-846 Method 5035A for soil and groundwater samples and by VOCs by TO-15 for the soil gas air samples. In addition, groundwater samples from the Barn Well and the on-site potable well will be collected and analyzed for VOCs.

2.2.4 Torch Lake

During 2007, 2008, and 2011, the analytical results from sediment samples indicated that contaminants emanating from documented contamination on land might be affecting the nearshore aquatic environment of Torch Lake.

To address these concerns, the MDEQ has developed a collaborative approach to this SAP that incorporates advanced technological methods and common sampling approaches for use in characterizing Torch Lake. Michigan Tech assisted in these characterization activities by conducting historical research of industrial operations in the QMCM. The historical archive research and mapping phase of the work assisted in the identification of historic shoreline and landward industrial operations responsible for the generation and/or disposal of wastes in and along Torch Lake. Michigan Tech utilized the university archives, Sanborn Fire Insurance Maps, blueprints, QMC operational records, aerial photos, and interviews with former employees to reconstruct potential waste and disposal areas in and around Torch Lake.

In addition to historical research, the MDEQ GSU conducted underwater mapping of the lake bottom and debris fields in the QMCM during 2016. The MDEQ GSU offshore sampling team also conducted a visual assessment of the near shore environment in the QMCM using a Remotely Operated Vehicle (ROV) equipped with video logging equipment and GPS. Prior to video surveillance of the lake bottom, the offshore areas were surveyed with side-scan sonar. The side-scan sonar imagery was used to identify anomalies on the lake bottom that may be targeted for video surveillance. The overall intent of the assessment was to collect qualitative data that could be used to develop a plan for investigation, sampling, and assessment of potential offshore contaminant sources.

The results and data derived from the underwater survey were compiled and evaluated. Several drums and debris areas were observed and noted as targets for further investigation and sampling. Offshore sampling will be completed using the MDEQ GSU's sampling vessel and necessary equipment to complete the scope of work. Sediment samples will be collected and analyzed for contaminants as described in the preceding subsections.

3.0 PROPOSED SCHEDULE

MSG has prepared this SAP to detail the planned approaches for investigative sampling, field screening, and laboratory analyses to be used at the QMCM. The proposed investigative and sampling methods are described in more detail in Section 4 and Section 5 of this SAP.

Field activities are scheduled to begin April 2017. Sampling and screening activities will be implemented in a phased approach and are anticipated to be initiated in May 2017. Laboratory analytical results are anticipated to become available approximately 30 to 45 days after receipt of the samples by the analytical laboratory. The anticipated schedule is outlined in the table below.

TABLE 3-1
SCHEDULE

Activities	Dates (Month Day, Year)		Deliverables	Deliverable Due Date
	Anticipated Date(s) of Initiation	Anticipated Date of Completion		
• HASP Preparation • SAP Preparation • Planning Meetings	March 01, 2017	April 01, 2017	Draft and Final SAP	Draft SAP April 01, 2017 and final following receipt of MDEQ review comments and planning meetings
MDEQ GSU Geophysics, Soil Vapor Well Installation and Reconnaissance	April 17, 2017	May 05, 2017	Geophysics results summary figures	2 weeks after completing field activities
Field Sample Collection – MDEQ GSU Terrestrial Investigation	May 16, 2017	May 24, 2017	Log Books, Sampling and Screening Logs	2 weeks after completing field activities
Laboratory Analysis – MDEQ Environmental Laboratory or Selected Contract Laboratory	May 17, 2017	June 14, 2017	Laboratory Analytical Report and EDDs	3 weeks after submitting the last sample(s)
Field Sample Collection – MDEQ GSU Offshore Investigation	June 5, 2017	June 14, 2017	Log Books, Sampling and Screening Logs, Video files	2 weeks after completing field activities
Laboratory Analysis – MDEQ Environmental Laboratory or Selected Contract Laboratory	June 01, 2017	June 29, 2017	Laboratory Analytical Report and EDDs	3 weeks after submitting the last sample(s)
Field Sample Collection – MDEQ GSU Offshore Investigation	August 14, 2017	August 23, 2017	Log Books, Sampling and Screening Logs, Video files	2 weeks after completing field activities
Laboratory Analysis – MDEQ Environmental Laboratory or Selected Contract Laboratory	August 16, 2017	September 13, 2017	Laboratory Analytical Report and EDDs	3 weeks after submitting the last sample(s)

Mobilization and field sampling activities are subject to change based on factors related to unforeseen circumstances, personnel and equipment availability, and similar conditions. Key project personnel, including the MDEQ SPM and representatives from MDEQ-GSU and MSG, will meet daily during sampling and fieldwork events to review findings, adjust and plan next steps as needed.

4.0 FIELD PROCEDURES AND SAMPLE COLLECTION

The field procedures and sample collection activities that will be implemented in the QMCM will be used to evaluate the presence of contaminated environmental media in the study areas defined in the preceding sections of the SAP. This Section describes the sampling methodology and procedures that will be implemented to collect samples from various environmental media.

The proposed sampling rationale for each of the study areas within the QMCM are described in Section 2. The proposed terrestrial and offshore sampling and screening locations within each study area are depicted as follows:

- Quincy Stamp Mills – Figure 4-1
- Quincy Reclamation Plant – Figure 4-2
- Quincy Stamp Sands – Figure 4-3
- Furniture Stripping Dollar Bay Site – Figure 4-4
- Torch Lake – Figure 4-5

Proposed sampling locations, proposed laboratory analyses, and sampling rationale are summarized on Table 4-1.

4.1 Potential Physical and Health Hazard Inventory

The investigation of each study area included in the QMCM will include a physical inspection of the area. The inspection will include the inventory and locating of historical structures and artifacts associated with the former industrial operations within each area. Preliminary reconnaissance and inspection of the QMC occurred in October 2016

During the spring of 2017 each area will be inspected for potential physical and health hazards. Such hazards may include potentially abandoned drums and containers, suspect asbestos containing materials, stained or oily soils, and similar observed environmental conditions. Potential physical hazards, including waste deposits, metal debris, and similar conditions in areas without restricted access will also be recorded.

Inventoried locations will be located with a GPS unit with sub-meter accuracy. Documented abandoned containers and suspect asbestos containing materials (SACM) will be sampled during implementation of the field program.

4.2 Surface Soil and Waste Deposit Sampling

Grab soil sample will be collected from proposed surface soil (0-6 inches) sampling locations. In sampling areas where waste deposits or historical surface soils have been capped or covered, the surface soil sample will be collected from directly beneath the cover media. These conditions are anticipated to be encountered in the Quincy Stamp Mills, Reclamation Plant, and Sands areas where the EPA installed a cap. Proposed surface soil sampling locations are illustrated on Figure 4-1 through Figure 4-4.

Specific procedures selected for this Project are summarized as follows:

- The location of each sampling point will be sketched on field documentation, and the coordinates of the sample location will be recorded using a GPS receiver with sub-meter accuracy.
- Rocks and organic matter (including grasses, shallow vegetation roots, and leaves) will be scraped from the surface of each location before surface soil is collected.
- Direct push boring techniques will be used to collect soil samples from each location. The surface samples will be collected from the 0 to 6 inch interval of the extracted soil core. Down hole sampling equipment will be decontaminated prior to sampling at another location. Decontamination fluids will be discharged to the ground surface by the MDEQ.
- Soil samples will be transferred directly into laboratory-provided sample jars.

- Sample jars will be labeled using the nomenclature outlined in **Section 5.1**, and placed in a cooler on ice for shipment to the identified analytical laboratory under chain of custody.
- Investigative-derived wastes (IDW), including potentially contaminated soil will be returned to the boring location from which it was generated by the MDEQ. Personal protective equipment (PPE) and waste generated by sample preparation will be bagged and staged for disposal as municipal solid waste by the MDEQ.

Field team members will don a new pair of disposable nitrile gloves prior to collection of each sample. The stainless-steel coring device will be decontaminated after collection of each sample by washing in an alconox-and-water solution, rinsing with distilled water, and drying with disposable paper towels.

Laboratory information related to the chemical analyses of surface soil samples is summarized in **Section 6**.

Field Screening
Soil will be field-screened with the following equipment:

- PID.

Sample Collection Equipment

- Laboratory-provided sample containers; and,
- Stainless steel trowels/coring tool.

Container and Analytical Requirements List

Matrix	Containers (Numbers, Size, and Type)	Analytical Parameter(s)	Analytical Method	Preservation Requirements	Holding Time
Surface Soil	One 250 mL wide mouth glass jar	Available Cyanide, Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Selenium, Silver, and, Zinc	6010/200.7 6020/200.8 7471/245.5 ASTM D7284	Cool to 4°C	6 months; 28 Days
		PCBs	8081/8082	Cool to 4°C	12 months
		SVOCs	8270	Cool to 4°C	14 Days
	One MeOH Kit, 40 mL glass vial	VOCs	8260	Cool to 4°C	14 Days
	One 4oz. glass bottle	Asbestos	CARB 435	None	Indefinite

Notes:
°C – degrees Celsius
mL – Milliliter
MeOH – Methanol
PCBs – Polychlorinated Biphenyls
SVOCs – Semi-Volatile Organic Compounds
VOCs – Volatile Organic Compounds

4.3 Subsurface Soil Sampling

Soil borings will be advanced to evaluate subsurface conditions. It is anticipated that a track-mounted hydraulic push-probe drill rig will be used to retrieve continuous soil cores from the subsurface. Actual boring depths will be determined in the field and will be based on field observations and field screening results. Proposed soil boring locations are illustrated on Figure 4-1 through Figure 4-4. Subsurface soil samples collected for laboratory analysis will be selected based on field screening results and visual or olfactory indication that contamination may be present. The soil borings will be logged and screened with a PID.

Select borings will be chosen for the collection of groundwater samples based on field observations. It is anticipated that a stainless steel slotted screen will be installed in select boring locations to allow for the collection of groundwater analytical samples.

- It is anticipated that soil borings will be advanced by the MDEQ GSU. MDEQ GSU will be responsible for coordinating utility locates using Michigan's one-call system and in accordance with *Public Act 174, Miss Dig Underground Facility Damage Prevention and Safety Act.*
- The location of each sampling point will be sketched on field documentation, and the coordinates of the sample location will be recorded using a GPS receiver with sub-meter accuracy.
- The lithology for each boring will be classified by the field geologist in accordance with the Unified Soil Classification System (USCS).
- Before advancing reusable downhole equipment, the driller will decontaminate all equipment including the working end of the hydraulic probe. Care will be taken to avoid placing equipment, tools, and materials on the ground during the boring activities.
- It is anticipated that borings will be advanced using a 5-foot long, 1.5-inch diameter Macro-Core sampler to collect continuous soil samples at all borings using a motor-driven hydraulic hammer to the desired depth.
- Soil samples will be transferred directly into laboratory-provided sample jars.
- Sample jars will be labeled using the nomenclature outlined in Section 5.1, and placed in a cooler on ice for shipment to the identified analytical laboratory under chain of custody.
- IDW, including potentially contaminated soil will be returned to the boring location from which it was generated. PPE and waste generated by sample preparation will be bagged and staged for disposal as municipal solid waste by the MDEQ.

Laboratory information related to the chemical analyses of subsurface soil samples is summarized in Section 6.

Field Screening

Soil will be field-screened with the following equipment:

- PID.

Sample Collection Equipment

- Laboratory-provided sample containers; and,
- Stainless bowls; and,
- Stainless steel trowels.

Container and Analytical Requirements List

Matrix	Containers (Numbers, Size, and Type)	Analytical Parameter(s)	Analytical Method	Preservation Requirements	Holding Time
Subsurface Soil	One 250 mL wide mouth glass jar	Available Cyanide, Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Selenium, Silver, and, Zinc	6010/200.7 6020/200.8 7471/245.5 ASTM D7284	Cool to 4°C	6 months; 28 Days
		PCBs	8081/8082	Cool to 4°C	12 months
		PNAs	8270	Cool to 4°C	14 Days
	1 MeOH Kit, 40 mL glass vial	VOCs	8260	Cool to 4°C	14 Days

Notes:
- °C – degrees Celsius
- mL – Milliliter
- MeOH – Methanol
- PCBs – Polychlorinated Biphenyls
- SVOCs – Semi-Volatile Organic Compounds
- VOCs – Volatile Organic Compounds

4.4 Groundwater Sampling

Groundwater samples will be collected from select soil borings advanced in each study area utilizing a Screen-Point-16 stainless steel screen, or similar reusable sampling rod. The actual locations and depths of the groundwater samples from soil borings will be determined in the field and will be based on field observations and field screening results. If it is determined the wells are currently in use, two potable well groundwater samples will be collected from the FSDB by allowing the water to run from a clean faucet without attachments for ten minutes (until cold) at full flow before reducing the flow to collect the sample directly into the laboratory provided vials. The potable well samples will be sent to either the MDEQ Environmental Laboratory or the MDEQ Drinking Water Laboratory for VOC analysis. The proposed soil boring and groundwater sampling locations are illustrated on Figure 4-1 through Figure 4-4.

The down hole sampling tools will be advanced into the water-bearing zone in each boring. The outer rod will be withdrawn to expose the internal stainless steel screen. Following the installation of the Screen-Point-16 sampling rod, a low-flow peristaltic pump with disposable Teflon tubing will be used to collect a groundwater grab sample from the screened sample interval. Field parameters for dissolved oxygen (DO), pH, oxidation reduction potential (ORP), conductivity, temperature, and turbidity will be measured with a water-quality monitoring instrument equipped with a flow-through cell at the time of groundwater sample collection. In the event of minimal groundwater presence and/or slow recharge, the available groundwater will be sampled regardless of the purge volume or field parameter stability. Groundwater will be pumped directly into laboratory-provided sample containers. Sample containers will be labeled using the nomenclature outlined in Section 5.1, and placed in a cooler on ice for delivery to the designated laboratory under COC.

Laboratory information related to the chemical analyses of groundwater samples are summarized in Section 6.

Sample Collection Equipment

- Laboratory-provided sample containers;
- Peristaltic pump;
- Teflon tubing or similar compatible material;
- Water quality meter with flow through cell such as a YSI Model 6820; and
- Turbidity-meter.

Container and Analytical Requirements List

Matrix	Containers (Numbers, Size, and Type)	Analytical Parameter(s)	Analytical Method	Preservation Requirements	Holding Time
Groundwater	One 500-mL plastic	Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Selenium, Silver, and, Zinc	6010/200.7 6020/200.8 7471/245.5	HNO^3 to PH<2; Cool to 4°C	6 months; 28 Days
	Two 1-L Amber glass	PCBs	8081/8082	Cool to 4°C	12 months
		SVOCs	8070	Cool to 4°C	14 Days
	Three 40-mL glass vials	VOCs	8260 or SW-846 Method 5035A for potable well samples	HCl to pH < 2; Cool to 4°C	14 Days

Notes:

°C – Degrees Celsius
< - Less than
HCl – hydrochloric acid
HNO_3 – nitric acid
L – Liter
mL – Milliliter
PCBs – Polychlorinated Biphenyls
SVOCs – Semi-Volatile Organic Compounds
VOCs – Volatile Organic Compounds

4.5 Surface Water Sampling

The collection of surface water samples will be at the discretion of field sampling personnel. In locations where drums or other wastes are observed, suggesting unusual conditions, a surface water sample may be collected. If a surface water sample is collected, it will be prior to the collection of any sediment samples at that location. The tentatively proposed surface water and sediment locations are depicted on Figure 4-2 and Figure 4-3. It is anticipated that sample locations will be located near landward sampling locations or submerged containers to assess the potential for contamination related to the migration of contaminants from potentially identified sources. It is anticipated that surface water samples will be collected from the water column within 1 foot of the lake bottom. Prior to sample collection, the depth to the bottom of the lake will be measured and recorded in the field log book.

