DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
US ARMY ENVIRONMENTAL COMMAND
2450 CONNELL ROAD
JOINT BASE SAN ANTONIO FORT SAM HOUSTON, TX 78234-7664

IMAE-M 19 April 2019

SUBJECT: Submittal of Gruber's Grove Bay Sediment Sampling Report
Badger Army Ammunition Plant

Mr. Jason Lowery
Wisconsin Department of Natural Resources
GEF2 Central Office
PO Box 7921
Madison, WI 53707-7921

Dear Mr. Lowery:

Enclosed is the Gruber's Grove Bay Sediment Sampling Report prepared by SpecPro Professional Services, LLC. The report documents the June 2018 sediment sampling activities conducted in Gruber's Grove Bay.

The sediment sampling project was conducted to delineate and quantify the residual soft sediments and mercury concentrations in Gruber's Grove Bay. The enclosed report provides a description of the field sampling methods, sediment thickness, sediment descriptions, sediment analytical results, and an assessment of the residual mercury-containing sediment in Gruber's Grove Bay.

Based on the analytical results from both the 2016 and 2018 sediment sampling, approximately 17.27 acres of Gruber's Grove Bay contain mercury-impacted sediment at concentrations exceeding the Most Probable Background Concentration (MPBC) of 0.36 milligrams per kilogram (mg/kg). Volumetric modeling estimates indicated an in-place mercury-impacted sediment volume of 54,120 cubic yards. Volumetric and sediment thickness modeling was completed based on the location and concentrations of both the 2016 and 2018 sediment sampling.

The Army is currently evaluating remediation technologies to address the mercury-impacted sediment in Gruber's Grove Bay.

IMAE-M
SUBJECT: Submittal of Gruber's Grove Bay Sediment Sampling Report
Badger Army Ammunition Plant

Please do not hesitate to contact me at 210-466-1684 if you have any questions.

Sincerely,

Digitally signed by LYNCH.BRYAN.PATRICK.1021561254
Date: 2019.04.19 10:26:44 -05'00'

Bryan P. Lynch
Commander's Representative

Enclosure
Copy furn: Bill Fitzpatrick, Wisconsin Department of Natural Resources
Joel Janssen, SpecPro Professional Services, LLC

GRUBER'S GROVE BAY

SEDIMENT SAMPLING REPORT

BADGER ARMY AMMUNITION PLANT,

BARABOO, WISCONSIN

Prepared for:
U.S. Army Environmental Command
2950 Connell Road
JBSA – Fort Sam Houston, TX 78232

MARCH 2019

Prepared by:
SpecPro Professional Services, LLC
S7560 U.S. Highway 12
North Freedom, WI 53951

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1.0 EXECUTIVE SUMMARY

The June 2018 sediment sampling activities conducted by SpecPro Professional Services, LLC (SPS) for the Department of the Army (Army) at Gruber's Grove Bay (GGB) located adjacent to the Badger Army Ammunition Plant (BAAP) was conducted to further delineate horizontal and vertical mercury concentrations and quantify the residual soft sediments in GGB. These activities were the result of the Wisconsin Department of Natural Resources' (WDNR) and Army's collective efforts and correspondence since the last GGB sampling event during February 2016 to determine an appropriate course of action for the GGB sediment. This effort increases the likelihood that additional remedial actions conducted will achieve the cleanup goal. The cleanup goal is to remove mercury contaminated sediment above the Most Probable Background Concentration (MPBC) of 0.36 milligrams per kilogram (mg/kg). The WDNR has referred to the MPBC also as the Remedial Action Level (RAL). The MPBC was established by the WDNR in 2000.

In February 2016, the Army completed shallow sediment sampling and sediment thickness measurements in GGB. In a letter dated August 11, 2017, the WDNR indicated levels of mercury in the GGB sediment continue to pose an unacceptable risk to aquatic life. On January 23, 2018, the WDNR provided the Army an acceptable course of action that would result in the state's satisfaction with the environmental quality of sediment in GGB. The Army responded in a letter dated February 20, 2018 indicating their intention to provide a sediment sampling work plan addendum followed by sampling for the GGB sediment.

The Army submitted the *Gruber's Grove Bay Sediment Sampling Work Plan Addendum* (Work Plan) on June 6, 2018. The Work Plan provided a summary of background information, design of the sediment investigation, explanation of the field sampling methods, quality assurance and quality control procedures, data analysis methods, and a schedule. Forty-one sediment sample locations were proposed in GGB.

In accordance with the Work Plan, sediment cores were collected from the 41 proposed sample locations. Seventy-nine sediment samples were collected from 40 of the 41 proposed sample locations and laboratory analyzed for mercury. A sediment sample could not be collected from the GGB-48 location because no sediment was recovered in the sampler.

Sediment samples collected for laboratory analyses were obtained in the soft sediment from the top of the sediment surface to 2.9 feet below the sediment surface. The sample depths were measured from the top of the recovered sediment core to the bottom of the recovered core. The sediment consisted of an upper thin layer of watery gelatinous "mud" sediment underlain by a thicker layer of firmer fine-grained sediment, down to the underlying native clay bottom.

Analytical results indicate that approximately 17.27 acres of GGB contain mercury-impacted sediment at concentrations exceeding the mercury MPBC of 0.36 mg/kg. Forty-three samples (at 27 locations) identified concentrations exceeding the mercury

MPBC. Volumetric and sediment thickness modeling was completed based on the location and concentrations of both the 2016 and 2018 sediment sampling. The modeling shows mercury-impacted sediment thicknesses generally less than 2 feet toward the northwest (Highway 78). In the southeast portion of GGB, closer to the Wisconsin River, the sediment thicknesses increase to more than 3 feet. A few pockets of thicker sediment, 4 to 6 feet, were identified in the center and towards the Wisconsin River. The modeling effort estimated an in-place sediment volume of 54,120 cubic yards that exceeded the MPBC. The Army is currently evaluating remediation technologies to address the impacted sediment in the GGB.

2.0 INTRODUCTION

SPS conducted a sediment sampling investigation from June 11 through 18, 2018, at GGB. The purpose of the sampling effort was to delineate both horizontally and vertically the mercury-impacted sediment in GGB.

This Sediment Sampling Report (Report) was prepared in accordance with the Environmental Remediation Support Contract W9124J-15-C-0081 between SPS and the Army.

3.0 BACKGROUND INFORMATION

BAAP was constructed in 1942 to manufacture small arms and ordnance propellants as part of the United States military manufacturing effort during World War II. BAAP also operated as a propellant manufacturing facility during the Korean conflict and the Vietnam era. The facility has been inactive since 1977 and was declared excess in 1999.

GGB is located on the northwestern shore of the Wisconsin River (Lake Wisconsin). GGB was formed following the construction of the Prairie Du Sac Dam in 1915. The bay is located immediately south of BAAP and approximately 6,000 feet upstream of the dam. The general location of GGB is shown in Figure 1.

GGB is located in a northwest-trending valley. The constructed embankment of the former State Highway 78 forms the northwest end of the bay. The southeast end of the bay opens into the Wisconsin River. Permanent and vacation residences occupy portions of the shoreline. Undeveloped portions of the shoreline are typically wooded. GGB occupies approximately 27 acres of water surface area. GGB is approximately 250 feet wide at the former State Highway 78 crossing and 530 feet wide at the confluence with the Wisconsin River. At its widest point, GGB is approximately 800 feet wide. The distance from the former State Highway 78 to the Wisconsin River is approximately 2,250 feet. The valley defining GGB slopes steeply to the water's edge on the south side of the bay. Slopes as steep as 20 percent are found along the south shore. Slopes are gentler on the north shore of GGB.

BAAP discharged both process and treated sanitary wastewater through a series of sand bottom settling ponds during active manufacturing periods. The wastewater flowed

through the settlings ponds and then discharged into GGB via culverts buried beneath the former Highway 78 roadbed. Wastewater has not been discharged to the bay since 1977 when manufacturing operations were terminated. Sanitary and process wastewater discharged from BAAP operations into GGB contained solid materials consisting primarily of powdered activated carbon, aluminum oxide flocculent, and nitrocellulose. Quantities of these solids deposited in GGB resulted in a blanket of variable thickness on the bottom of the bay. Sand and silt from surface runoff unrelated to the Army has incorporated with the wastewater sediments in GGB. These additional sand and silt deposits originated from the private land surrounding GGB and the runoff that resulted from the construction of Highway 78 during 2009.

Since 1970, numerous studies have been performed on GGB sediments. In 1998, the WDNR performed an investigation of sediment that indicated the presence of several metals and polynuclear aromatic hydrocarbons at concentrations above the "severe effect level" for benthic invertebrates.

On February 4, 2003, the WDNR indicated that GGB had been placed on the United States Environmental Protection Agency (USEPA) Section 303(d) list of impaired waters.

The Army has conducted multiple sediment investigations during 2000, 2004, 2009 and 2016. The Army has performed sediment dredging operations during 2001 and 2006. During the 2001 dredging operation, the Army removed approximately 88,000 cubic yards of sediment from GGB. During the 2006 dredging operation, the Army removed approximately 60,250 cubic yards of sediment from GGB. The area previously dredged encompassed approximately 18 acres.

In 2000, the WDNR instituted a performance standard for GGB and it was based on the Most Probable Background Concentration (MPBC) of 0.36 milligrams per kilogram (mg/kg) of mercury. The cleanup goal is to remove mercury contaminated sediment above 0.36 mg/kg. The WDNR has referred to the MPBC also as the Remedial Action Level (RAL).

The 2009 investigation results were used to calculate the Surface Weighted Average Concentration (SWAC) in GGB. The SWAC results were 0.899 mg/kg for the 2006 dredged extent and 0.627 mg/kg for the entire GGB. After the 2009 sediment investigation was completed, the WDNR informed the Army that remedial actions completed to date in GGB were insufficient in removing mercury contamination to a level adequate for benthic habitat. The WDNR indicated additional remediation was necessary and that upon successful completion of the remedy, the WDNR would then conduct final monitoring and prepare a proposal to the USEPA to remove GGB from the Section 303(d) list.