Surface water may be collected directly into sample containers if the depth of the water is sufficient or a dip sampler may be used. Alternatively, a low-flow peristaltic pump and Teflon tubing may be used to pump water from the lake into laboratory-provided sample containers. Sample containers will be labeled using the nomenclature outlined in Section 5.1, and properly preserved for delivery to the designated laboratory COC. At the time of sample collection field measurements of temperature, conductivity, pH, ORP, turbidity, and DO will also be made at all locations.

Laboratory information related to the chemical analyses of surface water samples is summarized in **Section 6**.

Sample Collection Equipment

- Laboratory-provided sample containers;
- Dip sampler (if needed);
- Peristaltic pump (if needed);
- Teflon tubing or similar compatible material (if needed);
- Water quality meter such as a YSI Model 6820; and
- Turbidity-meter.

Container and Analytical Requirements List

Matrix	Containers (Numbers, Size, and Type)	Analytical Parameter(s)	Analytical Method	Preservation Requirements	Holding Time
Surface Water	One 500-mL plastic	Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Selenium, Silver, and, Zinc	6010/200.7 6020/200.8 7471/245.5	HNO^{3} to PH<2; Cool to 4°C	6 months; 28 Days
	Two 1-L Amber glass	PCBs	8081/8082	Cool to 4°C	12 Months
		SVOCs	8270	Cool to 4°C	14 Days

Notes:
°C – Degrees Celsius
< - Less than
HCl – hydrochloric acid
HNO3 – nitric acid
L – Liter
mL – Milliliter
PCBs – Polychlorinated Biphenyls
SVOCs – Semi-Volatile Organic Compounds

4.6 Sediment Sampling

Proposed sediment sample locations within Torch Lake are depicted on **Figure 4-5**. Proposed sediment sample locations within ponds and drainage channels located near the Quincy Reclamation Plant and the Quincy Stamp Sands are depicted on **Figures 4-2** and **Figure 4-3**. At locations that are co-located with a surface water sample, the sediment sample collection will follow the collection of the surface water sample. Final sampling locations may be modified based on underwater reconnaissance completed by MDEQ GSU. It is anticipated that sample locations will be located near terrestrial sampling locations or where submerged containers were observed to assess the potential for contamination related to the migration of contaminants from potentially identified sources.

It is anticipated that sediment will be collected from multiple intervals within the sediment to evaluate the vertical extent of contamination. Sediment samples will be collected utilizing the MDEQ GSU's vibracore sampler. Lexane tubing or similar will be advanced in the sediment using the vibracore. The extracted sample core will be opened and the sediment column logged, screened and sampled, based on screening results and observations within the sample core.

Following collection, the sediment will be placed into a container constructed of inert material, homogenized, and transferred to the appropriate sample containers. The depth of water at the sample location will be recorded prior to sampling. Visual observations, including physical characteristics, staining, or olfactory evidence of contamination within the sediment will be recorded. Sample containers will be labeled using the nomenclature outlined in **Section 5.1**, and placed in a cooler on ice for delivery to the designated laboratory under chain of custody.

Laboratory information related to the chemical analyses of sediment samples is summarized in **Section 6**.

Sample Collection Equipment

- Laboratory-provided sample containers;
- Stainless steel bowls;
- Stainless steel trowels; and,
- Sample coring devices

Container and Analytical Requirements List

Matrix	Containers (Numbers, Size, and Type)	Analytical Parameter(s)	Analytical Method	Preservation Requirements	Holding Time
Sediment	One 250 mL wide mouth glass jar	Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Selenium, Silver, and, Zinc	6010/200.7 6020/200.8 7471/245.5	Cool to 4°C	6 months; 28 Days
		PCBs	8081/8082	Cool to 4°C	12 months
		SVOCs	8270	Cool to 4°C	14 Days

Notes:

°C – Degrees Celsius
mL – Milliliter
PCBs – Polychlorinated Biphenyls
SVOCs – Semi-Volatile Organic Compounds

4.7 Soil Gas Sampling

Proposed soil gas sample locations are depicted on **Figure 4-4**. Soil gas samples will be collected from soil borings advanced at the FSDB. The MDEQ Guidance Document for the Vapor Intrusion Pathway, dated May 2013 will be followed. Appendix F of that document contains SOPs for the installation of a soil gas probe and sampling utilizing USEPA Method TO-15 via Bottle-Vac®. Following the completion of soil gas sampling, the vapor monitoring well will be abandoned.

Precipitation events have the ability to displace shallow soil gas and close off pore space pathways; therefore, samples should not be collect from depths less than five feet following significant precipitation events until site conditions return to pre-precipitation conditions.

Minimum purge volumes and low-volume samples must be performed to minimize potential breakthrough from the surface or sampling intervals. Tracer/leak gas will be used to ensure breakthrough does not occur.

Furthermore, samples from wells with multiple points will not be collected simultaneously and a minimum of 30 minutes will elapse between each sample interval which will be documented on the file log.

Field Screening
Soil gas will be field-screened with the following equipment:

- PID.

Sample Collection Equipment

- Laboratory-provided sample containers;
- Tubing;
- Regulated flow meter assembly set to a maximum 200 ml/min (one per location);
- Tracer gas (lab grade helium);
- Sampling shroud for tracer gas;
- 50 ml syringe;
- Helium detector; and,
- Pre-calibrated flow regulator with vacuum gauge.

4.8 Drums, Containers, Building Materials, Bulk Asbestos, and Waste Deposit Sampling

Grab or composite samples may be collected from identified waste deposits. The contents of open or dilapidated drums or containers will be sampled. Field personnel will not open sealed drums or containers, but may elect to sample near such containers to determine if the contents of the containers are discharging to the surrounding environmental media. The collection of container or waste samples will be consistent with surface soil sampling methodologies described in Section 4.2.

Field decisions may be made to collect samples from abandoned containers and SACM. SACM will be organized into homogenous groups and a minimum of three representative samples will be collected from each homogenous group. Samples will be placed in sealable plastic bags/containers and submitted to the laboratory for analysis.

Laboratory information related to the chemical analyses of container contents, waste samples, and asbestos is summarized in Section 6.

Field team members will don a new pair of disposable nitrile gloves prior to collection of each sample. The stainless-steel coring device will be decontaminated after collection of each sample by washing in an alconox-and-water solution, rinsing with distilled water, and drying with disposable paper towels.

Field Screening
Soil will be field-screened with the following equipment:

- PID.

Sample Collection Equipment

- Laboratory-provided sample containers;
- Sealable plastic bags/containers; and,
- Stainless steel trowels/coring tool.

Container and Analytical Requirements List

Matrix	Containers (Numbers, Size, and Type)	Analytical Parameter(s)	Analytical Method	Preservation Requirements	Holding Time
Drum, Containers, RPM (Waste Characterization)	One 4-oz glass jar	TCLP VOCs	NA	Cool to 4°C	14 Days
	Two 16-oz glass jars	TCLP SVOCs	NA	Cool to 4°C	14 Days
		TCLP Pesticides	NA	Cool to 4°C	14 Days
		TCLP Herbicides	NA	Cool to 4°C	14 Days
		TCLP Metals	NA	Cool to 4°C	180 Days (28 for Hg)
		Reactive Cyanide	SW7.3.3.2NA	Cool to 4°C	28 Days
		Reactive Sulfide	SW7.3.4.2	Cool to 4°C	28 Days
		pH	SW9045D	Cool to 4°C	7 Days
		Flashpoint/Ignitability	SW1010A	Cool to 4°C	180 Days
		Free Liquids	SW9095B	Cool to 4°C	28 Days
		PCBs	SW8082	Cool to 4°C	14 Days
		Moisture	SW3550C	Cool to 4°C	14 Days
		SVOCs	SW846 8270D	Cool to 4°C	14 Days
		Pesticides	SW8081	Cool to 4°C	14 Days
		Herbicides	SW8151	Cool to 4°C	14 Days
		Metals by ICP (RCRA 8)	SW846 6010C	Cool to 4°C	180 Days
		Mercury	SW7471B	Cool to 4°C	28 Days
	Two 40 mL vials	VOCs (*MDEQ "plus" list*)	SW8260B	10 mL methanol, 4°C	6 months; 28 Days
Bulk Asbestos	Sealable Plastic Bag	PLM Method 600/R-93/116	PLM	None	Indefinite

Notes:

°C – degrees Celsius
mL – Milliliter
MeOH – Methanol
PCBs – Polychlorinated Biphenyls
PLM – Polarized Light Microscopy
SVOCs – Semi-volatile Organic Compounds
VOCs – Volatile Organic Compounds

5.0 SAMPLING PROCEDURES

This Section describes the Project-specific sample nomenclature, management of IDW, decontamination, custody procedures, and other standard operating procedures intended for use on this Project.

5.1 Sample Nomenclature

All samples for analysis, including QC samples, will be given a unique sample number. The sample numbers will be recorded in the field logbook and/or established sample tracking forms, on the sample jars, and on the COC paperwork. The sample identification (ID) number will be used to track field-screening data and laboratory analytical results from each parcel in the Project database.

MSG and the field sampling team will assign each sample its unique ID based on the nomenclature outlined below. The sample identification will be used for documentation purposes in field logbooks, as well as for presentation of the analytical data in memoranda and reports. The Project samples will be identified using the following format:

Project Identification Code
QMCM = Quincy Mining Company Mason Operations Area

Sample Media Code
This shall consist of the following:

- ASBBLK = Bulk Asbestos
- DM = Drum or container sample
- GW = Groundwater sample
- PW = Potable Well
- RPM = Residual Process Material
- SB = Subsurface soil sample
- SG = Soil Gas sample
- SD = Sediment sample
- SS = Surface soil sample
- SW = Surface water sample

Sample Number Code
The two digit sample number code will correspond to the consecutive sample count for a given sample media. For example, soil borings are tentatively numbered 01 through 38 and sediment samples are tentatively numbered 01 through 40. Field decisions will ultimately determine the total number of sampling locations for each media type.

Sample Interval or Sample Depth Code
The sample depth or interval code will utilize the top and bottom of the sample interval consisting of the following: This shall consist of the following:

- a_1-b_1"= Where "a_1" represents the top of the sample interval and "b_1" represents the bottom of the sample interval followed by " or ' to indicate the units are in inches or feet. For groundwater samples, the screen interval of the monitoring well shall represent the top and bottom of the sample interval.
- a_2-b_2'= If more than one sample is collected at location at a different depth interval than above, where "a_2" represents the top of the second sample interval and "b_2" represents the bottom of the second sample interval followed by ' to indicate the units are in feet.

QA/QC Identification Code
FD = Field duplicate

Date Code
MMDDYY = The two-digit month (MM), followed by the two-digit day (DD), followed by the two-digit year (YY).

Surface soil sample ID's will be constructed with the Project identification code, followed by the sample media code, followed by the sample interval code, followed by the QA/QC identification, if applicable. A sample identification example for a surface soil sample follows:

- QMCM-SS01-0-6" = the first surface soil sample collected from the QMCM from the 0-6 inch sample interval.

Subsurface soil sample ID's will be constructed with the Project identification code, followed by the sample media code, followed by the sample interval code, followed by the QA/QC identification, if applicable. A sample identification example for a subsurface soil sample follows:

- QMCM-SB14-1-3' = subsurface soil sample collected from the fourteenth soil boring advanced in the QMCM from the 1-3 foot sample interval.

Groundwater sample ID's will be constructed with the Project identification code, followed by the sample media code, followed by the sample/screen interval code, followed by the QA/QC identification, if applicable. A sample identification example for a field duplicate groundwater sample follows:

- QMCM-GW03-8-13'-FD = field duplicate of the third groundwater sample collected from the QMCM from a monitoring well screened from 8 to 13 feet.

Surface water sample ID's will be constructed with the Project identification code, followed by the sample media code, followed by the sample interval code, followed by the QA/QC identification, if applicable. A sample identification example for a surface water sample follows:

- QMCM-SW01-39-40' = the first surface water sample collected from the QMCM from a depth of 39 to 40 feet.

Sediment sample ID's will be constructed with the Project identification code, followed by the sample media code, followed by the sample interval code, followed by the QA/QC identification, if applicable. A sample identification example for a sediment sample collected from Torch Lake follows:

- QMCM-SD10-0-6" = the tenth sediment sample collected from the QMCM from the 0-6-inch sample interval.

Soil gas sample ID's will be constructed with the identification code, followed by the sample media code, followed by the sample/screen interval code, followed by the QA/QC identification, if applicable. A sample identification example for a soil gas sample follows:

- QMCM-SG01-5-6' = the first soil gas sample collected from the QMCM from a depth of 5 to 6 feet.

Potable well sample ID's will be constructed with the identification code, followed by the sample media code, followed by the data code, followed by the QA/QC identification, if applicable. A sample identification example for a soil gas sample follows:

- QMCM-PW01-061317 = the first potable well sample collected from the QMCM on 13 June 2017.

Residual Process Material sample ID's will be constructed with the identification code, followed by the sample media code, followed by the sample/screen interval code, followed by the QA/QC identification, if applicable. A sample identification example for a residual process material sample follows:

- QMCM-RPM01-0-6"' = the first residual process material sample collected from the QMCM from a depth of 0 to 6 inches.

Drum or Container sample ID's will be constructed with the Project identification code, followed by the sample media code, followed by the sample interval code, followed by the QA/QC identification, if applicable. A sample identification example for a drum/container sample follows:

- QMCM-DM03-0-6" = the third drum/container sample collected from the QMCM from the 0-6 inch sample interval.

Bulk Asbestos sample ID's will be constructed with the Project identification code, followed by the sample media code, followed by the date code. A sample identification example for a bulk asbestos (material) sample follows:

- QMCM-ASBBLK05-061817 = the fifth bulk asbestos (material) sample collected from the QMCM, collected on 18 June 2017.

5.2 Decontamination Procedures and Management of Investigative-Derived Wastes

For purposes of this SAP, IDWs are defined as any byproduct of the field activities that is suspected or known to be contaminated with hazardous substances. The performance of field activities will produce waste products, such as spent sampling supplies (*e.g*., sample tubing, disposable sample devices, paper towels, etc.), and expendable PPE. Disposable sampling supplies and PPE will be containerized in trash bags, near the work, which may include terrestrial locations and offshore locations, and disposed of as non-hazardous municipal solid waste at the end of the Project phase.

5.2.1 Terrestrial Investigation

Soil boring advancement and monitoring well installation will result in the generation of soil cuttings, purge water, and decontamination water. It is anticipated that soil cuttings, following logging, screening, and sampling will be temporarily contained in a five-gallon bucket. Following completion of the boring installation the staged soil cuttings will be returned to the boring. For locations where groundwater samples are collected, the soil cuttings will be staged until all samples have been collected and the sampling equipment extracted from the boring. Purge water generated as a result of groundwater sampling activities will be temporarily containerized in five-gallon bucket. Following groundwater sampling collection the collected purge water will be returned to the boring and the boring will be backfilled with the soil cuttings. Expendable groundwater sampling materials will be containerized in a trash bag for disposal as non-hazardous municipal solid waste at the end of the Project phase. Commercially-available topsoil may be added to soil sampling locations to restore original grade as necessary.

It is anticipated that reusable equipment, including the stainless steel sampling screen, will be decontaminated between boring locations using steam-cleaning methods which will minimize decontamination water. In addition, some parts or equipment may be decontaminated using an alconox wash and rinse. Decontamination water generated through washing and rinsing will be discharged in the vicinity of the sample locations. Spray bottles of wash and rinse water may be used to minimize the volume of decontamination fluids generated but the soil boring and well installation activities.

5.2.2 Offshore Investigation

Offshore sampling locations will result in the generation of similar waste streams. Spent Lexane tubing used in the collection of vibra-core sediment samples will be collected and staged for disposal as non-hazardous municipal solid waste. Sample tubing and similar reusable sampling equipment will be collected in a trash bag for disposal as non-hazardous municipal solid waste. Spent sampling supplies and PPE will be staged on the sampling vessel until the vessel returns to the dock at which time bagged and containerized waste will be transferred to a dumpster for disposal.

Excess sediment, debris, and surface water generated as a result of the sampling activities will be temporarily containerized on the vessel in a five-gallon bucket until sampling at the location is complete. Following completion of the sampling activities the excess sediment and surface water will be returned to the lake in the vicinity of the sample location.

It is anticipated that reusable equipment will be decontaminated on board the sampling vessel using an alconox wash and rinse. Spray bottles of wash and rinse water may be used to minimize the volume of decontamination fluids generated during the surface water and sediment sampling activities. Decontamination water generated through washing and rinsing will be discharged to the lake in the vicinity of the sample location.

In the event that free phase oils or liquids or grossly contaminated media are encountered during the terrestrial or offshore sampling activities, contingency containment will be available in the area of the work. Contingencies for containment will include two, clean, five-gallon buckets with lids that will be used to contain any free phase product or residues. The contingency containment will also be used to containerize decontamination fluids resulting from encountering the grossly contaminated material. The containerized waste will be sampled and characterized for proper disposal. It is assumed that any grossly contaminated media collected as a contingency will be temporarily secured and staged at the property where it was generated or at facility secure location until it can be properly characterized and disposed.

5.3 Sample Handling, Tracking, and Custody Procedures

All samples will be identified, handled, shipped, tracked, and maintained under COC. This section discusses sample identification (ID), sample labels, custody seals, sample documentation, sample chain-of-custody, the field log book, and sample shipment.

5.3.1 Sample Identification

As described in Section 5.1, each sample collected will be given a unique sample ID number that is project- and location-specific. A record of sample ID numbers will be kept with the field records and recorded on chain-of-custody forms.

5.3.2 Sample Labels

Sample labels will be affixed to sample containers. The label will be completed with the following information written in indelible ink:

- Project name and location
- Sample ID number
- Date and time of sample collection
- Preservative used
- Sample collector's initials
- Analyses required

After labeling, each sample will be placed in a cooler that contains ice to maintain the sample temperature at 4 ± 2 ºC. A temperature blank will be provided in each cooler for the laboratory to confirm storage temperature upon sample receipt.

5.3.3 Custody Seals

A self-adhesive custody seal will be placed across the lid of each sample cooler so that the cooler cannot be opened without breaking the seal. The shipping containers in which samples will be stored will be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. Custody seals will be signed and dated.

Custody seals also will be used in combination with strapping tape on the shipping containers to ensure that samples have not been disturbed during transport. Openings will be taped shut to prevent potential leakage during transport.

5.3.4 Sample Documentation

Documentation during sampling is essential to ensure proper sample identification. Sampling personnel will adhere to the general guidelines summarized below for maintaining field documentation:

- Documents will be completed in permanent blank ink;
- Entries will be legible;

- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout in a manner that allows the initial entry to be read;
- Any serialized documents including the sampling forms will be maintained in a site file folder by MDG field personnel and referenced in the site logbook; and,
- Unused portions of pages will be crossed out, and each page will be signed and dated.

MSG field personnel will be responsible for ensuring that sampling activities are properly documented.

5.3.5 Sample Chain of Custody

The field team will use standard sample custody procedures to maintain and document sample integrity during sample collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the statements below applies:

- It is in a person's physical possession or view;
- It is in a secure area with restricted access;
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal; and,
- Special instructions regarding short holding/extraction times will be noted.

Chain-of-custody procedures provide an accurate written record that traces the possession of in individual samples from the time of collection in the field to the time of acceptance at the laboratory. The chain-of-custody form will be used to document samples collected and the analyses requested. The field personnel will record the following information on the chain-of-custody record:

- Project name and number;
- Sampling location;
- Name and signature of sampler;
- Destination of samples (laboratory name);
- Sample ID number;
- Date and time of collection;
- Number and type of containers filled;
- Analyses requested;
- Preservatives used (if applicable);
- Filtering (if applicable);
- Sample designation (grab or composite);
- Signatures of individuals involved in custody transfer;
- Air bill number (if applicable); and,
- Project contact and telephone number.

Unused lines on the chain-of-custody record will be crossed out. Field personnel will sign chain-of-custody records that are initiated in the field, and the air bill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed air bills will serve as evidence of custody transfer between field personnel and the courier and between the courier and the laboratory. Copies of the chain-of-custody records and the air bills will be retained and filed by field personnel before the containers are shipped.

Laboratory chain-of-custody begins with sample receipt and continues until samples are discarded. Laboratories analyzing samples must follow custody procedures at least as stringent as those required by the U.S. EPA Contract Laboratory Program (CLP) Statement of Work (SOW) (U.S. EPA 2007). The laboratory should designate a specific individual as the sample custodian. The custodian will receive incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record pertinent information concerning the samples, including the person(s) delivering the samples, the date and time received, and sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; and other relevant remarks).

The sample ID numbers, along with unique laboratory ID numbers, will be recorded on the sample receipt form. After the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples requiring special handling, including samples that are heat- or light-sensitive or have other unusual physical characteristics, will be properly stored and maintained prior to analysis.

5.3.6 Sample Shipment

The procedures summarized below will be implemented to ship samples collected during this Project.

- The cooler will be filled with bubble wrap, sample bottles, and packing material. Sufficient packing material will be used to prevent sample containers from breaking during shipment. Enough ice will be added to maintain the sample temperature at 4 ± 2 °C. A temperature blank will be provided in each cooler for the laboratory to confirm storage temperature upon sample receipt. In addition, in order to avoid interference with the laboratory analysis, the packing material will be handled and used in such a manner that it will not contact the sample media at the Project.
- The chain-of-custody records will be placed inside a waterproof plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The air bill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.
- The cooler will be closed and taped shut with strapping tape around both ends. If the cooler has a drain, the drain will be taped shut both inside and outside the cooler.
- Signed and dated custody seals will be placed on the front and side of each cooler. Wide clear tape will be placed over the seals to prevent accidental breakage.
- The chain-of-custody record will be transported in the taped sealed cooler. When the cooler is received at the analytical laboratory, laboratory personnel will open the cooler and sign the chain-of-custody record to document the transfer of samples.

Multiple coolers may be sent in one shipment to the laboratory. The outsides of the coolers will be marked to indicate the number of coolers in the shipment.

Alternatively, samples may be transported by |MDEQ personnel directly to the environmental laboratory. Standard chain of custody procedures will be followed during transfer of the samples to the laboratory.

5.4 Sampling SOPs

MDEQ GSU will reference and follow MDEQ Standard Operating Procedures specific to but not limited to groundwater sampling, surface water sampling, decontamination procedures, sediment sampling, subsurface soil sampling, soil gas/vapor intrusion sampling, and soil boring logging and sampling.

5.5 Field Log Book

Complete and accurate documentation is essential to demonstrate that field measurement and sampling procedures are carried out as described in this. Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the Project name and number; the Project name and location; and the names of subcontractors.

At a minimum, the following information will be recorded in the field logbook:

- Names and affiliations of on-site personnel and visitors;
- Weather conditions during the field activity;
- Summary of daily activities and significant events;
- Information regarding sample collection, including collection date and time, sample ID number, sampling location, sample matrix (such as water or soil), sample type (such as regular, duplicate, blank, grab, or composite), and sampling depth;
- Notes of conversations with coordinating officials;
- References to other field logbooks or forms that contain specific information;
- Discussions of problems encountered and their resolution;
- Discussions of deviations from the SAP or other governing documents; and,
- Description of photographs taken

Changes or corrections will be made by crossing out the item with a single line initialed and dated by the person performing the correction. The original item, although erroneous, will remain legible beneath the cross-out. The new information will be written above the crossed-out item. Corrections will be written clearly and legibly with indelible ink.

6.0 LABORATORY INFORMATION

Investigative samples will be delivered by a courier or shipped under chain of custody to the designated laboratory listed in the table below.

Matrix	Laboratory Name	Laboratory Address	Laboratory Contact Name	Laboratory Phone Number	Accept Saturday Deliveries
Surface Soil Subsurface Soil Groundwater Surface Water Sediment Soil Gas	MDEQ Environmental Laboratory	3350 N. Martin Luther King Blvd. Lansing, MI 48906-2933	MDEQ Laboratory Services Section Kirby Shane	(517) 335-9800	No
Composite Soil for Waste Characterization	ALS Environmental	3352 128th Ave Holland MI, 49424	Alex Csaszar	(616) 399-6070	Yes
Bulk Asbestos and Asbestos in Soil	TestAmerica, Inc.	4101 Shuffel Street NW North Canton, OH 44720	Kris Brooks	330-966-9790	Yes

Although the MDEQ Environmental Laboratory does not perform certain waste characterization analyses and asbestos analysis, the contract laboratory program requires that the samples be shipped and managed by the MDEQ Environmental Laboratory. The laboratory or MSG will deliver the samples under chain of custody to the appropriate laboratory in the Contract Laboratory Program. Field personnel will follow these procedures unless directed otherwise by MDEQ or laboratory personnel.

6.1 Measurement and Performance Criteria

Generic measurement and performance criteria will be used. These criteria will ensure that data are sufficiently sensitive, precise, accurate, and representative to support Project decisions. The criteria are summarized below.

- Sensitivity – Sensitivity is the ability of the method or instrument to detect the contaminant of concern and other target analytes at the level of interest. For this project, the laboratory quantitation limits are below the Project action levels for lead as required (see Section 6.2).
- Accuracy – Accuracy is a measure of the agreement between an observed value and an accepted reference value. It is a combination of the random error (precision) and systematic error (bias), which are due to sampling and analytical operations. Accuracy is determined by percent recovery calculations of laboratory QC samples.
- Precision – Precision is a measure of the closeness of agreement among individual measurements. Precision is determined by relative percent difference (RPD) and/or standard deviation calculations for laboratory duplicate samples.
- Completeness – Completeness is a measure of the amount of valid data obtained compared to the amount of data that was planned to be collected. Completeness is project specific but is generally around 90 percent.
- Representativeness – Representativeness is a measure of the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Simply, this is the degree to which samples represent the conditions for which they were taken.
- Comparability – Comparability is a measure of the degree to which one data set can be compared with another. Some conditions of comparability of data sets are as follows: standardized sampling and analysis, consistency of reporting units, and standardized data format.

The MDEQ Environmental Laboratory will validate analytical results, ensuring that the data is acceptable for use in supporting Project decisions.

6.2 Data Quality Objectives Criteria

DQOs address requirements that include when, where, and how to collect samples; the number of samples; and the limits on tolerable error rates. Sufficient data will be obtained from a representative number of samples to support defensible decisions by MDEQ and to determine whether further actions at the Project are necessary. These steps should periodically be revisited as new information about a problem is learned.

The following is a list of DQOs that apply to the QMCM. Analytical data must meet all requirements for comparison to the following regulations:

Surface Soil

- MDEQ Cleanup Criteria Requirements for Response Activity.
  http://www.michigan.gov/deq/0,4561,7-135-3311_4109-251790--,00.html
  - Rule 299.46 Generic soil cleanup criteria for residential category; and,
  - Rule 299.48 Generic soil cleanup criteria for nonresidential category.

Subsurface Soil

- MDEQ Cleanup Criteria Requirements for Response Activity.
  http://www.michigan.gov/deq/0,4561,7-135-3311_4109-251790--,00.html
  - Rule 299.46 Generic soil cleanup criteria for residential category; and,
  - Rule 299.48 Generic soil cleanup criteria for nonresidential category.

Groundwater

- MDEQ Cleanup Criteria Requirements for Response Activity
  http://www.michigan.gov/deq/0,4561,7-135-3311_4109-251790--,00.html
  - Rule 299.44 Generic groundwater cleanup criteria.

Surface Water

- MDEQ – Rule 57 Water Quality Values, Surface Water Assessment Section
  http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3686_3728-11383--,00.html
- EPA Ecological Screening Levels (ESLs)
  https://www3.epa.gov/region5/waste/cars/esl.htm

Sediment

- MDEQ Cleanup Criteria Requirements for Response Activity;
  http://www.michigan.gov/deq/0,4561,7-135-3311_4109-251790--,00.html
  - Rule 299.46 Generic soil cleanup criteria for residential category; and,
  - Rule 299.48 Generic soil cleanup criteria for nonresidential category.
- EPA ESLs;
  https://www3.epa.gov/region5/waste/cars/esl.htm
- Sediment Quality Guidelines, Threshold Effect Concentrations (TECs) and Probable Effect Concentrations (PECs), MacDonald, et al, 2000.
  https://www.michigan.gov/documents/deq/deq-rrd-OpMemo_4Attach3Sediments_250004_7.pdf

Soil Gas

- MDEQ Guidance for the Vapor Intrusion Pathway.
  http://www.michigan.gov/documents/deq/deq-rrd-VIGuidanceDoc-May2013_422550_7.pdf

Bulk Asbestos

- EPA, National Emission Standards for Hazardous Air Pollutants (NESHAP).
  - 40 Code of Federal Regulations (CFR), Part 61, Subpart M.
    https://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol8/pdf/CFR-2011-title40-vol8-part61-subpartM.pdf

Waste

- 40 Code of Federal Regulations (CFR) Part 261 – Identification and Listing of Hazardous Waste.
  - 40 CFR Part 261 Subpart C – Characteristics of Hazardous Waste.
    https://www.gpo.gov/fdsys/pkg/CFR-2012-title40-vol27/xml/CFR-2012-title40-vol27-part261.xml

7.0 QUALITY CONTROL ACTIVITIES

The following sections describe the field and laboratory quality control procedures.

7.1 Field Quality Control

QC samples will be collected to evaluate the field sampling and decontamination methods, and the overall reproducibility of the laboratory analytical results. Specifically, QC samples will be collected at the following frequencies:

- Field duplicate samples
  - 1 per 10 investigative samples

Field duplicate samples will be collected using the same sampling techniques as its associated investigative sample. Field duplicate samples will be processed, stored, packaged, and analyzed by the same methods as the investigative samples. Sample nomenclature specific to QC samples is listed in Section 5.1. For field duplicates, the RPD between the duplicate and investigative sample will be calculated by the MSG QA reviewer and those RPDs greater than 50 percent (where detections are greater than the quantitation limit) will be summarized in the site investigation report. Corrective actions may include resampling, reassessment of the laboratory's methods, or the addition of data qualifiers to laboratory results.

Matrix spike/matrix spike duplicate (MS/MSD) samples will not be collected during the implementation of field activities. Alternatively, MS/MSD will be selected by the laboratory or "batched". As such, MS/MSD samples may not be derived from investigative samples from the Project, but may come from another sample set at the laboratory. The MDEQ Environmental Laboratory will flag data based on the MS/MSD results if appropriate, but the MS/MSD results will not be reported with investigative sample results. The collection of samples for MS/MSD analyses will not be conducted as part of this investigation.

7.2 Analytical Quality Control

QC for analytical procedures will be performed at the frequency described in the laboratory Standard Operating Procedures (SOPs). In addition, method-specific QC requirements will be used to ensure data quality.

7.3 Performance Evaluation Samples

Performance evaluation samples will not be used in this site assessment.

7.4 Quality Assurance Assessment / Corrective Actions

Field activities are anticipated to require three, 2-week mobilizations for completion; no long-term project field audit will be completed at this time.