After the 2009 sediment investigation, the Army conducted a hydrographic survey of GGB during 2012 to contour the subaqueous topography or bathymetric contours. The hydrographic survey mapped out the contours and slopes of the bottom of GGB. The

Army used these contours along with the 2009 sediment investigation results to develop potential remedial alternatives.

During an April 1, 2014 meeting between the Army and WDNR, it was determined that additional sediment investigation would be necessary before conducting any remedial actions. In a letter dated August 27, 2014, the WDNR formally requested the Army submit a sediment sampling work plan.

In accordance with the WDNR's August 27, 2014 letter, the Army submitted a Work Plan in November 2015. The Work Plan detailed the Army's plan to resample the sediment in GGB. The Work Plan provided a more detailed summary of background information, design of the sediment investigation, explanation of the field sampling methods, quality assurance and quality control procedures, data analysis methods, and a schedule. The November 2015 Work Plan was conditionally approved by the WDNR on January 12, 2016.

The sediment sampling was conducted in February of 2016 at 95 locations in GGB. Sediment samples were not collected from 35 of the 95 locations due to firm, rocky, or sandy conditions encountered at the bottom of GGB. The February 2016 sediment investigation characterized the mercury concentrations in the upper six inches (0.5 feet) of residual soft sediment. Sediment below six inches was not analyzed for mercury during the February 2016 investigation. The February 2016 sediment investigation also characterized the sediment thickness and sediment type down to the native clay sediment.

In July 2016, the Army provided the results of the 2016 sampling to the WDNR. Based on the results of the investigation, mercury concentrations ranged from 0.022 to 6.3 mg/kg in the top six inches and the sediment thickness varied from 0 to 5.2 feet. The WDNR provided a response to the Army on August 11, 2017 indicating the documented levels of mercury in the sediment posed an unacceptable risk to aquatic life and requested a meeting to discuss subsequent activities at GGB. On October 23 2017, Army and WDNR representatives met to discuss an appropriate course of action that would result in the State of Wisconsin's satisfaction with the environmental quality of sediment in GGB. This was reiterated in a WDNR letter to the Army dated January 23, 2018.

In a letter dated February 20, 2018, the Army indicated that they would be resampling GGB to delineate the mercury concentrations over depth in areas with elevated mercury concentrations that were sampled during February 2016. The letter also indicated that a sediment sampling work plan addendum would be provided to the WDNR describing the sampling effort.

4.0 FIELD INVESTIGATION

On June 6, 2018, the *Gruber's Grove Bay Sediment Sampling Work Plan Addendum* (Work Plan) was submitted to the WDNR. The Work Plan stated that the Army would be collecting additional sediment samples to delineate the horizontal and vertical mercury concentrations. The Work Plan stated that sediment sampling would be conducted to

evaluate the mercury concentrations below 6 inches and down to the native clay sediment. The investigation would help define the vertical extent of mercury concentrations above the MPBC within GGB. Appendix A includes a copy of the Work Plan and other recent correspondence between the Army and WDNR.

The WDNR provided the following comments to the Work Plan on June 19, 2018. The WDNR was concerned that the sampling performed from a boat might not have the same quality control for measuring the top of sediment to anticipate where the sediment core piston should be set during sampling. The sediment measurements conducted for GGB-96 and GGB-97 during the June 2018 sampling event were conducted in the same manner as the 2016 sampling event. SPS did not encounter any issues with measuring the top of the sediment. The WDNR suggested that the sampling plan should have a backup plan for obtaining a grab sample from locations where core sampling is unsuccessful. The WDNR recommended a dredge type of sampler may provide a means for recovering a sample and potential data on the distribution of mercury contamination from locations where coring is unsuccessful. The sediment sampling field activities were conducted from June 11 through 18, 2018. The WDNR's Work Plan comments were not received till June 19, 2018 and after the sampling project was completed. Therefore, SPS was unable to change to a dredge type sampler for the GGB-48 location.

In accordance with the *Gruber's Grove Bay Sediment Sampling Work Plan Addendum* dated June 6, 2018, sediment sampling and thickness measurement activities were conducted by SPS personnel from June 11 through 18, 2018. The June 2018 field investigation was completed to compliment the sediment sampling efforts conducted during February 2016. The 2016 sampling event accomplished two primary objectives. The first objective was to measure the overall thickness of the GGB sediment. The second objective was to determine the mercury concentration of the sediment within the top 0.5-feet of the sediment. The sample locations from the 2016 and 2018 sediment investigations and 2006 dredged extent are shown on Figure 2. Also shown on Figure 2 is the 2016 estimated extent of mercury above 0.36 mg/kg (MPBC) in the upper 0.5 feet of sediment.

The Work Plan proposed collecting sediment laboratory samples from 41 locations within GGB, including areas outside the footprint of the 2006 dredged extent of GGB. Of the 41 proposed sample locations, 39 were chosen based on the locations of the 2016 sampling investigation to further define the vertical extent of the mercury-impacted sediment. The other two sampling locations (GGB-96 and GGB-97) were added to further define both the horizontal and vertical extent of mercury-impacted sediment towards the southeast (further into the Wisconsin River), see Figure 2. During the 2016 investigation, sediment thickness measurements were collected from 39 of the 41 sample locations that coincide with the 2018 investigation. Sediment measurements or samples were not collected from locations GGB-96 and GGB-97 during the 2016 investigation. Sediment thickness measurements were collected in locations GGB-96 and GGB-97 during June 2018.

At sample location GGB-48, a sediment sample could not be obtained due to the lack of sediment recovered. During the 2016 sampling investigation, sediment could also not be recovered from GGB-48 even though 1.4 feet of sediment was measured in the field.

The field activities were conducted from a sampling platform of a pontoon boat. The pontoon was positioned using a trolling motor and held steady over the sampling point by two fluke anchors. Photographs of the field investigation are provided in Appendix B.

As previously mentioned, the 2016 investigation consisted of collecting detailed measurements of the top and bottom of the soft sediment, sampler driven depth, core recovery, and physical description of the sediment to characterize current GGB conditions. All sediment measurements were made relative to the water surface. The 2018 sampling event was designed to complement the 2016 sampling event and focused on collecting samples for analytical testing at depth. The 2018 investigation used the same sample number designations at the 2016 investigation.

4.1 Sample Location Surveying

A total of 41 sample locations (see Figure 2) were located using a survey grade global positioning system (GPS) unit. The GPS unit used was a Trimble Geo 7 Series Premium CM Kit with Terra Sync Centimeter Edition. The GPS unit was linked to the Wisconsin Continuously Operating Reference Stations (WISCORS) Real-Time Network through an internet connection. The Wisconsin Department of Transportation Geodetic Surveys Unit developed a statewide Global Navigation Satellite System (GNSS) reference station network, called the WISCORS Network. This WISCORS Network consists of over 80 permanent GNSS reference stations that can provide GNSS corrections to mobile users in real-time. Mobile users properly equipped to take advantage of these GNSS corrections can position in the field to the 2-centimeter accuracy level in real-time. GPS equipment specifications and WISCORS information is provided in Appendix C. Horizontal control was based on the English system, survey-foot, and referenced to the North American Datum of 1983 (NAD 83) and the Wisconsin State Plane Coordinate System, Wisconsin South Zone. The sampling platform was held steady over the sample locations though the use of the fluke anchors and trolling motor. The sample location coordinates are provided in Table 1.

4.2 Sediment Thickness Measurements

Sediment thickness measurements were collected from 39 of the 41 sample locations in GGB during the 2016 sampling event, as shown in Figure 2. Sediment thickness measurements for the two most southeastern locations (GGB-96 and GGB-97) were collected during the 2018 sampling effort. GGB-96 and GGB-97 are the new sampling locations. The intent of measuring the sediment was to determine the thickness of only the soft sediment. Firmer sediment thickness (i.e. clay, rock, sand) was not able to be measured with the equipment being used. Table 2 contains field measurements for the top and bottom of the soft sediment, sediment thickness, depth of sampler penetration (core driven), recovered sediment thickness (core recovery), and a ratio of the sediment

thickness to the recovered sediment thickness (core recovery percent). All sediment measurements were made relative to the water surface.

The top of soft sediment was measured at sample locations GGB-96 and GGB-97 using a six-inch diameter clear plastic plate attached to a threaded hollow PVC pipe with a 3/4-inch diameter. The threaded pipe allowed additional sections to be screwed together in deeper portions of GGB. The bottom five feet of the PVC pipe was perforated to allow water to pass through the pipe. The pipe string with the plate was allowed to slowly sink as it filled with water until it came to rest at the top of the sediment. Once a depth measurement was made, a quick-clamp device was attached to the pipe to mark the water surface. The PVC pipe, marked at the water interface, was removed and measured with an engineer's tape to within 0.1 feet. Photos of the measurement device are provided in Appendix B.

GGB is located upgradient of the Prairie du Sac Dam and the water level in GGB is controlled by the dam. The Prairie du Sac Dam keeps the elevation of GGB near 774.1 mean sea level (MSL) at all times. Due to the minor fluctuations in the water surface, an elevation of 774.1 feet MSL was used for the water surface. This elevation was used for all sampling locations to calculate the elevation of the top of sediment and bottom of sediment.

The post-dredge survey bathymetric contours shown in Figure 3 were revised based on the top of sediment measurements collected during February 2016 and June 2018. Bathymetric contours are similar to land surface topographic contours but interpret the depth of the water (water surface to top of sediment). The bathymetric contours shown in Figure 3 represent the change in elevation of the bottom of GGB. The original one-foot bathymetric contours were constructed by Veolia ES Special Services, Inc. (Veolia) in 2012. The bathymetric contours shown in Figure 3 were revised by SPS to encompass the entire sampling limits. Contours along the shoreline were modified in many locations because the Veolia sonar survey appeared to misrepresent the shallower depths. Depths to the top of the sediment ranged from 3.0 feet (along the shoreline) to 20.9 feet (closer to the Wisconsin River).