7.5 Documentation, Records, and Data Management

The MDEQ Environmental Laboratory and Contract Laboratories, as applicable will be expected to provide analytical results in electronic data deliverable (EDD) and report formats, with QA/QC and investigative data results. The EDDs will be specifically requested from the MDEQ Environmental Laboratory and will include analyte comments. Sample comments will be added to the database by MSG. Laboratory-generated data will be imported to the Project database for mapping, reporting, and archival activities. Laboratory reports will be archived electronically in the MSG Project file and by the MDEQ Environmental Laboratory.

8.0 REFERENCES

1. Booij, K, H.E. Hofmans, C.V. Fischer, and E.M. Van Weerlee. *Temperature-Dependent Uptake Rates of Nonpolar Organic Compounds by Semipermeable Membrane Devices and Low-Density Polyethylene Membranes*. Environmental Science and Technology, pp 37, pp 361-366. 2003.

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4. Julia A. Blair & Michigan Technological University Department of Social Sciences Archaeology Laboratory. Archaeological Survey Report of *The Quincy Mining Company, Torch Lake Smelter & Reclamation Plant, At Mason Sands, Torch Lake EPA Superfund Site*. May 2001.

5. Great Lakes Environmental Center. *Final Report, PCB Study Using Semipermeable Membrane Devices in Torch Lake, Houghton County, MDEQ Project Number 05-25*. March 2006.

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12. MDEQ Water Resources Division. *Staff Report, Status of Fish Contaminant Levels in the Torch Lake Area of Concern 2013*. January 2016.

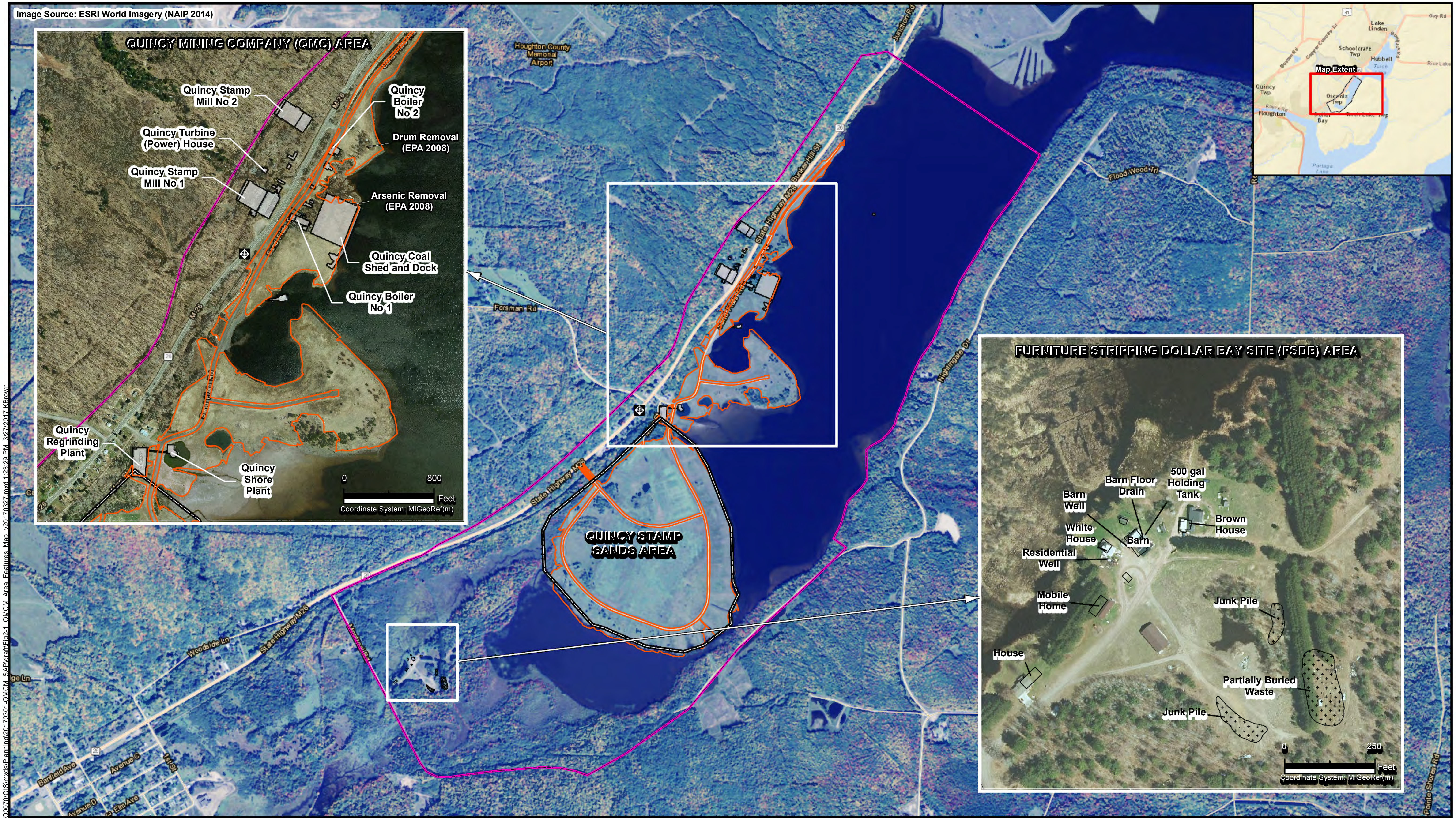
13. MDEQ RRD GSU. *Remotely Operated Vehicle (ROV) Videos for Torch Lake within the QMCM*. July 2016.

14. MSG. *Preliminary Reconnaissance Observations for QMCM*. October 2016.

15. UPEA. *Baseline Environmental Assessment Conducted Pursuant to Section 20126(1)(c) 1994 PA451, Part 201, as amended and the rules promulgated thereunder for Mason Sands, Houghton County, Michigan*. January 2017.

16. MSG. *Historical Data Review and Compilation Technical Memorandum Abandoned Mining Wastes-Torch Lake Non-Superfund Site Quincy Mining Company Mason Operations Area, Houghton County, Michigan Site ID#31000098*. February 2017.

FIGURES



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Mining Era Buildings and Structures
Building Outline (from MDEQ CAD)
Debris / Junk Piles (from MDEQ CAD)
Cap Boundary (2005 NRCS)
Approximate Quincy Stamp Sands
QMCM Study Area Boundary

Mining Era Buildings and Structures from:
- *Michigan Technological University Archive Research Phase 3 Report*

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Coordinate System: MIGeoRef(m)

Prepared for:
Michigan Department of Environmental Quality

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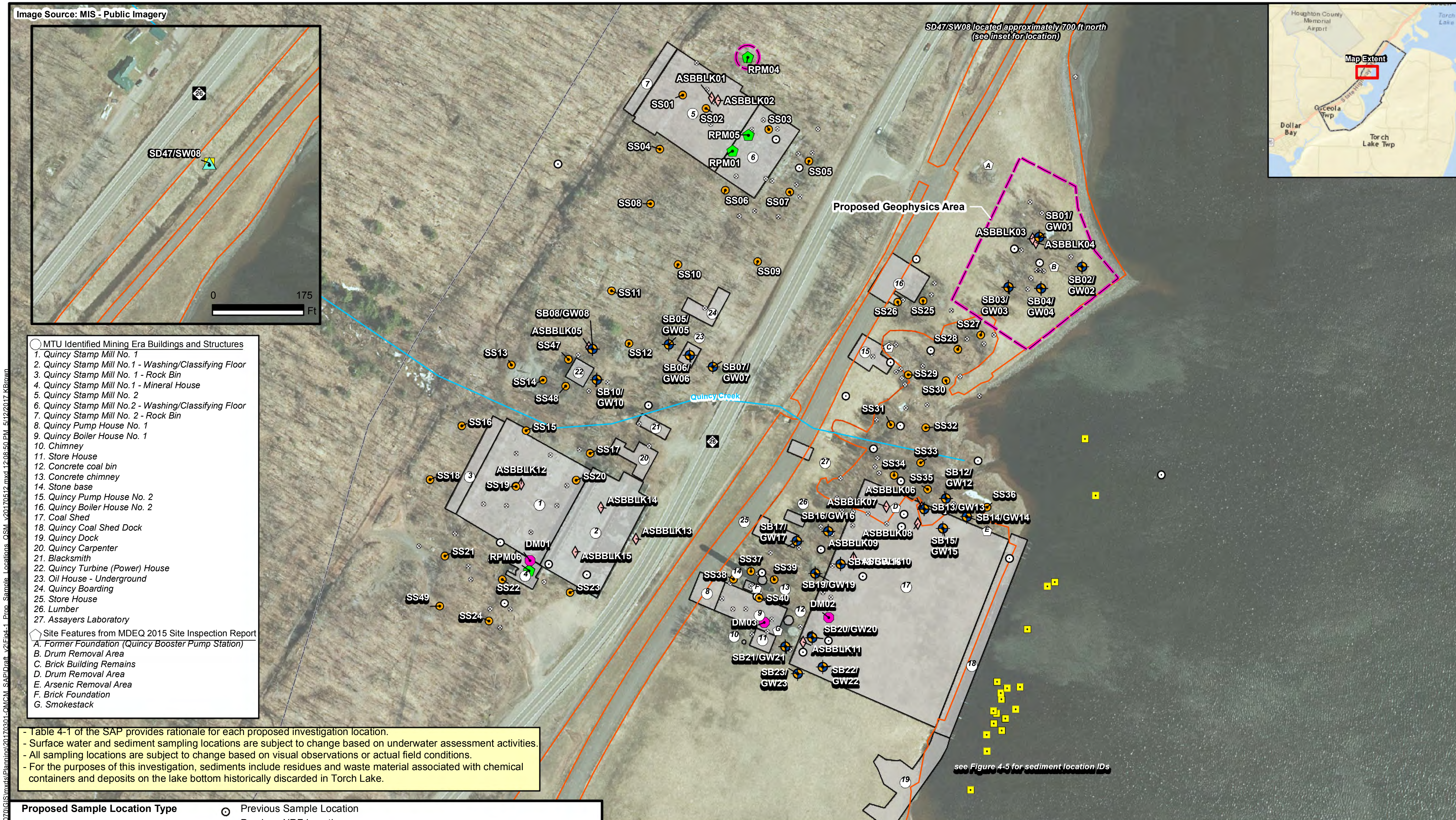
Figure 2-1
Area Features Map
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan



MTU Identified Mining Era Buildings and Structures

1. Quincy Stamp Mill No. 1
2. Quincy Stamp Mill No.1 - Washing/Classifying Floor
3. Quincy Stamp Mill No. 1 - Rock Bin
4. Quincy Stamp Mill No.1 - Mineral House
5. Quincy Stamp Mill No. 2
6. Quincy Stamp Mill No.2 - Washing/Classifying Floor
7. Quincy Stamp Mill No. 2 - Rock Bin
8. Quincy Pump House No. 1
9. Quincy Boiler House No. 1
10. Chimney
11. Store House
12. Concrete coal bin
13. Concrete chimney
14. Stone base
15. Quincy Pump House No. 2
16. Quincy Boiler House No. 2
17. Coal Shed
18. Quincy Coal Shed Dock
19. Quincy Dock
20. Quincy Carpenter
21. Blacksmith
22. Quincy Turbine (Power) House
23. Oil House - Underground
24. Quincy Boarding
25. Store House
26. Lumber
27. Assayers Laboratory

Site Features from MDEQ 2015 Site Inspection Report

A. Former Foundation (Quincy Booster Pump Station)
B. Drum Removal Area
C. Brick Building Remains
D. Drum Removal Area
E. Arsenic Removal Area
F. Brick Foundation
G. Smokestack

- Table 4-1 of the SAP provides rationale for each proposed investigation location.
- Surface water and sediment sampling locations are subject to change based on underwater assessment activities.
- All sampling locations are subject to change based on visual observations or actual field conditions.
- For the purposes of this investigation, sediments include residues and waste material associated with chemical containers and deposits on the lake bottom historically discarded in Torch Lake.

Proposed Sample Location Type

- Surface Soil
- Soil Boring & Groundwater
- Drum / Abandoned Container
- Residual Process Material (RPM)
- Sediment
- Bulk Asbestos
- Previous Sample Location
- Previous XRF Location
- Proposed Geophysics Area
- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures
- QMCM Study Area Boundary

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Coordinate System: MIGeoRef(m)

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Figure 4-1

Proposed Sampling Locations - Quincy Stamp Mills
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan
Revised: 12 May 2017

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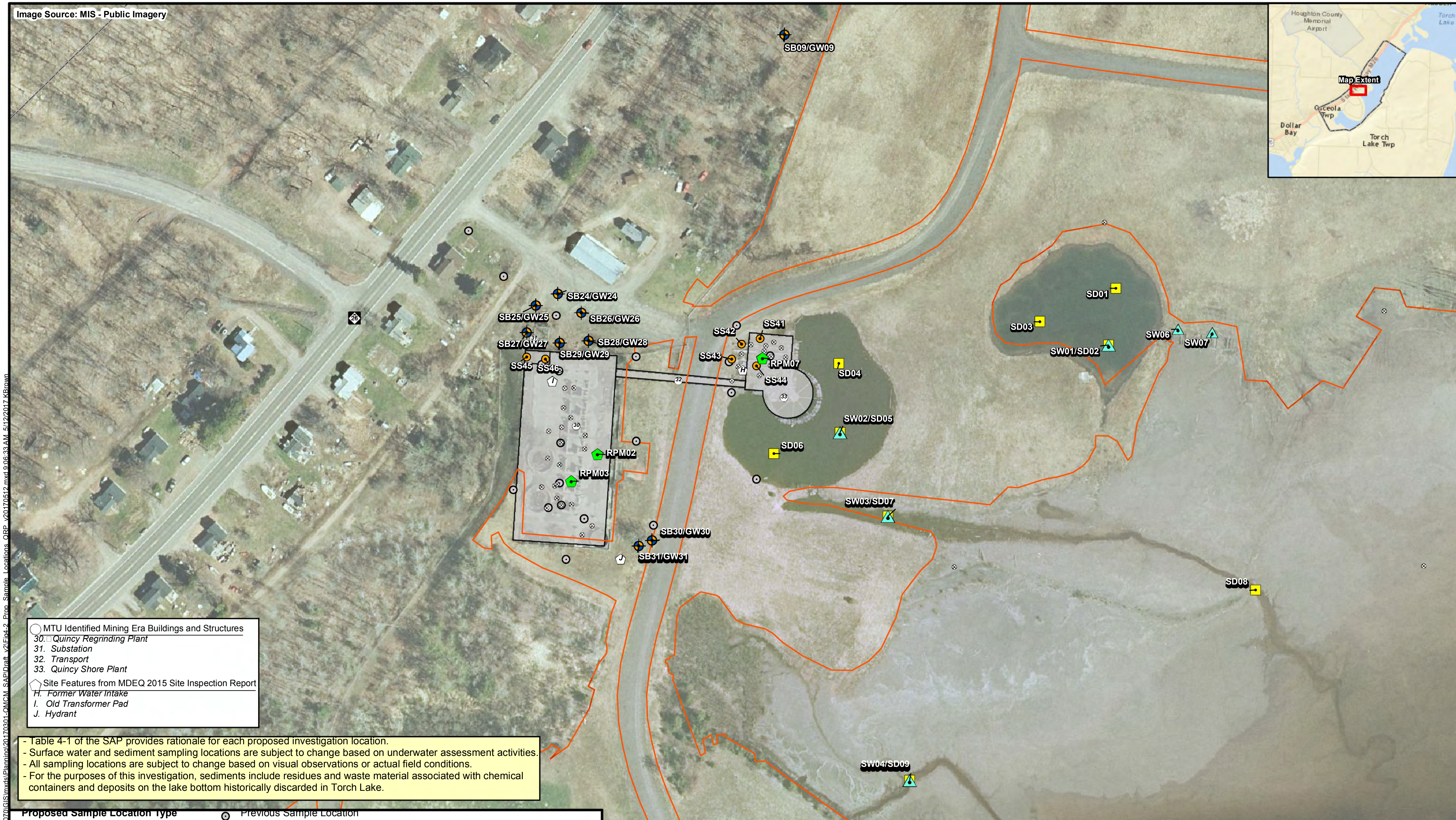

MTU Identified Mining Era Buildings and Structures
30. Quincy Regrinding Plant
31. Substation
32. Transport
33. Quincy Shore Plant

Site Features from MDEQ 2015 Site Inspection Report
H. Former Water Intake
I. Old Transformer Pad
J. Hydrant

- Table 4-1 of the SAP provides rationale for each proposed investigation location.
- Surface water and sediment sampling locations are subject to change based on underwater assessment activities.
- All sampling locations are subject to change based on visual observations or actual field conditions.
- For the purposes of this investigation, sediments include residues and waste material associated with chemical containers and deposits on the lake bottom historically discarded in Torch Lake.