The bottom of the soft sediment was measured at new sample locations GGB-96 and GGB-97. SPS manually pushed a measurement probe through the soft sediment until refusal or very firm sediment was encountered. The SPS measurement probe consisted of a 5/8-inch diameter hollow stainless-steel rod with threaded extensions equipped with a solid stainless-steel tapered drive point. Once resistance was encountered, a quick-clamp device was attached to the probe to mark the water surface and measured with an engineer's tape to within 0.1 feet. Table 2 indicates sediment thickness measurements at each sample location.

Figure 4 displays the sediment thickness isopach lines. The isopachs are contour lines of equal sediment thickness over GGB. The isopachs were constructed using the total measured sediment thickness or bottom of sediment measurement minus the top of sediment measurement collected from the sediment probe locations during February 2016

and June 2018. Table 2 contains the sediment thicknesses as recorded in the field. The total soft sediment thickness measured within GGB varied from 0 to 6 feet but was generally 1 to 4 feet thick. The sediment was generally found to be thickest down the center and near the mouth of GGB. However, an isolated pocket of sediment, nearly four feet thick, was observed near the northern shoreline at sample locations GGB-62 and GGB-63. These areas are located outside of the dredged area. The sediment thicknesses at sampling locations GGB-96 and GGB-97 were 4.5 and 6 feet, respectively. Locations GGB-96 and GGB-97 are located the farthest into the Wisconsin River, see Figure 4.

4.3 Sediment Sample Collection

The Work Plan proposed that sediment samples would be collected from 41 locations within GGB. Sediment samples were collected from 40 of the 41 locations. A sediment sample could not be collected from the GGB-48 location because no sediment was recovered in the sampler. During the 2016 sampling investigation, sediment could also not be recovered from GGB-48 even though 1.4 feet of sediment was measured in the field. The purpose of the sampling effort was to delineate and quantify only the residual soft sediments.

The 2016 and 2018 locations where sediment samples were collected and where sediment samples weren't collected are displayed on Figure 2. Sample locations for the 2018 sampling event are listed in Table 1. All sediment sampling was conducted under the direction of Joel Janssen of SPS. Mr. Janssen is a State of Wisconsin registered professional geologist. Photos of the sampling equipment and field collection methods are provided in Appendix B.

As specified in the Work Plan, sediment samples were collected using the same sampling equipment used during the 2016 sampling effort. The sampling equipment was a modified AMS multi-stage sediment/sludge sampler. Information about the sediment sampler is provided in Appendix D. The 2.375-inch by 1-foot AMS multi-stage sediment/sludge sampler comprised of a 1-foot stainless-steel multi-stage base section, butterfly valve core tip, and a semi-clear plastic disposable liner. Additional 1-foot stainless-steel sections were added to the base section to create a longer sampler. During the field sampling, either a 2-foot or 4-foot sampler was driven into the soft sediment. The measured sediment thickness determined the appropriate sampler length to implement at each location. The semi-clear plastic disposable liner had an inside diameter of 2-inches. The sampler as provided by AMS was modified by adding an inner dual piston within the plastic liner. The inner dual piston was equipped with two rubber seals that provided suction in the plastic liner as the sampler was pushed into the soft sediment. The inner piston was held stable by an attached rope. A diagram of the dual piston design is provided in Appendix D.

The measurements collected to determine the top and bottom of the sediment were used to determine the correct depth to place the sampler. The piston-type coring sampler was positioned directly above the sediment surface. The piston was locked at the soft sediment interface prior to advancing into the sediment. As the piston-type coring

sampler was lowered into the sediment, the inner piston of the sampler remained stationary, creating a suction that helped hold the soft sediment within the sampling device. The sampler was equipped with a butterfly valve core tip which was designed to stay open during sample penetration and close when the sample was retrieved. The sampler was manually driven into firmer sediment to allow the bottom to be plugged with firm material prior to removal.

4.3.1 Sample Preparation

After the sampler was retrieved, it was transported in an upright position to a field office trailer for sample preparation. The upper sampler sections were removed leaving only the disposable semi-clear inner plastic liner attached to the core tip, thus allowing a visual inspection of the sediment core and water retained above the sediment. Once the lighter flocculent material was allowed to settle, the core recovery was measured while the sample was positioned upright. The plastic liner was penetrated just above the top of the sediment core/surface water interface allowing retained water to drain out. The liner was then placed on a clean sheet of plastic and the sediment core was extruded with a piston affixed on the end of a plunger.

Prior to any disturbance of the sediment core, each core was photographed, measured, and described. See Section 4.3.2 for further discussion on the sediment core evaluation and description.

After each sediment core was described, a sample corresponding to the designated depth interval was placed into a stainless-steel bowl to be homogenized. Generally, sample depths corresponded to following depth intervals: 0 to 0.5 feet, 0.5 to 1.5 feet, 1.5 to 2.5 feet and 2.5 feet to maximum depth of sample. These intervals are based on the measured core recoveries.

The sample was then placed into laboratory supplied containers, placed on-ice, and prepared for chemical analysis. A total of 79 sediment samples were submitted for mercury and percent solids analyses. Consistent with the Work Plan, resampled locations, duplicate samples and a replicate sample were incorporated into the 2018 sampling event. Seven of the samples were a resample of the 2016 event at the 0 to 0.5-foot sample interval. Five of the samples were duplicate samples and one of the samples was a replicate sample. A chain-of-custody form accompanied each sample shipment to the analytical laboratory.

Each dissected core section selected for analysis was homogenized (composited) in a clean stainless-steel mixing bowl prior to placement into laboratory supplied containers to ensure a representative sample was obtained. Clean stainless-steel spoons and spatulas were used to mix each core section in a circular fashion, reversing direction, and occasionally turning the material over to create a uniform sample matrix. The homogenizing occurred in a field office trailer.

4.3.2 Sediment Evaluation and Description

The exposed sediment cores allowed for a complete cross sectional evaluation and description of the recovered sediment including identification of the native/non-native sediment interface. A tape measure was placed alongside each core starting at the original top end of the core. Prior to any disturbance of the sediment core, each core was photographed, measured, and described. Appendix E contains photos of each core section prior to any disturbance from sample identification or sample homogenization. A field description of each core was recorded. The description included core length, color, particle size distribution, relative density, texture, and changes in lithology. Table 3 contains the core section descriptions.

Note that any reference to the sediment depth is related to the amount of sediment recovered in the core (core recovery). The sediment depths were measured from the top of the recovered sediment core to the bottom of the recovered core. Due to the differences in the measured sediment thickness and core recovery, the sample depth does not directly correspond to the measured sediment thickness present in GGB. This difference is a factor of compaction and compression while manually pushing the sampler through the sediment.

In general, the upper portion (within the top 0.5 feet) of the sediment had moisture contents greater than 50 percent. This upper gelatinous "mud" sediment was described as a watery, very fine-grained gelatinous sediment, non-cohesive, and black with a high organic content. This gelatinous sediment had a mild to moderate "rotten-egg" (hydrogen sulfide gas) odor. The gelatinous sediment would be classified as non-native sediment. The gelatinous sediment appears uniform upon visual observation but could be disturbed from recreational activities (e.g., anchoring, boating, fishing and swimming). The thickness of the gelatinous sediment generally ranged from 0.1 to 1.6 feet. The gelatinous sediment was encountered in 38 of the 41 sample locations collected during 2018. The gelatinous sediment was found only in areas deeper than five (5) feet of water. Figure 5 displays the distribution of gelatinous sediment (2016 and 2018 sampling events) along with the estimated extent of mercury above the MPBC. The mercury results are discussed in Section 5.1. As shown on Figure 5, gelatinous sediment was present in all 2016 and 2018 sample locations located within the extent of mercury above the MPBC (except GGB-02, 43, and 79). Gelatinous sediment was present in only one sample location (GGB-61) located outside the extent of mercury above the MPBC.

The sediment beneath the gelatinous sediment consisted mostly of a black silty clay, cohesive, and soft. Beneath that was a much firmer dark gray silty clay that was cohesive. This firmer silty clay would be classified as native sediment. A firm gray clay was encountered occasionally beneath the silty clay.

At sample location GGB-48, a sediment sample could not be obtained due to the lack of sediment recovered. Sediment was also unable to be recovered at sample location GGB-48 during the 2016 investigation. The measured sediment thickness at GGB-48 was 1.4 feet during the 2016 and 2018 investigations.

Natural sedimentation processes produced sediment with decreasing moisture content and increased cohesiveness with depth. Relative density of the sediment ranged from semi-liquid (top of sediment layer), to very soft, to firm (bottom of sediment layer).

4.3.3 Resampling

Per the request of the WDNR, seven (7) locations from the 2016 sediment investigation were resampled and the sediment from the 0 to 0.5 foot depth was analyzed for mercury. These resampling locations were GGB-10, GGB-22, GGB-46, GGB-58, GGB-77, GGB-78, and GGB-89. This is approximately 10% of the 2016 sediment investigation samples. The sample locations were distributed throughout GGB where higher mercury concentrations were detected during 2016.

4.3.4 Duplicate Sampling

For quality assurance and to demonstrate laboratory proficiency, duplicate samples were randomly selected at a minimum of one per ten sediment sample locations. Five (5) duplicate samples (GGB-22, GGB-26, GGB-58, GGB-77, and GGB-96) was analyzed for mercury. The original retrieved sediment core was split vertically into two equal portions during sample dissection. Both the original and duplicate portions were homogenized in separate stainless-steel bowls, and then placed into separate laboratory supplied jars.

4.3.5 Replicate Sample

In addition to the resampling and duplicate sampling, a replicate sample from GGB-25 was collected and analyzed for mercury. The replicate sediment core was collected within three feet of the original sample location.