Proposed Sample Location Type

- Surface Soil
- Soil Boring & Groundwater
- Residual Process Material (RPM)
- Sediment
- Surface Water
- Sediment & Surface Water
- Previous Sample Location
- Previous XRF Location
- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures
- QMCM Study Area Boundary

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Coordinate System: MIGeoRef(m)

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Figure 4-2
Proposed Sampling Locations - Quincy Reclamation Plant
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan
Revised: 12 May 2017

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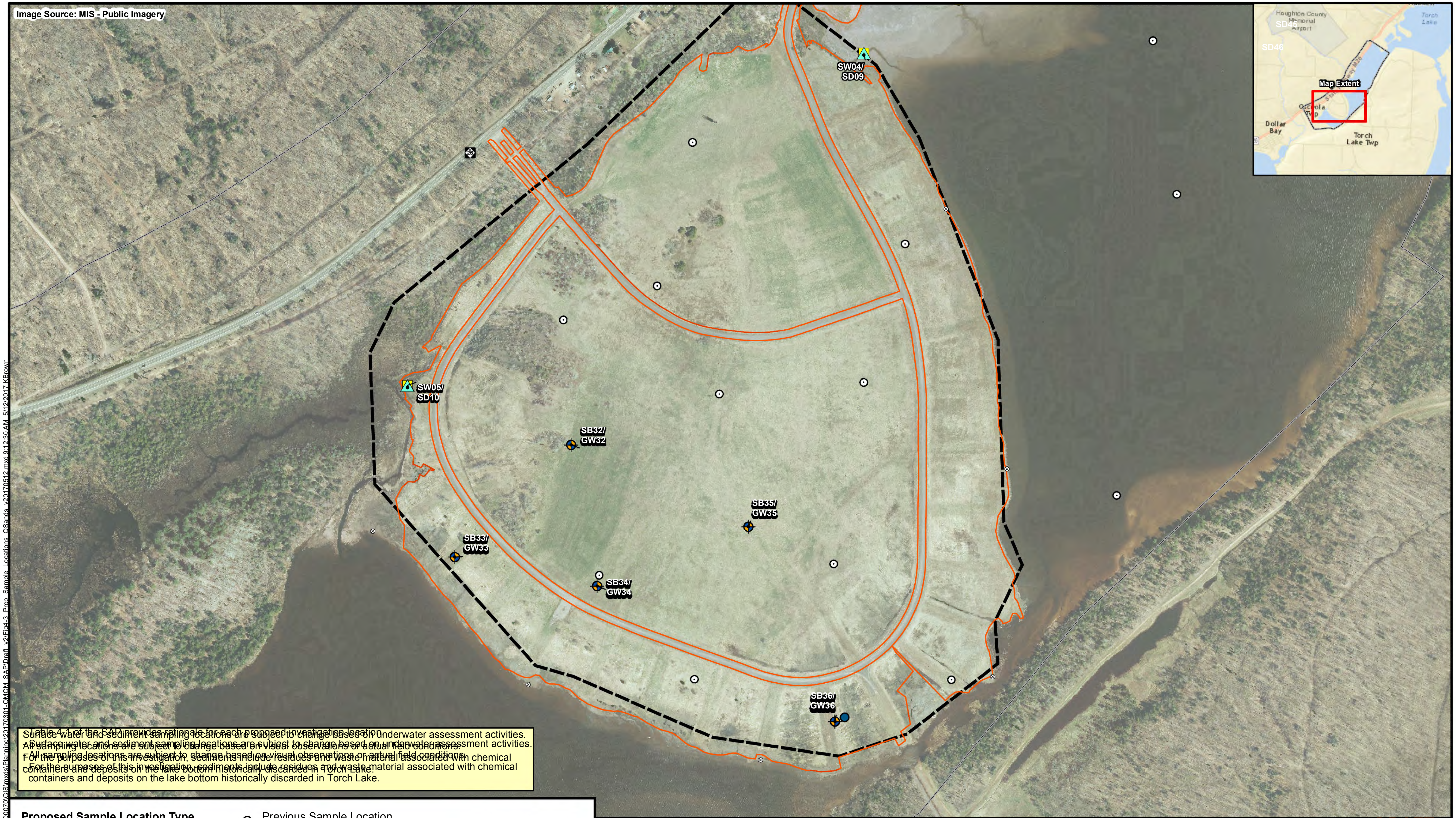

- Table 4-1 of the SAP provides rationale for each proposed investigation location.
- Surface water and sediment sampling locations are subject to change based on underwater assessment activities.
- All sampling locations are subject to change based on visual observations or actual field conditions.
- For the purposes of this investigation, sediments include residues and waste material associated with chemical containers and deposits on the lake bottom historically discarded in Torch Lake.

Proposed Sample Location Type

- Soil Boring & Groundwater
- Sediment
- Sediment & Surface Water
- Approximate Quincy Stamp Sands
- Previous Sample Location
- Previous XRF Location
- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures
- QMCM Study Area Boundary

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Coordinate System: MIGeoRef(m)

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Figure 4-3

Proposed Sampling Locations - Quincy Stamp Sands
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan
Revised: 12 May 2017

- Table 4-1 of the SAP provides rationale for each proposed investigation location.
- Surface water and sediment sampling locations are subject to change based on underwater assessment activities.
- All sampling locations are subject to change based on visual observations or actual field conditions.
- For the purposes of this investigation, sediments include residues and waste material associated with chemical containers and deposits on the lake bottom historically discarded in Torch Lake.

Surface water and sediment sampling locations are subject to change based on underwater assessment activities.
All sampling locations are subject to change based on visual observations or actual field conditions.
For the purposes of this investigation, sediments include residues and waste material associated with chemical containers and deposits on the lake bottom historically discarded in Torch Lake.

Proposed Sample Location Type

Groundwater

Soil Boring, Groundwater & Soil Gas

Previous Sample Location

Previous XRF Location

Cap Boundary (2005 NRCS)

QMCM Study Area Boundary

Building Outline (from MDEQ CAD)

Debris / Junk Piles (from MDEQ CAD)

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Coordinate System: MIGeoRef(m)

DEQ

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Figure 4-4
Proposed Sampling Locations - Furniture Stripping Dollar Bay Site
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan
Revision: 12 May 2017

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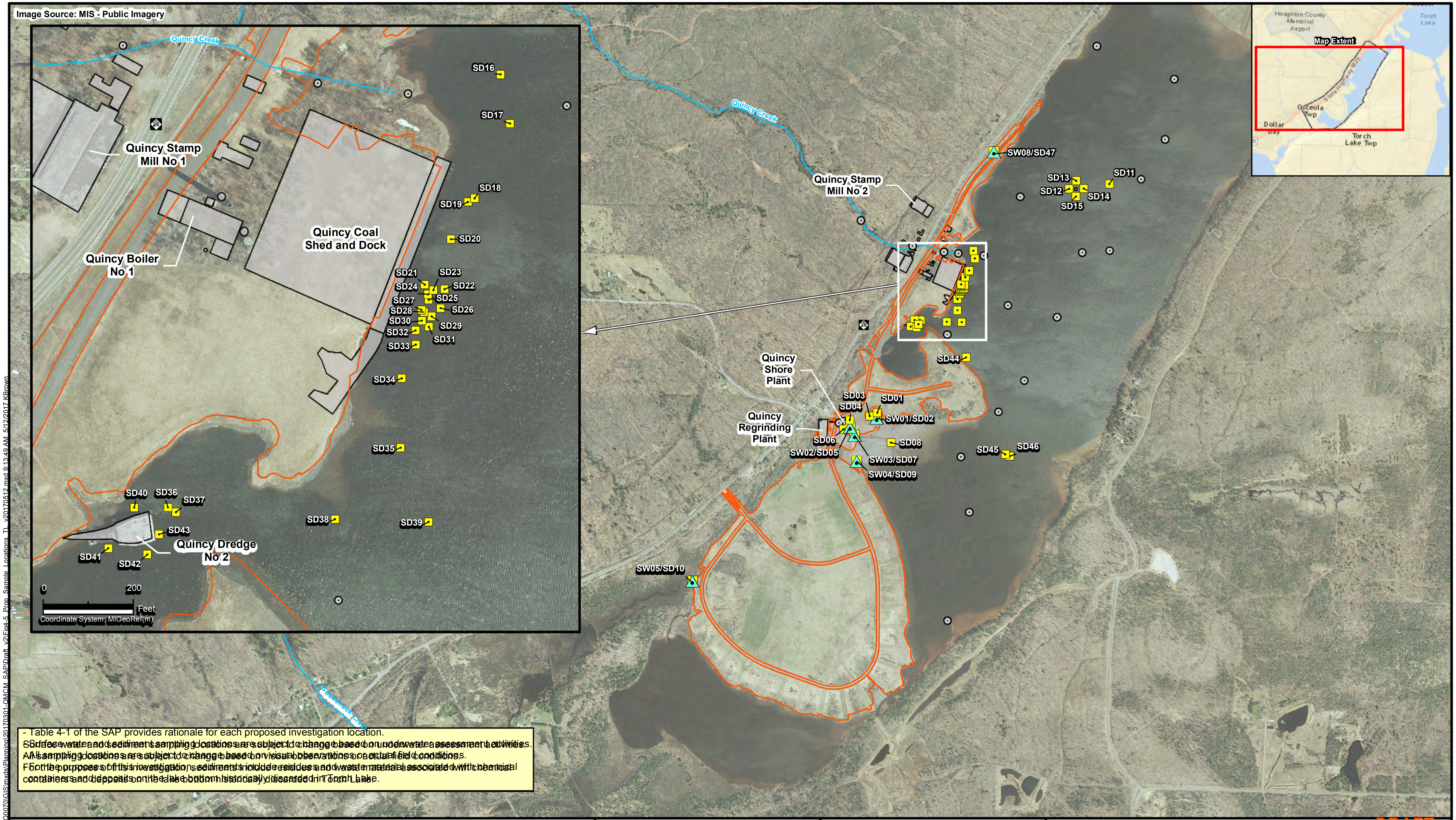

- Table 4-1 of the SAP provides rationale for each proposed investigation location.
- Surface water and sediment sampling locations are subject to change based on underwater assessment activities.
- All sampling locations are subject to change based on visual observations or actual field conditions.
- For the purposes of this investigation, sediments include residues and waste material associated with chemical containers and deposits on the lake bottom historically discarded in Torch Lake.

Proposed Sample Location Type

- Sediment (see Fig # for labels)
- Sediment & Surface Water
- Previous Sediment Sample Location
- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures

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Coordinate System: MIGeoRef(m)

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Figure 4-5

Propose Sampling Locations - Torch Lake
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan
Revised: 12 May 2017

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TABLES

Table 4-1
Sampling and Analysis Summary
QMCM Area
Houghton County, Michigan

Proposed Sampling Location	Longitude	Latitude	Proposed Sample ID	Sampling Rationale	Anticipated Sampling Method	Sample Type/Matrix							Sample Analyses							Duplicate Analyses						
						Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment	Soil Gas	Drums, Containers, and Building Materials/SACM	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization
Quincy Stamp Mills Area																										
QMCM-SS01	-88.45952010170	47.14906465670	QMCM-SS01 a_1-b_1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS02	-88.45933716609	47.14899766540	QMCM-SS02 a_1-b_1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS03	-88.45885009160	47.14889854250	QMCM-SS03 a1-b1"	Near XRF locations exceeding direct contact criteria (XRF-141 and XRF-144)	Hand Tools	X										X										
QMCM-SS04	-88.45968490167	47.14877660440	QMCM-SS04 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X		X								
QMCM-SS05	-88.45853033749	47.14873787751	QMCM-SS05 a1-b1"	Near XRF location exceeding direct contact criteria (XRF-132)	Hand Tools	X										X		X								
QMCM-SS06	-88.45916964453	47.14857162997	QMCM-SS06 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS07	-88.45867073767	47.14857289382	QMCM-SS07 a1-b1"	Near XRF location exceeding direct contact criteria (XRF-133)	Hand Tools	X										X										
QMCM-SS08	-88.45974052294	47.14848900650	QMCM-SS08 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS09	-88.45890157660	47.14820408429	QMCM-SS09 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS10	-88.45951618077	47.14817452392	QMCM-SS10 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X							X			
QMCM-SS11	-88.46002216026	47.14802755263	QMCM-SS11 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS12	-88.45987538416	47.14775366976	QMCM-SS12 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS13	-88.46077591310	47.14762202930	QMCM-SS13 a1-b1"	Soil Pile/Stamp Sand Pile	Hand Tools	X										X										
QMCM-SS14	-88.46052992060	47.14754778890	QMCM-SS14 a1-b1"	Soil Pile/Stamp Sand Pile	Hand Tools	X										X										
QMCM-SS15	-88.46064734570	47.14728018280	QMCM-SS15 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS16	-88.46114470891	47.14729458235	QMCM-SS16 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS17	-88.46014808763	47.14717267694	QMCM-SS17 a1-b1"	Near XRF location exceeding direct contact criteria (XRF-115)	Hand Tools	X										X		X								
QMCM-SS18	-88.46137585879	47.14700792669	QMCM-SS18 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X		X								
QMCM-SS19	-88.46071077320	47.14698692898	QMCM-SS19 a1-b1"	Near XRF location exceeding direct contact criteria (XRF-122)	Hand Tools	X										X										
QMCM-SS20	-88.46025037430	47.14702923630	QMCM-SS20 a1-b1"	Near XRF location exceeding direct contact criteria (XRF-114)	Hand Tools	X										X							X			
QMCM-SS21	-88.46124244360	47.14661102470	QMCM-SS21 a1-b1"	Surface soil - Stamp Mill No.1 and No. 2 area	Hand Tools	X										X										
QMCM-SS22	-88.46079494012	47.14649682594	QMCM-SS22 a1-b1"	Near XRF location exceeding direct contact criteria (XRF-107)	Hand Tools	X										X										
QMCM-SS23	-88.46026877719	47.14644145292	QMCM-SS23 a1-b1"	Near XRF location exceeding direct contact criteria (XRF-102)	Hand Tools	X										X		X								
QMCM-SS24	-88.46088816185	47.14627885271	QMCM-SS24 a1-b1"	Data Gap - Near Stamp Mill No. 1 and No. 2	Hand Tools	X										X										
QMCM-SS25	-88.45761670628	47.14802492720	QMCM-SS25 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS26	-88.45781250110	47.14801512340	QMCM-SS26 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS27	-88.45716506421	47.14785614777	QMCM-SS27 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS28	-88.45733694722	47.14777735599	QMCM-SS28 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS29	-88.45771584064	47.14763545406	QMCM-SS29 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS30	-88.45742161090	47.14761243720	QMCM-SS30 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X							X			
QMCM-SS31	-88.45783797269	47.14737226238	QMCM-SS31 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS32	-88.45756564103	47.14736164236	QMCM-SS32 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS33	-88.45759850475	47.14717782664	QMCM-SS33 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS34	-88.45779831654	47.14710782797	QMCM-SS34 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS35	-88.45753715638	47.14704062678	QMCM-SS35 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X		X								
QMCM-SS36	-88.45707371470	47.14695509650	QMCM-SS36 a1-b1"	Data Gap - North of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS37	-88.45887848586	47.14658105394	QMCM-SS37 a1-b1"	Data Gap - West of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS38	-88.45901153078	47.14653695002	QMCM-SS38 a1-b1"	Data Gap - West of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS39	-88.45869926735	47.14654155549	QMCM-SS39 a1-b1"	Data Gap - West of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X										
QMCM-SS40	-88.45880867740	47.14644363031	QMCM-SS40 a1-b1"	Data Gap - West of Former Coal Shed (various XRF locations exceed direct contact criteria)	Hand Tools	X										X							X			
QMCM-SS47	-88.46033774220	47.14766060040	QMCM-SS47 a1-b1"	Near Quincy Turbine (Power) House	Hand Tools	X								X	X	X	X									
QMCM-SS48	-88.46035187980	47.14752082020	QMCM-SS48 a1-b1"	Near Quincy Turbine (Power) House	Hand Tools	X								X	X	X	X						X			
QMCM-SS49	-88.46126969016	47.14634905978	QMCM-SS49 a1-b1"	Proximal to black residue in container (Observation: Container#9)	Hand Tools	X							X	X	X	X										
QMCM-SB01	-88.45673547907	47.14837855568	QMCM-SB01 a_1-b_1"	Former dump area and near soil sample SS-15 (9/11/2013)	Direct Push Boring	X							X	X	X	X	X	X								
			QMCM-SB01 a_2-b_2'	Former dump area and near soil sample SS-15 (9/11/2013)	Direct Push Boring		X						X	X	X	X	X									
QMCM-SB02	-88.45640045720	47.14823026420	QMCM-SB02 a_1-b_1"	Former dump area and near soil sample SS-15 (9/11/2013)	Direct Push Boring	X							X	X	X	X	X									
			QMCM-SB02 a_2-b_2'	Former dump area and near soil sample SS-15 (9/11/2013)	Direct Push Boring		X						X	X	X	X	X									
QMCM-SB03	-88.45696222920	47.14811167800	QMCM-SB03 a1-b1"	Former dump area and near soil sample SS-15 (9/11/2013)	Direct Push Boring	X							X	X	X	X	X									
			QMCM-SB03 a2-b2'	Former dump area and near soil sample SS-15 (9/11/2013)	Direct Push Boring		X						X	X	X	X	X									
QMCM-SB04	-88.45671004624	47.14811028600	QMCM-SB04 a1-b1"	Former dump area and near soil sample SS-15 (9/11/2013)	Direct Push Boring	X							X	X	X	X	X									
			QMCM-SB04 a2-b2'	Former dump area and near soil sample SS-15 (9/11/2013)	Direct Push Boring		X						X	X	X	X	X									

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Table 4-1
Sampling and Analysis Summary
QMCM Area
Houghton County, Michigan

						Sample Type/Matrix							Sample Analyses							Duplicate Analyses						
Proposed Sampling Location	Longitude	Latitude	Proposed Sample ID	Sampling Rationale	Anticipated Sampling Method	Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment	Soil Gas	Drums, Containers, and Building Materials/SACM	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization
QMCM-SB05	-88.45956791146	47.14775597958	QMCM-SB05 a1-b1"	Proximal to underground oil house	Direct Push Boring	X							X	X	X	X	X									
			QMCM-SB05 a2-b2'	Proximal to underground oil house	Direct Push Boring		X						X	X	X	X	X			X	X	X	X	X		
QMCM-SB06	-88.45940356368	47.14770332585	QMCM-SB06 a1-b1"	Above undergound oil house	Direct Push Boring	X							X	X	X	X	X									
			QMCM-SB06 a2-b2'	Above undergound oil house	Direct Push Boring		X						X	X	X	X	X									
QMCM-SB07	-88.45922245040	47.14764546044	QMCM-SB07 a1-b1"	Proximal to underground oil house	Direct Push Boring	X							X	X	X	X	X									
			QMCM-SB07 a2-b2'	Proximal to underground oil house	Direct Push Boring		X						X	X	X	X	X									
QMCM-SB08	-88.46015290688	47.14771867903	QMCM-SB08 a1-b1"	Near Quincy Turbine (Power) House	Direct Push Boring	X							X	X	X	X	X									
			QMCM-SB08 a2-b2'	Near Quincy Turbine (Power) House	Direct Push Boring		X						X	X	X	X	X									
QMCM-SB10	-88.46011240130	47.14755853100	QMCM-SB10 a1-b1"	Near Quincy Turbine (Power) House	Direct Push Boring	X							X	X	X	X	X									
			QMCM-SB10 a2-b2'	Near Quincy Turbine (Power) House	Direct Push Boring		X						X	X	X	X	X									
QMCM-SB12	-88.45739478350	47.14699548230	QMCM-SB12 a1-b1"	Around SB-07 (9/10/2013)	Direct Push Boring	X							X	X		X	X									
			QMCM-SB12 a2-b2'	Around SB-07 (9/10/2013)	Direct Push Boring		X						X	X		X	X									
QMCM-SB13	-88.45755886420	47.14693583020	QMCM-SB13 a1-b1"	Around SB-07 (9/10/2013)	Direct Push Boring	X							X	X		X	X	X								
			QMCM-SB13 a2-b2'	Around SB-07 (9/10/2013)	Direct Push Boring		X						X	X		X	X									
QMCM-SB14	-88.45722981718	47.14690201464	QMCM-SB14 a1-b1"	Around SB-07 (9/10/2013)	Direct Push Boring	X							X	X		X	X									
			QMCM-SB14 a2-b2'	Around SB-07 (9/10/2013)	Direct Push Boring		X						X	X		X	X									
QMCM-SB15	-88.45741013872	47.14683743141	QMCM-SB15 a1-b1"	Around SB-07 (9/10/2013)	Direct Push Boring	X							X	X		X	X									
			QMCM-SB15 a2-b2'	Around SB-07 (9/10/2013)	Direct Push Boring		X						X	X		X	X			X	X		X	X		
QMCM-SB16	-88.45829361536	47.14680428005	QMCM-SB16 a1-b1"	Around SS-08 (9/11/2013)	Direct Push Boring	X							X	X		X	X									
			QMCM-SB16 a2-b2'	Around SS-08 (9/11/2013)	Direct Push Boring		X						X	X		X	X									
QMCM-SB17	-88.45853415095	47.14674833047	QMCM-SB17 a1-b1"	Around SS-08 (9/11/2013)	Direct Push Boring	X							X	X		X	X									
			QMCM-SB17 a2-b2'	Around SS-08 (9/11/2013)	Direct Push Boring		X						X	X		X	X									
QMCM-SB18	-88.45818944290	47.14663438680	QMCM-SB18 a1-b1"	Around SS-08 (9/11/2013)	Direct Push Boring	X							X	X		X	X	X								
			QMCM-SB18 a2-b2'	Around SS-08 (9/11/2013)	Direct Push Boring		X						X	X		X	X									
QMCM-SB19	-88.45838286426	47.14658086841	QMCM-SB19 a1-b1"	Around SS-08 (9/11/2013)	Direct Push Boring	X							X	X		X	X									
			QMCM-SB19 a2-b2'	Around SS-08 (9/11/2013)	Direct Push Boring		X						X	X		X	X			X	X		X	X		
QMCM-SB20	-88.45838952760	47.14624488290	QMCM-SB20 a1-b1"	Around SS-07 (9/11/2013)	Direct Push Boring	X							X	X		X										
			QMCM-SB20 a2-b2'	Around SS-07 (9/11/2013)	Direct Push Boring		X						X	X		X										
QMCM-SB21	-88.45859553028	47.14619405090	QMCM-SB21 a1-b1"	Around SS-07 (9/11/2013)	Direct Push Boring	X							X	X		X		X							X	
			QMCM-SB21 a2-b2'	Around SS-07 (9/11/2013)	Direct Push Boring		X						X	X		X										
QMCM-SB22	-88.45830288660	47.14609311993	QMCM-SB22 a1-b1"	Around SS-07 (9/11/2013)	Direct Push Boring	X							X	X		X										
			QMCM-SB22 a2-b2'	Around SS-07 (9/11/2013)	Direct Push Boring		X						X	X		X										
QMCM-SB23	-88.45849481372	47.14605329470	QMCM-SB23 a1-b1"	Around SS-07 (9/11/2013)	Direct Push Boring	X							X	X		X										
			QMCM-SB23 a2-b2'	Around SS-07 (9/11/2013)	Direct Push Boring		X						X	X		X										
QMCM-SD47	-88.45535204548	47.15110286557	QMCM-SD47 a1-b1"	Sheen observed in ditch	Vibracore Sampler					X			X	X	X	X										
QMCM-SW08	-88.45535204548	47.15110286557	QMCM-SW08 a-b'	Sheen observed in ditch	Peristaltic Pump				X				X	X	X	X										
QMCM-GW01	-88.45673547907	47.14837855568	QMCM-GW01 a-b'	Former dump area and near soil sample SS-15 (9/11/2013)	Peristaltic Pump			X					X	X	X	X										
QMCM-GW02	-88.45640045720	47.14823026420	QMCM-GW02 a-b'	Former dump area and near soil sample SS-15 (9/11/2013)	Peristaltic Pump			X					X	X	X	X										
QMCM-GW03	-88.45696222920	47.14811167800	QMCM-GW03 a-b'	Former dump area and near soil sample SS-15 (9/11/2013)	Peristaltic Pump			X					X	X	X	X										
QMCM-GW04	-88.45671004624	47.14811028600	QMCM-GW04 a-b'	Former dump area and near soil sample SS-15 (9/11/2013)	Peristaltic Pump			X					X	X	X	X										
QMCM-GW05	-88.45956791146	47.14775597958	QMCM-GW05 a-b'	Proximal to underground oil house	Peristaltic Pump			X					X	X	X	X										
QMCM-GW06	-88.45940356368	47.14770332585	QMCM-GW06 a-b'	Above underground oil house	Peristaltic Pump			X					X	X	X	X				X	X	X	X			
QMCM-GW07	-88.45922245040	47.14764546044	QMCM-GW07 a-b'	Proximal to underground oil house	Peristaltic Pump			X					X	X	X	X										
QMCM-GW08	-88.46015290688	47.14771867903	QMCM-GW08 a-b'	Near Quincy Turbine (Power) House	Peristaltic Pump			X					X	X	X	X										
QMCM-GW10	-88.46011240130	47.14755853100	QMCM-GW10 a-b'	Near Quincy Turbine (Power) House	Peristaltic Pump			X					X	X	X	X										
QMCM-GW12	-88.45739478350	47.14699548230	QMCM-GW12 a-b'	Around SB-07 (9/10/2013)	Peristaltic Pump			X					X	X		X										
QMCM-GW13	-88.45755886420	47.14693583020	QMCM-GW13 a-b'	Around SB-07 (9/10/2013)	Peristaltic Pump			X					X	X		X										
QMCM-GW14	-88.45722981718	47.14690201464	QMCM-GW14 a-b'	Around SB-07 (9/10/2013)	Peristaltic Pump			X					X	X		X										
QMCM-GW15	-88.45741013872	47.14683743141	QMCM-GW15 a-b'	Around SB-07 (9/10/2013)	Peristaltic Pump			X					X	X		X										
QMCM-GW16	-88.45829361536	47.14680428005	QMCM-GW16 a-b'	Around SS-08 (9/11/2013)	Peristaltic Pump			X					X	X		X										
QMCM-GW17	-88.45853415095	47.14674833047	QMCM-GW17 a-b'	Around SS-08 (9/11/2013)	Peristaltic Pump			X					X	X		X										
QMCM-GW18	-88.45818944290	47.14663438680	QMCM-GW18 a-b'	Around SS-08 (9/11/2013)	Peristaltic Pump			X					X	X		X										
QMCM-GW19	-88.45838286426	47.14658086841	QMCM-GW19 a-b'	Around SS-08 (9/11/2013)	Peristaltic Pump			X					X	X		X				X	X		X			
QMCM-GW20	-88.45838952760	47.14624488290	QMCM-GW20 a-b'	Around SS-07 (9/11/2013)	Peristaltic Pump			X					X	X		X										