4.3.6 Sampling Equipment Decontamination

Decontamination of equipment was essential in preventing cross contamination between sampling locations. Every effort was made to limit cross contamination by using a new disposable liner each time the sediment sampler was driven into the sediment. Also the use of new plastic sheeting beneath each sample core reduced potential cross contamination. Reusable sediment sampling equipment was decontaminated between sampling locations. Reusable sediment sampling equipment included the following: sediment sampler including the core tip and inner dual piston, stainless-steel mixing bowls, spoons, and spatulas, and the sample core extruder.

Decontamination of the sampling equipment consisted of removing sediment or debris adhered to the equipment with a brush and tap water until all visible traces of sediment were removed. Then all equipment was washed in an Alconox® soap/water solution with a cleaned brush. Then the equipment was rinsed with tap water, a 10 percent nitric acid solution, and finally with distilled water. The equipment was allowed to air dry.

5.0 LABORATORY ANALYTICAL RESULTS

5.1 Mercury Analytical Results - Sediment

A total of 79 sediment samples including seven (7) resamples, five (5) duplicates, and one (1) replicate sample were submitted to CT Laboratories, LLC (CT Labs) in Baraboo, Wisconsin for mercury analysis. These 79 samples were collected from 40 of the 41 proposed sampling locations. As previously mentioned in Section 4.3, sediment samples were not collected from the GGB-48 location since no sediment was recovered in the sampler. The sediment samples were analyzed for mercury utilizing USEPA SW-846 method 7471B. The sediment samples were reported on a dry weight basis. CT Labs is certified by the WDNR under NR 149 to perform analytical testing for mercury (certification #157066030) and meets the requirements of the Department of Defense Environmental Laboratory Accreditation Program.

Generally, sediment samples for laboratory analysis corresponded to following depth intervals: 0 to 0.5 feet, 0.5 to 1.5 feet, 1.5 to 2.5 feet and 2.5 feet to maximum depth of sample. At each sample location, the sediment sampler was manually pushed until refusal was encountered. The goal was to recover a core of sediment that represented the vertical sediment profile. Note that any reference to the sample depth is related to the amount of sediment recovered in the core (core recovery). The sample depths were measured from the top of the recovered sediment core to the bottom of the recovered core. Due to the differences in the measured sediment thickness and core recovery, the sample depth does not directly correspond to the measured sediment thickness present in GGB. This difference is a factor of compaction and compression while manually pushing the sampler through the sediment.

Mercury concentrations ranged from non-detect to 12.4 mg/kg. Of the 79 sediment samples submitted for mercury analysis, 78 had detections above the laboratory's limit of detection (LOD) or method detection limit (MDL). CT Labs' lowest LOD for mercury equaled 0.003 mg/kg. Mercury analytical results for the sediment samples are summarized in Table 4.

Forty-three samples (27 separate locations) identified concentrations exceeding the mercury MPBC of 0.36 mg/kg. Figure 6 delineates the estimated extent of mercury that exceeded 0.36 mg/kg in a sediment sample. The areas shaded in yellow on Figure 6 indicate where mercury concentrations exceeded 0.36 mg/kg regardless of the sample depth. Both the 2016 and 2018 mercury results were used to construct the extent of mercury-impacted sediment. Approximately 17.27 acres of GGB contain mercury-impacted sediment at concentrations exceeding the MPBC of 0.36 mg/kg.

The frequency of mercury concentrations above the MPBC decreased with depth in the sediment cores. Thirty-one of the 40 sediment samples collected from the bottom of the sample cores had mercury concentrations below the MPBC. In the 0 to 0.5-foot sampling interval, approximately 85% of the samples indicated mercury concentrations above the MPBC. In the interval from 0.5 to 1.5 feet, approximately 50% of the samples indicated

mercury concentrations above the MPBC. This frequency drops to approximately 35% in the sample interval from 1.5 to 2.5 and there were no exceedances of the MPBC deeper than 2.8 feet. Note that the sample depth intervals are related to the sediment recovered in the core and not the undisturbed sediment thickness.

The average mercury concentration in the 0 to 0.5-foot sampling interval was 1.2 mg/kg. The average mercury concentration in the 0.5 to 1.5 feet sampling interval was 1.6 mg/kg. The average mercury concentration in the 1.5 to 2.5 feet sampling interval was 1.0 mg/kg. The average mercury concentration in the sampling interval deeper than 2.8 feet was 0.08 mg/kg.

Appendix F contains sediment core photo logs for sample locations GGB-10, GGB-22, GGB-58, GGB-96, and GGB-97. These five sample locations were chosen to provide a representation of the sediment cores. These sediment core photo logs show a photo of the recovered sediment core alongside the mercury sample concentrations and core section descriptions. The sample depths are referenced to the vertical ruler scale shown in the photo so each can be correlated with the visual sediment color and type. Mercury concentrations exceeding the MPBC of 0.36 mg/kg are highlighted in gray.

The two new sample locations GGB-96 and GGB-97 were located the farthest into the Wisconsin River, see Figure 6. Mercury concentrations in GGB-96 were found above the MPBC in the sample depths 0 to 0.5-foot, 0.5 to 1.5 feet, and 1.5 to 2.5 feet. The mercury concentration in GGB-96 at the 2.5 to 2.9 feet sample depth was below the MPBC. Mercury concentrations in GGB-97 were found above the MPBC in the sample depths, 0.5 to 1.5 feet and 1.5 to 2.2 feet. The mercury concentration in GGB-97 at the 0 to 0.5-foot sample depth was below the MPBC.

5.2 Percent Solids Analytical Results - Sediment

A total of 79 sediment samples including seven (7) resamples, five (5) duplicate and one (1) replicate sediment samples were submitted to CT Labs for percent solids analysis or solids content. The sediment samples were analyzed for percent solids utilizing USEPA SW-846 method 8000C. Method 8000C is another name for method SW 2540. Percent solids is determined by taking a well-mixed sample, placing it in a weighed dish, and then drying it to a constant weight in an oven at 103 to 105°C. The increase in weight over that of the empty dish represents the total solids. The difference in weight between the wet sample and the dried sample is calculated as a percent. Percent solids results compared to the mercury results are summarized in Table 5. When mercury concentrations were above 0.36 mg/kg, the percent solids values averaged 26%. When mercury concentrations were below 0.36 mg/kg, the percent solids values averaged 56%. Based on these results, the sediment with higher solids content had lower mercury concentrations. Also, the sediment with a higher liquid content (watery) had higher mercury concentrations. The majority of these higher mercury samples consisted of gelatinous sediment.

5.3 Mercury Analytical Results - Equipment Blanks

A total of six (6) equipment blank or rinse blank samples were collected during this sampling project and subsequently submitted to CT Labs for mercury analysis. The equipment blanks were collected on six (6) separate days. These equipment blanks are necessary when re-usable sampling equipment is involved in collecting sediment samples. The collection of equipment blanks was conducted after following the decontamination procedures outlined in Section 4.3.5. The equipment blanks were obtained by pouring distilled water over and through the sediment sampler, mixing bowls, spoons, or spatulas while collecting the water in a clean container. All equipment blanks were placed into laboratory supplied containers and stored in a cooler until they were received by the laboratory.

The equipment blank samples were analyzed for mercury utilizing USEPA SW-846 method 7470A. The equipment blank mercury results are summarized in Table 6. Mercury was not identified in any of the equipment blanks. These results confirmed the effectiveness of the field equipment decontamination between sample locations.

5.4 Quality Assurance and Quality Control

A detailed Quality Assurance Project Plan (QAPP) was provided in the 2016 Work Plan. The QAPP was specifically related to laboratory sample collection and analysis. A SPS chemist performed an internal quality control review of the laboratory data reported by CT Labs. The internal review did not find any issues with the laboratory data.

Per the request of the WDNR, seven (7) locations from the 2016 sediment investigation were resampled and the sediment from the 0 to 0.5 foot depth was analyzed for mercury. The resampled mercury results are summarized in Table 7. The resampling locations were GGB-10, GGB-22, GGB-46, GGB-58, GGB-77, GGB-78, and GGB-89. The range in variability between the original and resampled mercury concentrations was between 0.1 to 3.2 mg/kg. In four of the seven resampling locations, the mercury concentrations were within 0.6 mg/kg of each other. In five of the seven sample locations, the 2016 mercury concentrations were higher compared to their resampled locations in 2018. The mercury concentrations between the 2016 and 2018 sampling events were similar but not always repeatable. As described in Section 4.3.2, the top 0.5 to 1.6 feet of sediment consists of a gelatinous flocculant sediment that has a high moisture content. The gelatinous sediment appears uniform upon visual observation but could be disturbed from recreational activities (e.g., anchor, boating, fishing and swimming).

For quality assurance and to assess precision of the sample collection process, field duplicate sediment samples were randomly selected at a rate of 1 per 10 sample location. The five (5) duplicate samples (GGB-22, GGB-26, GGB-58, GGB-77, and GGB-96) were analyzed for mercury. The mercury results are summarized in Table 4. The range in variability between the original and duplicate sample mercury results was between 0.06 to 0.5 mg/kg. Based on the results, the duplicate samples were representative of the original samples.

In addition to the 2016 resampled locations and the duplicate samples, one (1) replicate sample GGB-25R was also collected at random from the 0.5 to 1.0-foot sampling interval and analyzed for mercury. The replicate sample was taken within three feet of the original sample. The mercury concentration of the two samples were 0.16 and 1 mg/kg. The lack of consistency with the analytical results for the replicate sample illustrate the variability of the mercury in the sediment and of the gelatinous sediment.

CT Labs operates a formal quality assurance program to demonstrate the precision and bias of the method as performed by the laboratory and procedures for determining the limit of detection and reporting limit. CT Labs' quality assurance program is required as part of maintaining their WDNR and Department of Defense certifications. The minimum requirements of this program consist of an initial demonstration of laboratory proficiency, ongoing analysis of standards and blanks as a test of continued performance, and the analysis of laboratory control spikes and matrix spikes to assess accuracy and/or precision.

6.0 VOLUMETRIC AND SEDIMENT THICKNESS MODELING

Volumetric and sediment thickness modeling was completed based on the sample locations and mercury-impacted sediment thicknesses from both the 2016 and 2018 sediment investigations. Figure 7 displays the mercury-impacted sediment thickness isopach lines. The isopachs are contour lines of equal thicknesses of the mercury-impacted sediment. The isopachs were constructed by taking the depth the of mercury-impacted sediment minus the top of the sediment. A three-dimensional surface of the mercury-impacted sediment was compared to the surface created by the bathymetry of GGB. The difference between these two surfaces helped create the isopach contour lines. At locations where the lowest sample interval had mercury concentrations above the MPBC, the depth the native clay was used to determine the sediment thickness. At locations where the top 6-inches of sediment were below the MPBC but there was mercury-impacted below, the clean sediment was included in the thickness because that sediment would need to be removed to access the mercury-impacted sediment below. The zero-foot boundary on the southeastern corner by the Wisconsin River is only estimated. No sediment samples were collected south of sample locations GGB-96 or GGB-97. The isopach lines in this area could not be closed due to the lack of horizontal and vertical delineation of the mercury-impacted sediment.

The mercury-impacted sediment thickness was generally less than 2 feet toward the northwest (toward Highway 78). In the southeast portion of GGB, closer to the Wisconsin River, the sediment thicknesses increase to more than 3 feet. A few pockets of thicker sediment, 4 to 6 feet, were identified in the center and towards the Wisconsin River. The modeling effort was also utilized to estimate an in-place mercury-impacted sediment volume of 54,120 cubic yards covering approximately 17.27 acres.

7.0 REPORT LIMITATIONS

As shown in Figure 6, the southeastern extent of the study area ends at sample locations GGB-96 and GGB-97. These two sample locations were evaluated to determine if mercury-impacted sediment extended further southeast toward the Wisconsin River. The results of the analytical testing for the samples associated with these two locations, yielded mercury concentrations ranging from 0.36 to 2.5 mg/kg. Based on the analytical results from the samples at these two locations, the horizontal and vertical extent of the mercury-impacted sediment toward the Wisconsin River was estimated. Additional sampling locations, further south, southeast and southwest of GGB-96 and GGB-97 would further delineate the limits of mercury-impacted sediment toward the Wisconsin River.

8.0 SUMMARY AND CONCLUSIONS

From June 11 to 18, 2018, SPS collected 79 sediment samples from 40 of the 41 proposed sample locations in GGB. These 79 samples were laboratory analyzed for mercury and percent solids. Based on the lack of soft sediment, a sediment sample was not collected from the GGB-48 location. Sediment samples collected for laboratory analyses were obtained from 0 to 2.9 feet. The sample depths were measured from the top of the recovered sediment core to the bottom of the recovered core. The sediment consisted of an upper thin layer (within the top 1.6 feet) of watery gelatinous "mud" sediment underlain by a thicker layer of firmer fine-grained sediment, down to the underlying native clay bottom.

Mercury concentrations ranged from non-detect to 12.4 mg/kg as a whole and from 0.37 to 4 mg/kg in the top 0.5 feet in GGB. Samples collected from the center of the bay tended to have the greatest percentage of gelatinous "mud" sediment and, therefore, higher mercury concentrations. Almost all the gelatinous sediment is located within the extent of mercury above the MPBC. Forty-three samples (at 27 locations) identified concentrations exceeding the mercury MPBC of 0.36 mg/kg. The frequency of mercury concentrations above the MPBC decreased with depth in the sediment cores. Thirty-one of the 40 sediment samples collected from the bottom of the sample cores had mercury concentrations below the MPBC. This indicates that the vertical distribution of mercury-impacted sediment is greatly reduced before encountering the native clay bottom.

For sediment with mercury concentrations exceeding the MPBC, modeling indicated that sediment thicknesses varied from 0 to greater than 5 feet but were generally 1 to 4 feet thick. The mercury-impacted sediment was generally found to be thickest down the center of GGB and close to the Wisconsin River. Volumetric modeling estimates indicated an in-place mercury-impacted sediment volume of 54,120 cubic yards within a 17.27-acre area.

This sediment sampling investigation further delineated the mercury-impacted sediment and quantified the residual sediments within GGB. Based on the mercury concentrations found above the MPBC in sample locations GGB-96 and GGB-97, the Army intends to

perform additional delineation of the limits of mercury-impacted sediment towards the Wisconsin River.

The Army is currently evaluating remediation technologies to address the mercury-impacted sediment in the GGB.

9.0 REFERENCES

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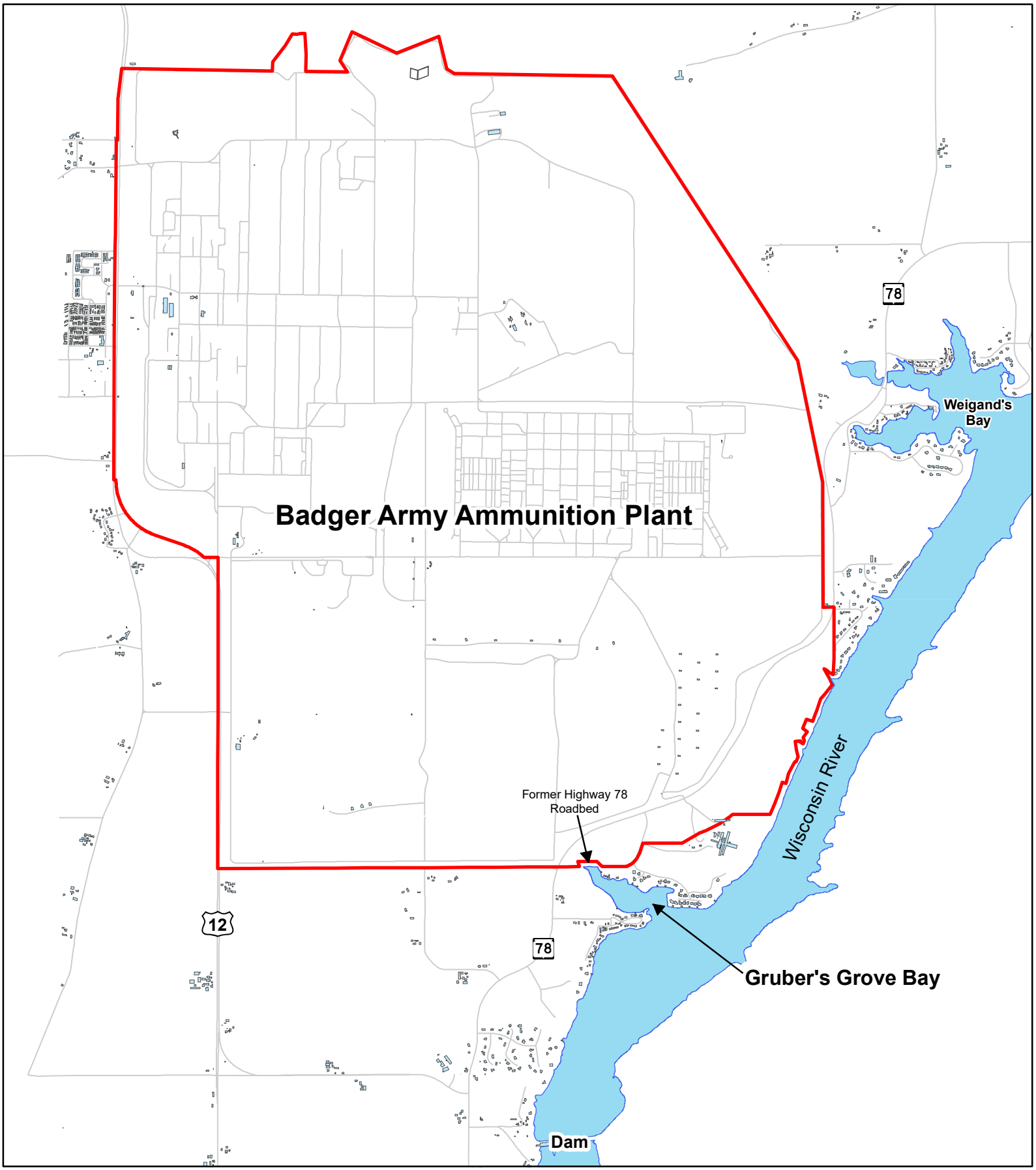
19. Wisconsin Department of Natural Resources, 2018. 23 January

Figures



Legend

- Badger Army Ammunition Plant Boundary
- Road
- Existing Building

Figure 1

Site Location Map
Gruber's Grove Bay Sediment Sampling Report
Badger Army Ammunition Plant