Table 4-1
Sampling and Analysis Summary
QMCM Area
Houghton County, Michigan

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Proposed Sampling Location	Longitude	Latitude	Proposed Sample ID	Sampling Rationale	Anticipated Sampling Method	Sample Type/Matrix							Sample Analyses							Duplicate Analyses						
						Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment	Soil Gas	Drums, Containers, and Building Materials/SACM	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization
QMCM-GW21	-88.45859553028	47.14619405090	QMCM-GW21 a-b'	Around SS-07 (9/11/2013)	Peristalitic Pump			X					X	X		X										
QMCM-GW22	-88.45830288660	47.14609311993	QMCM-GW22 a-b'	Around SS-07 (9/11/2013)	Peristalitic Pump			X					X	X		X										
QMCM-GW23	-88.45849481372	47.14605329470	QMCM-GW23 a-b'	Around SS-07 (9/11/2013)	Peristalitic Pump			X					X	X		X										
QMCM-ASBBLK01	-88.45929685835	47.14905433339	QMCM-ASBBLK01-mmddyy	SACM (Observation #1)	Hand Tools							X						X								
QMCM-ASBBLK02	-88.45924649893	47.14904177729	QMCM-ASBBLK02-mmddyy	SACM, possible thermal insulation (Observation #2)	Hand Tools							X						X								
QMCM-ASBBLK03	-88.45678755263	47.14836987119	QMCM-ASBBLK03-mmddyy	SACM, wire wrap (Observation #18)	Hand Tools							X						X								
QMCM-ASBBLK04	-88.45676023413	47.14834798240	QMCM-ASBBLK04-mmddyy	SACM, wire wrap (Observation #17)	Hand Tools							X						X								
QMCM-ASBBLK05	-88.46018128965	47.14772811521	QMCM-ASBBLK05-mmddyy	SACM, counter top (Observation #4)	Hand Tools							X						X								
QMCM-ASBBLK06	-88.45757794456	47.14694395955	QMCM-ASBBLK06-mmddyy	SACM, roofing (Observation #11)	Hand Tools							X						X								
QMCM-ASBBLK07	-88.45784952024	47.14694260229	QMCM-ASBBLK07-mmddyy	SACM, roofing (Observation #12)	Hand Tools							X						X								
QMCM-ASBBLK08	-88.45760454549	47.14685859739	QMCM-ASBBLK08-mmddyy	SACM, roofing (Observation #10)	Hand Tools							X						X								
QMCM-ASBBLK09	-88.45809179140	47.14666835581	QMCM-ASBBLK09-mmddyy	Conveyor Belt Roll (Observation #9)	Hand Tools							X						X								
QMCM-ASBBLK10	-88.45808877753	47.14663785835	QMCM-ASBBLK10-mmddyy	Conveyor Belt Roll (Observation #8)	Hand Tools							X						X							X	
QMCM-ASBBLK11	-88.45845951820	47.14622141005	QMCM-ASBBLK11-mmddyy	SACM, rolled roofing on coal bin (Observation #7)	Hand Tools							X						X								
QMCM-ASBBLK12	-88.46067281656	47.14700030880	QMCM-ASBBLK12-mmddyy	SACM (Observation #5)	Hand Tools							X						X								
QMCM-ASBBLK13	-88.45977431710	47.14673254553	QMCM-ASBBLK13-mmddyy	Pipe wrap in steam tunnel	Hand Tools							X						X								
QMCM-ASBBLK14	-88.46005118479	47.14688969435	QMCM-ASBBLK14-mmddyy	Inside Quincy Stamp Mill No.1	Hand Tools							X						X								
QMCM-ASBBLK15	-88.46023952437	47.14665361713	QMCM-ASBBLK15-mmddyy	Inside Quincy Stamp Mill No.1	Hand Tools							X						X								
QMCM-RPM01	-88.45912107912	47.14878074770	QMCM-RPM01 a-b"	Suspect tailings (Observation #3)	Hand Tools							X			X				X							
QMCM-RPM04	-88.45902570999	47.14927340014	QMCM-RPM04a-b"	Waste deposit	Hand Tools							X			X				X							
QMCM-RPM05	-88.45900313003	47.14886593040	QMCM-RPM05a-b"	Suspect processing cake material	Hand Tools							X			X				X							
QMCM-RPM06	-88.46059074061	47.14654917987	QMCM-RPM06a-b"	Suspect tailing/sludge material in Mineral House thickener	Hand Tools							X							X							
QMCM-DM01	-88.46058514062	47.14660050118	QMCM-DM01 a-b"	Crushed drum (Observation: Drum#4)	Hand Tools							X			X				X			X				X
QMCM-DM02	-88.45826772825	47.14635220295	QMCM-DM02 a-b"	Crushed drum with granular, tan substance (Observation: Drum#17)	Hand Tools							X			X				X							
QMCM-DM03	-88.45876276780	47.14631610890	QMCM-DM03 a-b"	Crushed drum with crystallized, white solid substance (Observation: Drum#19)	Hand Tools							X			X				X							
Quincy Reclamation Plant Area																										
QMCM-SS41	-88.46335829190	47.14085564850	QMCM-SS41 a1-b1"	Proximal to XRF-10 (2013) location	Hand Tools	X									X	X										
QMCM-SS42	-88.46346029080	47.14083260650	QMCM-SS42 a1-b1"	Proximal to XRF-10 (2013) location	Hand Tools	X									X	X										
QMCM-SS43	-88.46351097980	47.14077618640	QMCM-SS43 a1-b1"	Proximal to XRF-10 (2013) location	Hand Tools	X									X	X										
QMCM-SS44	-88.46337365704	47.14075331692	QMCM-SS44 a1-b1"	Proximal to XRF-10 (2013) location	Hand Tools	X									X	X							X			
QMCM-SS45	-88.46464076921	47.14076026529	QMCM-SS45 a1-b1"	On substation pad	Hand Tools	X									X											
QMCM-SS46	-88.46453750900	47.14075411030	QMCM-SS46 a1-b1"	On substation pad	Hand Tools	X									X											
QMCM-SB09	-88.46327643007	47.14199561985	QMCM-SB39 a1-b1"	Petroleum-like odor near drum	Direct Push Boring	X							X	X	X	X										
			QMCM-SB39 a2-b2'	Petroleum-like odor near drum	Direct Push Boring		X						X	X	X	X										
QMCM-SB24	-88.46447897393	47.14099990961	QMCM-SB24 a1-b1"	Near Substation / PCB exceedance (SS-18)	Direct Push Boring	X									X							X				
			QMCM-SB24 a2-b2'	Near Substation / PCB exceedance (SS-18)	Direct Push Boring		X								X											
QMCM-SB25	-88.46459933356	47.14095345266	QMCM-SB25 a1-b1"	Near Substation / PCB exceedance (SS-18)	Direct Push Boring	X									X											
			QMCM-SB25 a2-b2'	Near Substation / PCB exceedance (SS-18)	Direct Push Boring		X								X											
QMCM-SB26	-88.46434721821	47.14093168606	QMCM-SB26 a1-b1"	Near Substation / PCB exceedance (SS-18)	Direct Push Boring	X									X											
			QMCM-SB26 a2-b2'	Near Substation / PCB exceedance (SS-18)	Direct Push Boring		X								X											
QMCM-SB27	-88.46464393420	47.14085178680	QMCM-SB27 a1-b1"	Near Substation / PCB exceedance (SS-18)	Direct Push Boring	X									X											
			QMCM-SB27 a2-b2'	Near Substation / PCB exceedance (SS-18)	Direct Push Boring		X								X											
QMCM-SB28	-88.46430264777	47.14082816445	QMCM-SB28 a1-b1"	Near Substation / PCB exceedance (SS-18)	Direct Push Boring	X									X											
			QMCM-SB28 a2-b2'	Near Substation / PCB exceedance (SS-18)	Direct Push Boring		X								X											
QMCM-SB29	-88.46446134995	47.14081640978	QMCM-SB29 a1-b1"	Near Substation / PCB exceedance (SS-18)	Direct Push Boring	X									X											
			QMCM-SB29 a2-b2'	Near Substation / PCB exceedance (SS-18)	Direct Push Boring		X								X											
QMCM-SB30	-88.46391797481	47.14008841274	QMCM-SB30 a1-b1"	Proximal to "flammable storage" building	Direct Push Boring	X							X	X	X	X	X			X	X	X	X	x		
			QMCM-SB30 a2-b2'	Proximal to "flammable storage" building	Direct Push Boring		X						X	X	X	X	X									
QMCM-SB31	-88.46399115420	47.14006668830	QMCM-SB31 a1-b1"	Proximal to "flammable storage" building	Direct Push Boring	X							X	X	X	X	X									
			QMCM-SB31 a2-b2'	Proximal to "flammable storage" building	Direct Push Boring		X						X	X	X	X	X									
QMCM-GW09	-88.46327643007	47.14199561985	QMCM-GW39 a-b'	Petroleum-like odor near drum	Peristalitic Pump			X					X	X	X	X										
QMCM-GW24	-88.46447897393	47.14099990961	QMCM-GW24 a-b'	Near Substation / PCB exceedance (SS-18)	Peristalitic Pump			X							X											
QMCM-GW25	-88.46459933356	47.14095345266	QMCM-GW25 a-b'	Near Substation / PCB exceedance (SS-18)	Peristalitic Pump			X							X											
QMCM-GW26	-88.46434721821	47.14093168606	QMCM-GW26 a-b'	Near Substation / PCB exceedance (SS-18)	Peristalitic Pump			X							X											
QMCM-GW27	-88.46464393420	47.14085178680	QMCM-GW27 a-b'	Near Substation / PCB exceedance (SS-18)	Peristalitic Pump			X							X											

Table 4-1
Sampling and Analysis Summary
QMCM Area
Houghton County, Michigan

DRAFT

Proposed Sampling Location	Longitude	Latitude	Proposed Sample ID	Sampling Rationale	Anticipated Sampling Method	Sample Type/Matrix							Sample Analyses							Duplicate Analyses						
						Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment	Soil Gas	Drums, Containers, and Building Materials/SACM	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization
QMCM-GW28	-88.46430264777	47.14082816445	QMCM-GW28 a-b'	Near Substation / PCB exceedance (SS-18)	Peristaltic Pump			X							X											
QMCM-GW29	-88.46446134995	47.14081640978	QMCM-GW29 a-b'	Near Substation / PCB exceedance (SS-18)	Peristaltic Pump			X							X											
QMCM-GW30	-88.46391797481	47.14008841274	QMCM-GW30 a-b'	Proximal to "flammable storage" building	Peristaltic Pump			X					X	X	X	X				X	X	X	X			
QMCM-GW31	-88.46399115420	47.14006668830	QMCM-GW31 a-b'	Proximal to "flammable storage" building	Peristaltic Pump			X					X	X	X	X										
QMCM-SD01	-88.46140770880	47.14108553227	QMCM-SD01 a1-b1"	Eastern pond near Quincy Reclamation Plant	Vibracore Sampler					X				X	X	X										
			QMCM-SD01 a2-b2'	Eastern pond near Quincy Reclamation Plant	Vibracore Sampler					X				X	X											
QMCM-SD02	-88.46143847081	47.14087286452	QMCM-SD02 a1-b1"	Eastern pond near Quincy Reclamation Plant	Vibracore Sampler					X				X	X	X										
			QMCM-SD02 a2-b2'	Eastern pond near Quincy Reclamation Plant	Vibracore Sampler					X				X	X											
QMCM-SD03	-88.46182038720	47.14095226733	QMCM-SD03 a1-b1"	Eastern pond near Quincy Reclamation Plant	Vibracore Sampler					X				X	X	X										
			QMCM-SD03 a2-b2'	Eastern pond near Quincy Reclamation Plant	Vibracore Sampler					X				X	X											
QMCM-SD04	-88.46291989322	47.14077204713	QMCM-SD04 a1-b1"	Western pond near Quincy Reclamation Plant - Shore Plant	Vibracore Sampler					X				X	X	X										
			QMCM-SD04 a2-b2'	Western pond near Quincy Reclamation Plant - Shore Plant	Vibracore Sampler					X				X	X											
QMCM-SD05	-88.46290129658	47.14051434539	QMCM-SD05 a1-b1"	Western pond near Quincy Reclamation Plant - Shore Plant	Vibracore Sampler					X				X	X	X										
			QMCM-SD05 a2-b2'	Western pond near Quincy Reclamation Plant - Shore Plant	Vibracore Sampler					X				X	X											
QMCM-SD06	-88.46326209807	47.14042827436	QMCM-SD06 a1-b1"	Western pond near Quincy Reclamation Plant - Shore Plant	Vibracore Sampler					X				X	X	X										
			QMCM-SD06 a2-b2'	Western pond near Quincy Reclamation Plant - Shore Plant	Vibracore Sampler					X				X	X											
QMCM-SD07	-88.46262373492	47.14020687591	QMCM-SD07 a1-b1"	Drainage between pond and Torch Lake	Vibracore Sampler					X				X	X	X										
			QMCM-SD07 a2-b2'	Drainage between pond and Torch Lake	Vibracore Sampler					X				X	X											
QMCM-SD08	-88.46058662726	47.13997389746	QMCM-SD08 a1-b1"	Drainage between pond and Torch Lake	Vibracore Sampler					X				X	X	X					X	X	X			
			QMCM-SD08 a2-b2'	Drainage between pond and Torch Lake	Vibracore Sampler					X				X	X											
QMCM-SD09	-88.46245972482	47.13922177164	QMCM-SD09 a1-b1"	Drainage channel between Quincy Reclamation Plant and Quincy Stamp Sands	Vibracore Sampler					X				X	X	X										
			QMCM-SD09 a2-b2'	Drainage channel between Quincy Reclamation Plant and Quincy Stamp Sands	Vibracore Sampler					X				X	X											
QMCM-SW01	-88.46143847081	47.14087286452	QMCM-SW01 a-b'	Eastern pond near Quincy Reclamation Plant	Peristaltic Pump				X					X	X	X										
QMCM-SW02	-88.46290129658	47.14051434539	QMCM-SW02 a-b'	Western pond near Quincy Reclamation Plant	Peristaltic Pump				X					X	X	X										
QMCM-SW03	-88.46262373492	47.14020687591	QMCM-SW03 a-b'	Drainage between pond and Torch Lake	Peristaltic Pump				X					X	X	X					X	X	X			
QMCM-SW04	-88.46245972482	47.13922177164	QMCM-SW04 a-b'	Drainage channel between Quincy Reclamation Plant and Quincy Stamp Sands	Peristaltic Pump				X					X	X	X										
QMCM-RPM02	-88.46423348078	47.14040432825	QMCM-RPM02 a-b"	Re-sample location SS-03 (9/10/2013)	Hand Tools							X			X	X			X			X	X			
QMCM-RPM03	-88.46437268099	47.14030012266	QMCM-RPM03 a-b"	Composite sample of soil/waste on foundation floor	Hand Tools							X							X							
QMCM-RPM07	-88.46334202010	47.14078320991	QMCM-RPM06 a-b"	Composite sample of waste on foundation of Quincy Reclamation Plant - Shore Plant	Hand Tools							X							X							
QMCM-SW06	-88.46105807123	47.14094123029	QMCM-SW06 a-b'	Wood-lined pits east of Eastern pond near Quincy Reclamation Plant - Shore Plant	Peristaltic Pump				X					X	X	X										
QMCM-SW07	-88.46086861131	47.14093196711	QMCM-SW07 a-b'	Wood-lined pits east of Eastern pond near Quincy Reclamation Plant - Shore Plant	Peristaltic Pump				X					X	X	X										
Quincy Stamp Sands Area																										
QMCM-SB32	-88.46808342304	47.13375837203	QMCM-SB32 a1-b1"	Proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring	X							X													
			QMCM-SB32 a2-b2'	Proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring		X						X													
QMCM-SB33	-88.47035006303	47.13218180775	QMCM-SB33 a1-b1"	Proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring	X							X							X						
			QMCM-SB33 a2-b2'	Proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring		X						X													
QMCM-SB34	-88.46747733626	47.13184433227	QMCM-SB34 a1-b1"	Immediatly proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring	X							X													
			QMCM-SB34 a2-b2'	Immediatly proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring		X						X													
QMCM-SB35	-88.46447653870	47.13271819742	QMCM-SB35 a1-b1"	Proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring	X							X													
			QMCM-SB35 a2-b2'	Proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring		X						X													
QMCM-SB36	-88.46262177730	47.13010425180	QMCM-SB36 a1-b1"	Proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring	X							X													
			QMCM-SB36 a2-b2'	Proximal to SB-07-2_5 (11/30/2016)	Direct Push Boring		X						X													
QMCM-GW32	-88.46808342304	47.13375837203	QMCM-GW32 a-b'	Proximal to SB-07-2_5 (11/30/2016)	Peristaltic Pump			X					X													
QMCM-GW33	-88.47035006303	47.13218180775	QMCM-GW33 a-b'	Proximal to SB-07-2_5 (11/30/2016)	Peristaltic Pump			X					X													
QMCM-GW34	-88.46747733626	47.13184433227	QMCM-GW34 a-b'	Immediatly proximal to SB-07-2_5 (11/30/2016)	Peristaltic Pump			X					X													
QMCM-GW35	-88.46447653870	47.13271819742	QMCM-GW35 a-b'	Proximal to SB-07-2_5 (11/30/2016)	Peristaltic Pump			X					X							X						
QMCM-GW36	-88.46262177730	47.13010425180	QMCM-GW36 a-b'	Proximal to SB-07-2_5 (11/30/2016)	Peristaltic Pump			X					X													
QMCM-SD10	-88.47140950300	47.13449742520	QMCM-SD10 a1-b1"	Drainage channel near Quincy Stamp Sands	Vibracore Sampler					X				X	X	X	X									
			QMCM-SD10 a2-b2'	Drainage channel near Quincy Stamp Sands	Vibracore Sampler					X				X	X											
QMCM-SW05	-88.47140950300	47.13449742520	QMCM-SW05 a-b'	Drainage channel near Quincy Stamp Sands	Peristaltic Pump				X					X	X	X										
Furniture Stripping Dollar Bay Site Area																										
QMCM-SB37	-88.48046459510	47.12899361860	QMCM-SB37 a1-b1"	Near barn and tank	Direct Push Boring	X							X							X						
			QMCM-SB37 a2-b2'	Near barn and tank	Direct Push Boring		X						X													
QMCM-SB38	-88.48043709520	47.12884900790	QMCM-SB38 a1-b1"	Near barn	Direct Push Boring	X							X													
			QMCM-SB38 a2-b2'	Near barn	Direct Push Boring		X						X													
QMCM-GW37	-88.48046459510	47.12899361860	QMCM-GW37 a-b'	Near barn and tank	Peristaltic Pump			X					X							X						
QMCM-GW38	-88.48043709520	47.12884900790	QMCM-GW38 a-b'	Near barn	Peristaltic Pump			X					X													