1:38,321

0 5,200 10,400 Feet

SPS
SPECPRO PROFESSIONAL SERVICES

N

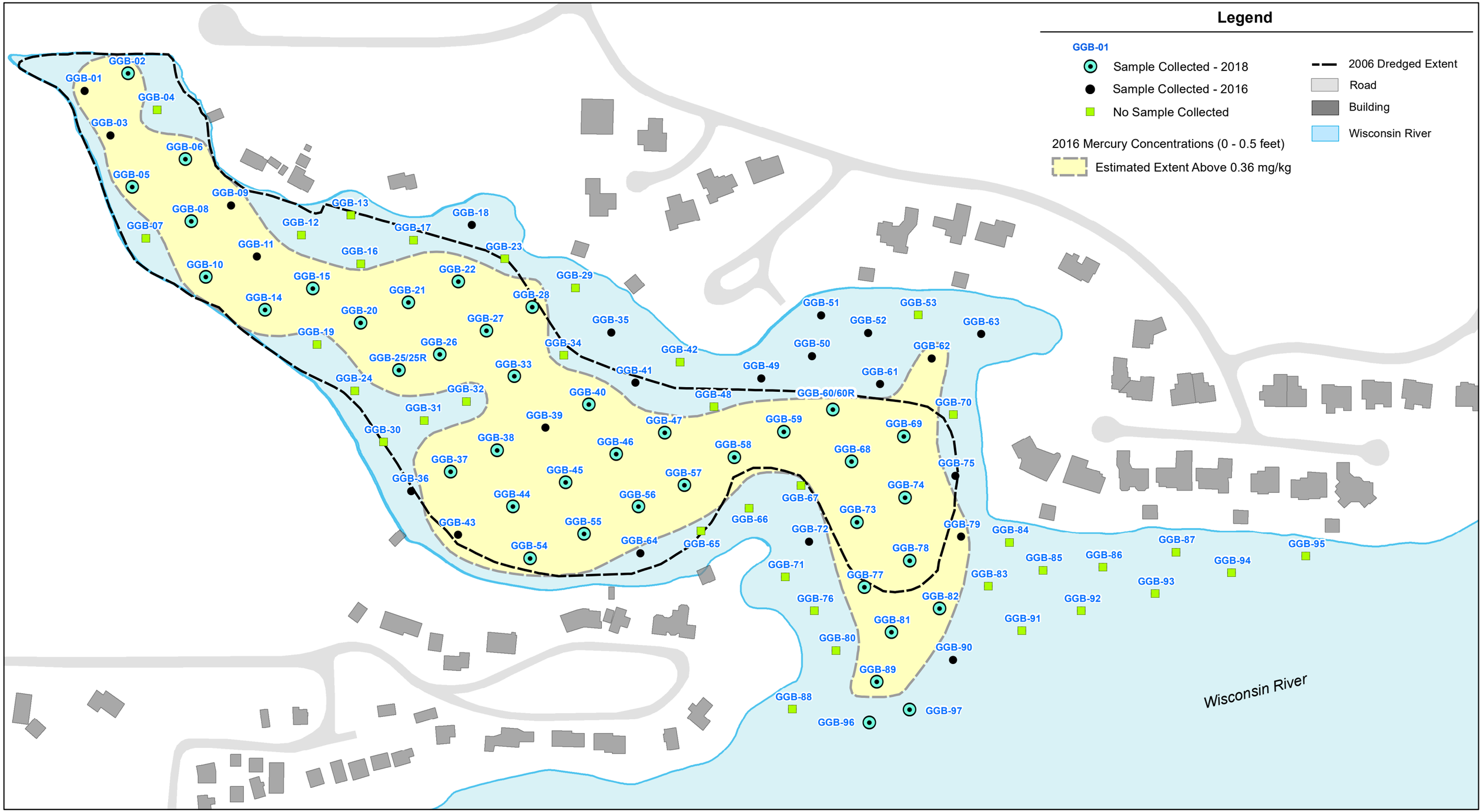


Figure 2

Sampling Locations
Gruber's Grove Bay Sediment Sampling Report
Badger Army Ammunition Plant

Feet
0 130 260 520 780 1,040

1:2,344

Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Vertical Datum: North American Vertical Datum 88 (NAVD 88)
Units: Foot US

Legend

Bathymetric Contours

Top of Sediment (Feet)

- 0.3 - 3.3
- 3.4 - 7.3
- 7.4 - 10.3
- 10.4 - 14.3
- 14.4 - 17.3
- 17.4 - 22.3

GGB-01
- Sample Collected - 2018
- Sample Collected - 2016
- No Sample Collected
- 2006 Dredged Extent
- Road
- Building
- Wisconsin River

Wisconsin River

Figure 3

Bathymetric Contours
Gruber's Grove Bay Sediment Sampling Report
Badger Army Ammunition Plant

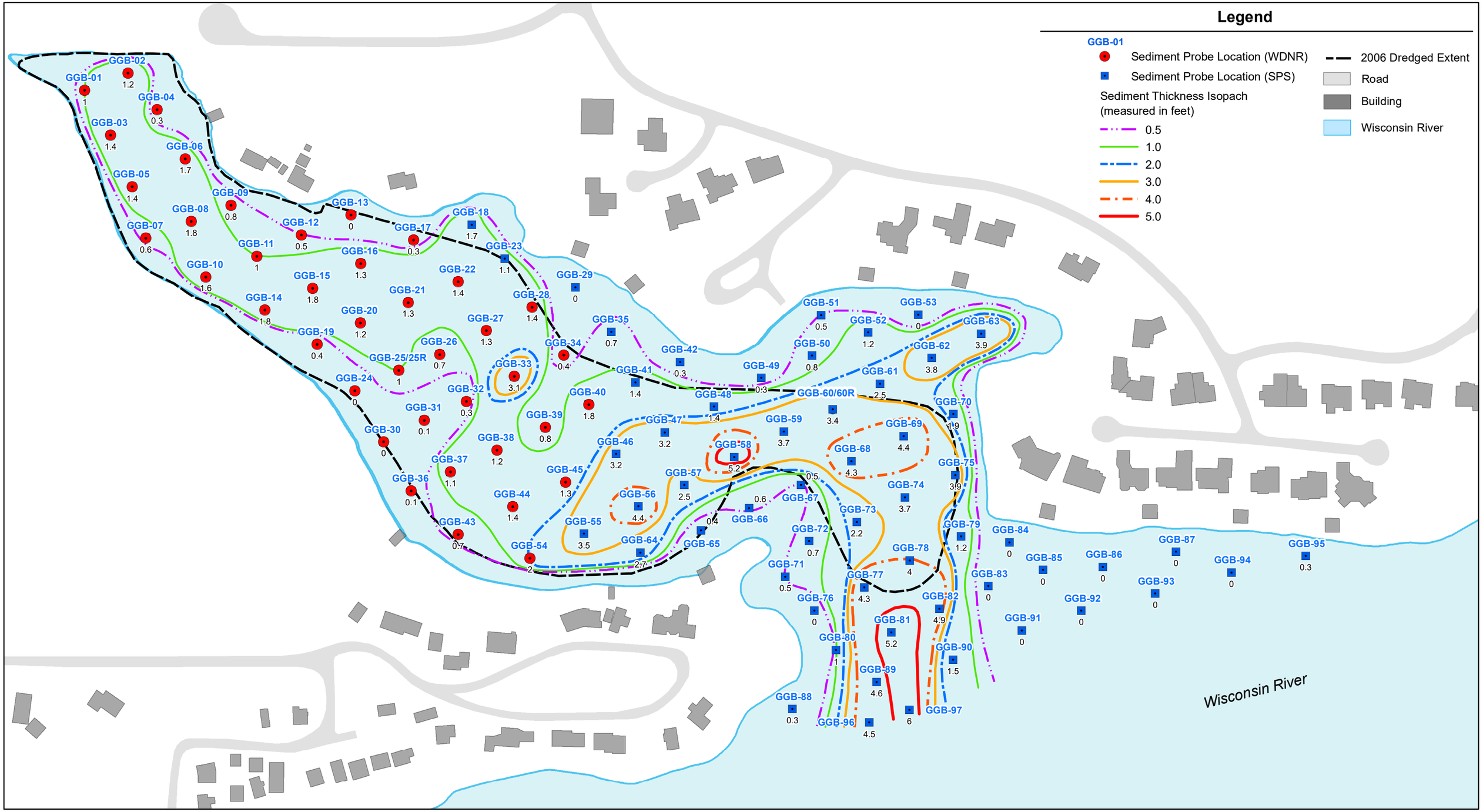
Bathymetric contour survey (sediment depth) conducted by Veolia ES Special Services, Inc. on 10/10/12.
Depths of GGB were obtained via multi-beam sonar survey.
Contours were updated with 2016 & 2018 sediment depth measurements collected with manual probe.

Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Vertical Datum: North American Vertical Datum 88 (NAVD 88)
Units: Foot US

0 130 260 520 780 1,040 Feet

SPS SPECPRO PROFESSIONAL SERVICES

1:2,344



Note: The type of probe used for measuring the bottom of the sediment changed on February 8, 2016 from SPS to WDNR.
SPS probe was narrow with a drive point bottom.
WDNR probe was wider with a mushroom shaped bottom.

Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Vertical Datum: North American Vertical Datum 88 (NAVD 88)
Units: Foot US

Figure 4

Sediment Thickness Isopach
Gruber's Grove Bay Sediment Sampling Report
Badger Army Ammunition Plant

0 130 260 520 780 1,040 Feet

SPS SPECPRO PROFESSIONAL SERVICES

1:2,344

Legend

GGB-01

- Gelatinous Sediment Present
- Gelatinous Sediment Not Present
- Estimated Extent of Mercury above MPBC
- 2006 Dredged Extent
- Road
- Building
- Wisconsin River

Note: Most Probable Background Concentration (MPBC) = 0.36 mg/kg

GGB-01, GGB-02, GGB-03, GGB-04, GGB-05, GGB-06, GGB-07, GGB-08, GGB-09, GGB-10, GGB-11, GGB-12, GGB-13, GGB-14, GGB-15, GGB-16, GGB-17, GGB-18, GGB-19, GGB-20, GGB-21, GGB-22, GGB-23, GGB-24, GGB-25/25R, GGB-26, GGB-27, GGB-28, GGB-29, GGB-30, GGB-31, GGB-32, GGB-33, GGB-34, GGB-35, GGB-36, GGB-37, GGB-38, GGB-39, GGB-40, GGB-41, GGB-42, GGB-43, GGB-44, GGB-45, GGB-46, GGB-47, GGB-48, GGB-49, GGB-50, GGB-51, GGB-52, GGB-53, GGB-54, GGB-55, GGB-56, GGB-57, GGB-58, GGB-59, GGB-60/60R, GGB-61, GGB-62, GGB-63, GGB-64, GGB-65, GGB-66, GGB-67, GGB-68, GGB-69, GGB-70, GGB-71, GGB-72, GGB-73, GGB-74, GGB-75, GGB-76, GGB-77, GGB-78, GGB-79, GGB-80, GGB-81, GGB-82, GGB-83, GGB-84, GGB-85, GGB-86, GGB-87, GGB-88, GGB-89, GGB-90, GGB-91, GGB-92, GGB-93, GGB-94, GGB-95, GGB-96, GGB-97

Wisconsin River

Figure 5

Gelatinous Sediment Distribution
Gruber's Grove Bay Sediment Sampling Report
Badger Army Ammunition Plant

Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Vertical Datum: North American Vertical Datum 88 (NAVD 88)
Units: Foot US

0 130 260 520 780 1,040 Feet

SPS SPECPRO PROFESSIONAL SERVICES

1:2,344

Legend

GGB-01

- Sample Collected - 2018
- Sample Collected - 2016
- No Sample Collected
- Estimated Extent of Mercury above MPBC
- 2006 Dredged Extent
- Road
- Building
- Wisconsin River

Note: Most Probable Background Concentration (MPBC) = 0.36 mg/kg

Wisconsin River

Figure 6

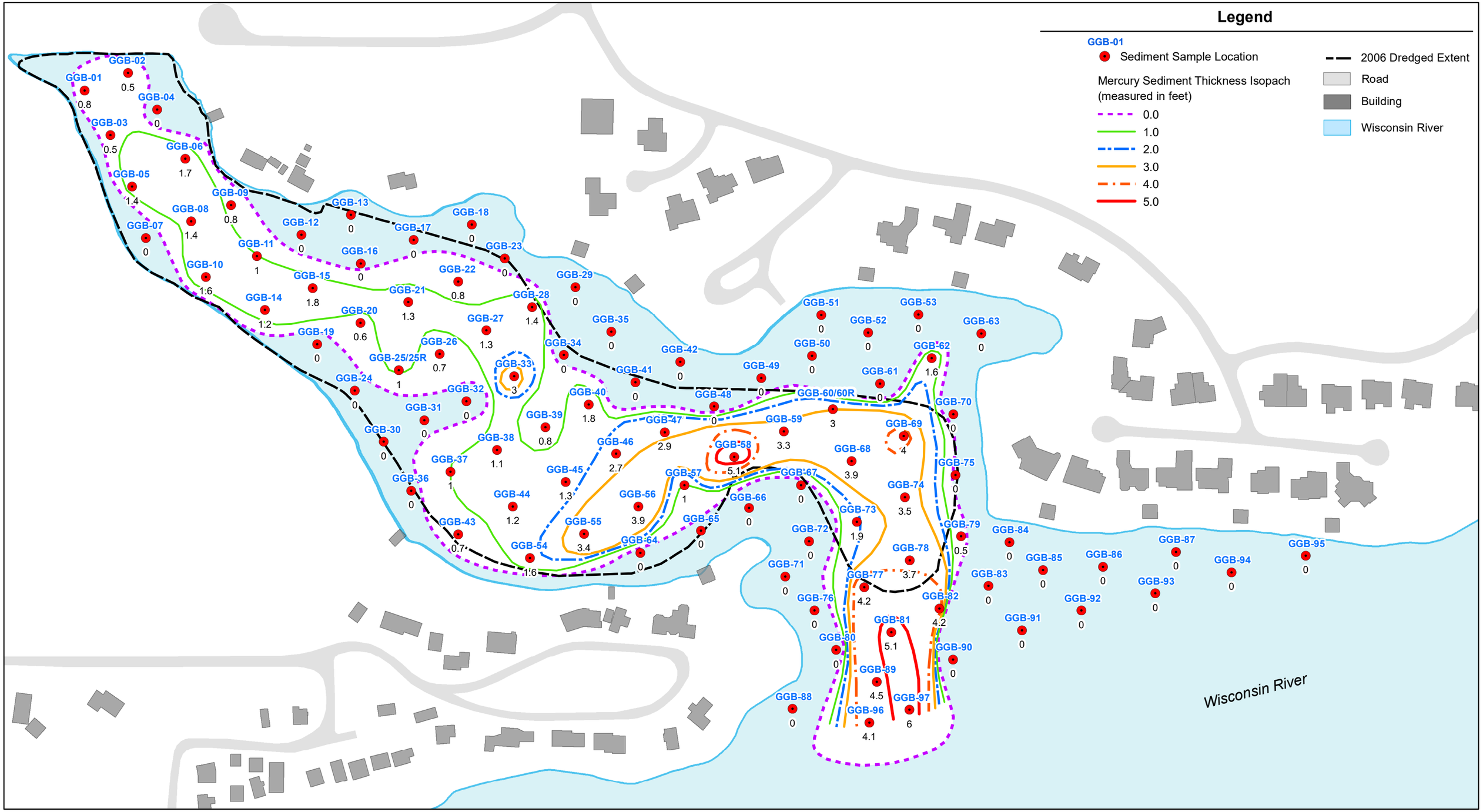
Estimated Extent of Mercury Above MPBC
Gruber's Grove Bay Sediment Sampling Report
Badger Army Ammunition Plant

Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Vertical Datum: North American Vertical Datum 88 (NAVD 88)
Units: Foot US

0 130 260 520 780 1,040 Feet

SPS SPECPRO PROFESSIONAL SERVICES

1:2,344



Note: The mercury sediment thickness isopach lines are based on the mercury concentrations that are above the Most Probable Background Concentration (MPBC) = 0.36 mg/kg.
The zero foot boundary on the southeastern corner by the Wisconsin River is only estimated.
No sediment samples were collected south of sample locations GGB-96 or GGB-97.

Figure 7

Mercury Sediment Thickness Isopach
Gruber's Grove Bay Sediment Sampling Report
Badger Army Ammunition Plant

Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Vertical Datum: North American Vertical Datum 88 (NAVD 88)
Units: Foot US

0 130 260 520 780 1,040 Feet

SPS SPECPRO PROFESSIONAL SERVICES

1:2,344

Tables

Table 1
2018 Sediment Sampling Locations
Gruber's Grove Bay Sediment Sampling Report

Sample Location	NAD 83 Northing	NAD 83 Easting
GGB-02	484565.9	2042202.4
GGB-05	484316.5	2042211.5
GGB-06	484377.5	2042327.9
GGB-08	484240.8	2042340.9
GGB-10	484118.6	2042372.8
GGB-14	484046.1	2042502.1
GGB-15	484093.6	2042607.6
GGB-20	484018.0	2042711.9
GGB-21	484062.7	2042816.9
GGB-22	484108.5	2042926.3
GGB-25	483913.9	2042796.3
GGB-25R	483913.9	2042793.3
GGB-26	483949.3	2042885.9
GGB-27	484000.9	2042988.1
GGB-28	484052.9	2043088.4
GGB-33	483900.6	2043049.5
GGB-37	483691.0	2042909.7
GGB-38	483738.9	2043011.4
GGB-40	483839.0	2043212.7
GGB-44	483615.3	2043046.1
GGB-45	483668.7	2043162.2
GGB-46	483730.0	2043273.1
GGB-47	483777.4	2043379.9
GGB-48	483834.1	2043487.7
GGB-54	483501.6	2043084.0
GGB-55	483555.1	2043202.7
GGB-56	483614.7	2043321.5
GGB-57	483662.0	2043422.5
GGB-58	483723.6	2043531.7
GGB-59	483780.0	2043640.7
GGB-60	483827.9	2043747.9
GGB-68	483714.2	2043789.2
GGB-69	483769.2	2043903.9
GGB-73	483581.0	2043800.7
GGB-74	483635.0	2043906.6
GGB-77	483437.8	2043817.4
GGB-78	483496.4	2043916.8
GGB-81	483339.1	2043876.5
GGB-82	483391.1	2043982.1
GGB-89	483230.3	2043844.4
GGB-96	483141.1	2043828.2
GGB-97	483169.0	2043916.0

Local Coordinate System: NAD 1983 State Plane Wisconsin South FIPS 4803 feet

Table 2
2018 Sediment Core Measurements
Gruber's Grove Bay Sediment Sampling Report

Sample Location	Lab Sample ID	Date Collected	Sample Interval (feet)[1]	Top of Sediment (feet)[2,3]	Top Sediment Elevation (feet MSL)[3]	Bottom of Sediment[2,3]	Bottom Sediment Elevation (feet MSL)[3]	Sediment Thickness[3]	Core Driven[3]	Core Recovery (feet)	Core Recovery (Percent)
GGB-02	02-2-18	6/11/18	0.5 - 1.1	7.0	767.1	8.2	765.9	1.2	1.7	1.1	65
GGB-05	05-2-18	6/11/18	0.5 - 1.3	7.2	766.9	8.6	765.5	1.4	1.4	1.3	93
GGB-06	06-2-18	6/12/18	0.5 - 0.8	9.9	764.2	11.6	762.5	1.7	1.7	0.8	47
GGB-08	08-2-18	6/12/18	0.5 - 0.9	10.3	763.8	12.1	762.0	1.8	2	0.9	45
GGB-10	10-1-18	6/12/18	0 - 0.5	9.0	765.1	10.6	763.5	1.6	2.7	1.5	56
	10-2-18		0.5 - 1.5								
	10-3-18		1.5								
GGB-14	14-2-18	6/12/18	0.5 - 0.8	10.8	763.3	12.6	761.5	1.8	2.3	0.9	39
	14-3-18		0.9								
GGB-15	15-2-18	6/12/18	0.5 - 0.8	12.0	762.1	13.8	760.3	1.8	2.7	0.8	30
GGB-20	20-2-18	6/13/18	0.5 - 1.1	12.8	761.3	14.0	760.1	1.2	1.4	1.1	79
GGB-21	21-2-18	6/13/18	0.5 - 1.5	12.7	761.4	14.0	760.1	1.3	2	1.5	75
	21-3-18		1.5								
GGB-22	22-1-18	6/13/18	0 - 0.5	11.8	762.3	13.2	760.9	1.4	2.2	1.1	50
	22-1-18(D)		0 - 0.5								
	22-2-18		0.5 - 1.1								
GGB-25	25-2-18	6/13/18	0.5 - 1.0	12.2	761.9	13.2	760.9	1.0	2.2	1	45
GGB-25R	25R-2-18	6/13/18	0.5 - 1.0	12.2	761.9	13.2	760.9	1.0	2.2	1	45
GGB-26	26-2-18	6/13/18	0.5 - 1.0	14.0	760.1	14.7	759.4	0.7	1.8	1	56
	26-2-18(D)		0.5 - 1.0								
GGB-27	27-2-18	6/13/18	0.5	14.5	759.6	15.8	758.3	1.3	1.1	0.1	9
GGB-28	28-2-18	6/13/18	0.5 - 0.8	11.7	762.4	13.1	761.0	1.4	1.7	0.8	47
GGB-33	33-2-18	6/14/18	0.5 - 1.5	15.9	758.2	19	755.1	3.1	3.5	2.5	71
	33-3-18		1.5 - 2.4								
	33-4-18		2.5								
GGB-37	37-2-18	6/12/18	0.5 - 0.6	14.2	759.9	15.3	758.8	1.1	1.3	0.6	46
GGB-38	38-2-18	6/12/18	0.5 - 0.6	15.8	758.3	17	757.1	1.2	2	0.6	30
GGB-40	40-2-18	6/13/18	0.5	15.7	758.4	17.5	756.6	1.8	2	0.5	25
GGB-44	44-2-18	6/12/18	0.5 - 0.6	15.8	758.3	17.2	756.9	1.4	1.6	0.6	38
GGB-45	45-1-18	6/12/18	0 - 0.3	17.2	756.9	18.5	755.6	1.3	1.9	0.3	16