Table 4-1
Sampling and Analysis Summary
QMCM Area
Houghton County, Michigan

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Proposed Sampling Location	Longitude	Latitude	Proposed Sample ID	Sampling Rationale	Anticipated Sampling Method	Sample Type/Matrix							Sample Analyses							Duplicate Analyses						
						Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment	Soil Gas	Drums, Containers, and Building Materials/SACM	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization
QMCM-PW01	-88.48090115830	47.12879757616	QMCM-PW01-mmddyy	Potable Well at FSDB Site	Well Pump			X					X							X						
QMCM-PW02	-88.48063361355	47.12888916375	QMCM-PW02-mmddyy	Barn Well at FSDB Site	Well Pump			X					X													
QMCM-SG01	-88.48046459510	47.12899361860	QMCM-SG01 a1-b1"	Near barn and tank	Direct Push Boring						X		X							X						
			QMCM-SG01 a2-b2'	Near barn and tank	Direct Push Boring						X		X													
			QMCM-SG01 a3-b3'	Near barn and tank	Direct Push Boring						X		X													
QMCM-SG02	-88.48043709520	47.12884900790	QMCM-SG02 a1-b1"	Near barn	Direct Push Boring						X		X													
			QMCM-SG02 a2-b2'	Near barn	Direct Push Boring						X		X													
			QMCM-SG02 a3-b3'	Near barn	Direct Push Boring						X		X													
Torch Lake																										
QMCM-SD11	-88.44886460733	47.15001000979	QMCM-SD11 a1-b1"	Observation No. 25 - Pock marked lake bottom	Vibracore Sampler					X					X	X										
			QMCM-SD11 a2-b2'	Observation No. 25 - Pock marked lake bottom	Vibracore Sampler					X					X											
QMCM-SD12	-88.45110740270	47.14978252841	QMCM-SD12 a1-b1"	Observation No. 32 - Quincy Dredge No. 1 - sunken in Torch Lake	Vibracore Sampler					X					X	X										
			QMCM-SD12 a2-b2'	Observation No. 32 - Quincy Dredge No. 1 - sunken in Torch Lake	Vibracore Sampler					X					X							X				
QMCM-SD13	-88.45072453916	47.15010784756	QMCM-SD13 a1-b1"	Observation No. 32 - Quincy Dredge No. 1 - sunken in Torch Lake	Vibracore Sampler					X					X	X										
			QMCM-SD13 a2-b2'	Observation No. 32 - Quincy Dredge No. 1 - sunken in Torch Lake	Vibracore Sampler					X					X											
QMCM-SD14	-88.45029287009	47.14981325959	QMCM-SD14 a1-b1"	Observation No. 32 - Quincy Dredge No. 1 - sunken in Torch Lake	Vibracore Sampler					X					X	X										
			QMCM-SD14 a2-b2'	Observation No. 32 - Quincy Dredge No. 1 - sunken in Torch Lake	Vibracore Sampler					X					X											
QMCM-SD15	-88.45070195948	47.14950688742	QMCM-SD15 a1-b1"	Observation No. 32 - Quincy Dredge No. 1 - sunken in Torch Lake	Vibracore Sampler					X					X	X										
			QMCM-SD15 a2-b2'	Observation No. 32 - Quincy Dredge No. 1 - sunken in Torch Lake	Vibracore Sampler					X					X											
QMCM-SD16	-88.45633474961	47.14733010581	QMCM-SD16 a1-b1"	Observation No. 19 - Tan pile of "sand?"	Vibracore Sampler					X					X	X										
			QMCM-SD16 a2-b2'	Observation No. 19 - Tan pile of "sand?"	Vibracore Sampler					X					X											
QMCM-SD17	-88.45623975708	47.14703510412	QMCM-SD17 a1-b1"	Observation No. 17 - White drum?	Vibracore Sampler					X				X	X	X					X	X	X			
			QMCM-SD17 a2-b2'	Observation No. 17 - White drum?	Vibracore Sampler					X					X											
QMCM-SD18	-88.45653305643	47.14657512433	QMCM-SD18 a1-b1"	Observation No. 34 - Possible drum carcass?	Vibracore Sampler					X				X	X	X										
			QMCM-SD18 a2-b2'	Observation No. 34 - Possible drum carcass?	Vibracore Sampler					X					X											
QMCM-SD19	-88.45658972770	47.14655178377	QMCM-SD19 a1-b1"	Observation No. 35 - Possible drum carcass?	Vibracore Sampler					X				X	X	X										
			QMCM-SD19 a2-b2'	Observation No. 35 - Possible drum carcass?	Vibracore Sampler					X					X											
QMCM-SD20	-88.45673306564	47.14632345570	QMCM-SD20 a1-b1"	Observation No. 36 - Possible Drum?	Vibracore Sampler					X				X	X	X										
			QMCM-SD20 a2-b2'	Observation No. 36 - Possible Drum?	Vibracore Sampler					X					X											
QMCM-SD21	-88.45695474463	47.14604345857	QMCM-SD21 a1-b1"	Observation No. 37 - Debris with possible drum carcass	Vibracore Sampler					X				X	X	X										
			QMCM-SD21 a2-b2'	Observation No. 37 - Debris with possible drum carcass	Vibracore Sampler					X					X											
QMCM-SD22	-88.456677645854	47.14602011114	QMCM-SD22 a1-b1"	Observation No. 13 - Drum on side	Vibracore Sampler					X				X	X	X										
			QMCM-SD22 a2-b2'	Observation No. 13 - Drum on side	Vibracore Sampler					X					X											
QMCM-SD23	-88.45687479110	47.14601177179	QMCM-SD23 a1-b1"	Observation No. 2 - Open ended barrel, possible contents	Vibracore Sampler					X				X	X	X										
			QMCM-SD23 a2-b2'	Observation No. 2 - Open ended barrel, possible contents	Vibracore Sampler					X					X											
QMCM-SD24	-88.45692312229	47.14598511265	QMCM-SD24 a1-b1"	Observation No. 5 - Drum or cylinder @ angle out of sediments	Vibracore Sampler					X				X	X	X										
			QMCM-SD24 a2-b2'	Observation No. 5 - Drum or cylinder @ angle out of sediments	Vibracore Sampler					X					X							X				
QMCM-SD25	-88.45691641708	47.14595345886	QMCM-SD25 a1-b1"	Observation No. 38 - Drum	Vibracore Sampler					X				X	X	X										
			QMCM-SD25 a2-b2'	Observation No. 38 - Drum	Vibracore Sampler					X					X											
QMCM-SD26	-88.45680474765	47.14590345729	QMCM-SD26 a1-b1"	Observation No. 39 - Drum	Vibracore Sampler					X				X	X	X										
			QMCM-SD26 a2-b2'	Observation No. 39 - Drum	Vibracore Sampler					X					X											
QMCM-SD27	-88.45697474942	47.14589012907	QMCM-SD27 a1-b1"	Observation No. 40 - Drum(?) with unknown contents	Vibracore Sampler					X				X	X	X										
			QMCM-SD27 a2-b2'	Observation No. 40 - Drum(?) with unknown contents	Vibracore Sampler					X					X											
QMCM-SD28	-88.45695146500	47.14587677277	QMCM-SD28 a1-b1"	Observation No. 3 - 1/2 drum, metal debris, near pilings, lumber & debris	Vibracore Sampler					X				X	X	X										
			QMCM-SD28 a2-b2'	Observation No. 3 - 1/2 drum, metal debris, near pilings, lumber & debris	Vibracore Sampler					X					X											
QMCM-SD29	-88.45688307916	47.14585345766	QMCM-SD29 a1-b1"	Observation No. 41 - Drum.	Vibracore Sampler					X				X	X	X										
			QMCM-SD29 a2-b2'	Observation No. 41 - Drum.	Vibracore Sampler					X					X											
QMCM-SD30	-88.45696979622	47.14582511428	QMCM-SD30 a1-b1"	Observation No. 4 - Drum?	Vibracore Sampler					X				X	X	X										
			QMCM-SD30 a2-b2'	Observation No. 4 - Drum?	Vibracore Sampler					X					X							X				
QMCM-SD31	-88.45690646651	47.14579011291	QMCM-SD31 a1-b1"	Observation No. 12 - Drum	Vibracore Sampler					X				X	X	X										
			QMCM-SD31 a2-b2'	Observation No. 12 - Drum	Vibracore Sampler					X					X											
QMCM-SD32	-88.45702142323	47.14576512956	QMCM-SD32 a1-b1"	Observation No. 42 - Wood debris and drum	Vibracore Sampler					X				X	X	X										
			QMCM-SD32 a2-b2'	Observation No. 42 - Wood debris and drum	Vibracore Sampler					X					X											
QMCM-SD33	-88.45701480090	47.14567844386	QMCM-SD33 a1-b1"	Observation No. 11 - Drum on side	Vibracore Sampler					X				X	X	X										
			QMCM-SD33 a2-b2'	Observation No. 11 - Drum on side	Vibracore Sampler					X					X											
QMCM-SD34	-88.45713313756	47.14547344633	QMCM-SD34 a1-b1"	Observation No. 9 - Concrete slabs w/ rectangular opening	Vibracore Sampler					X					X	X										
			QMCM-SD34 a2-b2'	Observation No. 9 - Concrete slabs w/ rectangular opening	Vibracore Sampler					X					X											

Table 4-1
Sampling and Analysis Summary
QMCM Area
Houghton County, Michigan

DRAFT

Proposed Sampling Location	Longitude	Latitude	Proposed Sample ID	Sampling Rationale	Anticipated Sampling Method	Sample Type/Matrix							Sample Analyses							Duplicate Analyses						
						Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment	Soil Gas	Drums, Containers, and Building Materials/SACM	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization	VOCs	SVOCs	PCBs	Metals	Cyanide	Asbestos	Waste Characterization
QMCM-SD35	-88.45712310244	47.14505346138	QMCM-SD35 a1-b1"	Observation No. 43 - Unknown debris	Vibracore Sampler					X					X	X										
			QMCM-SD35 a2-b2'	Observation No. 43 - Unknown debris	Vibracore Sampler					X					X											
QMCM-SD36	-88.45917984930	47.14464680159	QMCM-SD36 a1-b1"	Observation No. 26 - Edge of something buried - contents of a former drum or a timber?	Vibracore Sampler					X				X	X	X					X	X	X			
			QMCM-SD36 a2-b2'	Observation No. 26 - Edge of something buried - contents of a former drum or a timber?	Vibracore Sampler					X					X											
QMCM-SD37	-88.45910817955	47.14462014080	QMCM-SD37 a1-b1"	Observation No. 28 - Pock marks/pitting	Vibracore Sampler					X					X	X										
			QMCM-SD37 a2-b2'	Observation No. 28 - Pock marks/pitting	Vibracore Sampler					X					X											
QMCM-SD38	-88.45768816555	47.14460845299	QMCM-SD38 a1-b1"	Observation No. 7 - Strange surface appearance on sediments	Vibracore Sampler					X					X	X										
			QMCM-SD38 a2-b2'	Observation No. 7 - Strange surface appearance on sediments	Vibracore Sampler					X					X											
QMCM-SD39	-88.45685311274	47.14460845758	QMCM-SD39 a1-b1"	Observation No. 44 - Uknown debris-possible drums	Vibracore Sampler					X				X	X	X										
			QMCM-SD39 a2-b2'	Observation No. 44 - Uknown debris-possible drums	Vibracore Sampler					X					X											
QMCM-SD40	-88.45947914313	47.14463968558	QMCM-SD40 a1-b1"	Observation No. 33 - Quincy Dredge No. 2 - partially sunken near shoreline	Vibracore Sampler					X					X	X										
			QMCM-SD40 a2-b2'	Observation No. 33 - Quincy Dredge No. 2 - partially sunken near shoreline	Vibracore Sampler					X					X											
QMCM-SD41	-88.45970093417	47.14438797732	QMCM-SD41 a1-b1"	Observation No. 33 - Quincy Dredge No. 2 - partially sunken near shoreline	Vibracore Sampler					X					X	X										
			QMCM-SD41a2-b2'	Observation No. 33 - Quincy Dredge No. 2 - partially sunken near shoreline	Vibracore Sampler					X					X							X				
QMCM-SD42	-88.45935206525	47.14435982351	QMCM-SD42 a1-b1"	Observation No. 33 - Quincy Dredge No. 2 - partially sunken near shoreline	Vibracore Sampler					X					X	X										
			QMCM-SD42 a2-b2'	Observation No. 33 - Quincy Dredge No. 2 - partially sunken near shoreline	Vibracore Sampler					X					X											
QMCM-SD43	-88.45925218954	47.14448225345	QMCM-SD43 a1-b1"	Observation No. 33 - Quincy Dredge No. 2 - partially sunken near shoreline	Vibracore Sampler					X					X	X										
			QMCM-SD43 a2-b2'	Observation No. 33 - Quincy Dredge No. 2 - partially sunken near shoreline	Vibracore Sampler					X					X											
QMCM-SD44	-88.456653986261	47.14329010801	QMCM-SD44 a1-b1"	Observation No. 1 - Pock-marked lake bottom	Vibracore Sampler					X					X	X										
			QMCM-SD44a2-b2'	Observation No. 1 - Pock-marked lake bottom	Vibracore Sampler					X					X											
QMCM-SD45	-88.45419493870	47.13966673919	QMCM-SD45 a1-b1"	Observation No. 30 - Lake bottom has white appearance	Vibracore Sampler					X					X	X										
			QMCM-SD45 a2-b2'	Observation No. 30 - Lake bottom has white appearance	Vibracore Sampler					X					X											
QMCM-SD46	-88.45394326850	47.13960007603	QMCM-SD46 a1-b1"	Observation No. 31 - Lake bottom has white appearance	Vibracore Sampler					X					X	X										
			QMCM-SD46 a2-b2'	Observation No. 31 - Lake bottom has white appearance	Vibracore Sampler					X					X							X				
					Total Sample Count	**86**	**37**	**39**	**8**	**93**	**6**	**25**	**104**	**123**	**171**	**175**	**41**	**25**	**10**	**13**	**11**	**16**	**18**	**4**	**2**	**1**

Notes:
QMCM = Quincy Mining Company Mason Operations Area

PCBs = Polychlorinated Biphenyls
SACM = Suspect Asbestos Containing Material
SVOCs = Semi-Volatile Organic Compounds
VOCs = Volatile Organic Compounds
X = Planned analyte based on the sampling rationale and the horizontal and vertical location of the sample

Laboratory Quality Assurance/Quality Control Matrix Spike and Matrix Spike Duplicate samples will be a batch quality control sample prepared by the laboratory.
All sampling locations are subject to change based on visual observations or actual field conditions.
Additional analytes may be selected at the descretion of the field sampling team based on visual observations or field conditions.
Surface water and sediment sampling locations area subject to change based on underwater assessment activities.
For the purposes of this investigation, sediments include residues and waste material associated with chemical containers and deposits on the lake bottom historically discarded in Torch Lake.

In areas that have been resurfaced or capped, analytical samples will be collected from directly beneath the cap/resurfacing medium (i.e. soil cap, beach sand, gravel, etc...) so that samples are representative of historical waste deposits.