Sample Location	Lab Sample ID	Date Collected	Sample Interval (feet)[1]	Top of Sediment (feet)[2,3]	Top Sediment Elevation (feet MSL)[3]	Bottom of Sediment[2,3]	Bottom Sediment Elevation (feet MSL)[3]	Sediment Thickness[3]	Core Driven[3]	Core Recovery (feet)	Core Recovery (Percent)
GGB-46	46-1-18	6/12/18	0 - 0.5	17.9	756.2	21.1	753.0	3.2	3.2	1.0	31
	46-2-18		0.5 - 1.0								
GGB-47	47-2-18	6/12/18	0.5 - 0.7	18.4	755.7	21.6	752.5	3.2	3	0.7	23
GGB-48	No Recovery	6/13/18	No Recovery	13.7	760.4	15.1	759.0	1.4	0	0	0
GGB-54	54-2-18	6/13/18	0.5 - 0.7	13.7	760.4	15.7	758.4	2.0	1.3	0.7	54
GGB-55	55-2-18	6/15/18	0.5 - 1.5	15.9	758.2	19.4	754.7	3.5	3	2.5	83
	55-3-18		1.5 - 2.4								
	55-4-18		2.4 - 2.5								
GGB-56	56-2-18	6/15/18	0.5 - 1.5	17.6	756.5	22	752.1	4.4	3.5	2	57
	56-3-18		1.5 - 2.0								
GGB-57	57-2-18	6/15/18	0.5 - 1.0	18.6	755.5	21.1	753.0	2.5	2.5	1	40
GGB-58	58-1-18	6/18/18	0 - 0.5	17.8	756.3	23	751.1	5.2	5.2	2.9	56
	58-2-18		0.5 - 1.5								
	58-2-18(D)		0.5 - 1.5								
	58-3-18		1.5 - 2.8								
	58-4-18		2.8 - 2.9								
GGB-59	59-2-18	6/18/18	0.5 - 1.5	18.3	755.8	22	752.1	3.7	3.7	1.7	46
	59-3-18		1.5 - 1.7								
GGB-60	60-2-18	6/18/18	0.5 - 1.5	18.2	755.9	20.9	753.2	2.7	3.4	1.9	56
	60-3-18		1.5 - 1.9								
GGB-68	68-2-18	6/18/18	0.5 - 1.5	18.2	755.9	22.5	751.6	4.3	4.3	1.9	44
	68-3-18		1.5 - 1.9								
GGB-69	69-2-18	6/18/18	0.5 -1.5	18.6	755.5	23.0	751.1	4.4	4.4	2.4	55
	69-3-18		1.5 - 2.4								
GGB-73	73-2-18	6/15/18	0.5 - 0.8	17.8	756.3	20.0	754.1	2.2	2.2	0.8	36
GGB-74	74-2-18	6/18/18	0.5 - 1.0	19.8	754.3	23.5	750.6	3.7	3.7	1	27
GGB-77	77-1-18	6/15/18	0 - 0.5	18.3	755.8	22.6	751.5	4.3	4.3	2.3	53
	77-1-18(D)		0 - 0.5								
	77-2-18		0.5 - 1.5								
	77-3-18		1.5 - 2.2								
	77-4-18		2.2 - 2.3								
GGB-78	78-1-18	6/14/18	0 - 0.5	20.9	753.2	24.9	749.2	4.0	4	1.8	45
	78-2-18		0.5 - 1.5								
	78-3-18		1.5 - 1.8								

Sample Location	Lab Sample ID	Date Collected	Sample Interval (feet)[1]	Top of Sediment (feet)[2,3]	Top Sediment Elevation (feet MSL)[3]	Bottom of Sediment[2,3]	Bottom Sediment Elevation (feet MSL)[3]	Sediment Thickness[3]	Core Driven[3]	Core Recovery (feet)	Core Recovery (Percent)
GGB-81	81-2-18	6/14/18	0.5 - 1.5	20.1	754.0	25.3	748.8	5.2	5.2	1.6	31
	81-3-18		1.5 - 1.6								
GGB-82	82-2-18	6/14/18	0.5 -1.5	19.2	754.9	24.1	750.0	4.9	4.9	2.2	45
	82-3-18		1.5 - 2.2								
GGB-89	89-1-18	6/14/18	0 - 0.5	20.9	753.2	25.5	748.6	4.6	4.6	2.6	57
	89-2-18		0.5 - 1.5								
	89-3-18		1.5 - 2.5								
	89-4-18		2.5 - 2.6								
GGB-96	96-1-18	6/14/18	0 - 0.5	20.8	753.3	25.3	748.8	4.5	4.5	2.9	64
	96-2-18		0.5 - 1.5								
	96-2-18(D)		0.5 - 1.5								
	96-3-18		1.5 - 2.5								
	96-4-18		2.5 - 2.9								
GGB-97	97-1-18	6/14/18	0 - 0.5	19.7	754.4	25.7	748.4	6	6	2.2	37
	97-2-18		0.5 - 1.5								
	97-3-18		1.5 - 2.2								

Notes:

(1) - Measured in feet from top of recovered sample

(2) - Measured in feet below water surface

(3) - Based on 2016 sampling event, except samples GGB-96 & 97

Table 3
Sediment Core Desrcription
Gruber's Grove Bay Sediment Sampling Report

Sample Location	Date Collected	Measured Sediment Thickness (feet)[1]	Gelatinous Sediment Thickness (feet)	Core Driven (feet)[1]	Core Recovery (feet)	Core Recovery Percent	Core Section (feet)[2]	Core Section Description
GGB-02	6/11/18	1.2	0	1.7	1.1	65	0-0.5	black, silty clay, cohesive, soft
							0.5-1.1	dark gray, silty clay, cohesive, firmer
GGB-05	6/11/18	1.4	0.3	1.4	1.3	93	0-0.3	black, very fine-grained gelatinous sediment, non-cohesive, wet, trace brown silt
							0.3-1.3	dark gray, silty clay, cohesive, firm
GGB-06	6/12/18	1.7	0.4	1.7	0.8	47	0-0.4	black, very fine-grained gelatinous sediment, non-cohesive, wet, trace brown silt
							0.4-0.8	black, silty clay, cohesive, soft
GGB-08	6/12/18	1.8	0.2	2	0.9	45	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet, trace brown silt
							0.2-0.9	black, silty clay, cohesive, soft
GGB-10	6/12/18	1.6	0.1	2.7	1.5	56	0-0.1	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.1-1.1	black, silty clay, cohesive, soft
							1.1-1.5	dark gray, silty clay, cohesive, firmer
GGB-14	6/12/18	1.8	0.3	2.3	0.9	39	0-0.3	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.3-0.8	black, silty clay, cohesive, soft
							0.8-0.9	dark gray, silty clay, cohesive, firmer
GGB-15	6/12/18	1.8	0.2	2.7	0.8	30	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.2-0.8	black, silty clay, cohesive, soft
GGB-20	6/13/18	1.2	0.2	1.4	1.1	79	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.2-1.1	black, silty clay, cohesive
GGB-21	6/13/18	1.3	1.0	2	1.5	75	0-1.0	black, very fine-grained gelatinous sediment, non-cohesive, wet
							1.0-1.5	black, silty clay, cohesive
GGB-22	6/13/18	1.4	0.4	2.2	1.1	50	0-0.4	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.4-1.1	black, silty clay, cohesive, firm
GGB-25	6/13/18	1.0	0.2	2.2	1	45	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.2-0.4	black, silty clay, soft, moist
							0.4-1.0	black, silty clay, cohesive, firmer
GGB-25R	6/13/18	1.0	0	2.2	1	45	0-0.2	black, silty clay, soft, moist
							0.2-1.0	black, silty clay, cohesive, firmer
GGB-26	6/13/18	0.7	0.4	1.8	1	56	0-0.4	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.4-1.0	black, silty clay, soft, moist
GGB-27	6/13/18	0.1	0	1.1	0.1	9	0-0.1	black, silty clay, soft, moist
GGB-28	6/13/18	1.4	0.4	1.7	0.8	47	0-0.4	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.4-0.8	black, silty clay, soft, moist

Sample Location	Date Collected	Measured Sediment Thickness (feet)[1]	Gelatinous Sediment Thickness (feet)	Core Driven (feet)[1]	Core Recovery (feet)	Core Recovery Percent	Core Section (feet)[2]	Core Section Description
GGB-33	6/14/18	3.1	1.3	3.5	2.5	71	0-1.3	black, very fine-grained gelatinous sediment, non-cohesive, wet
							1.3-1.9	black, silty clay, soft, moist
							1.9-2.5	dark gray, silty clay, cohesive, firm
GGB-37	6/12/18	1.1	0.2	1.3	0.6	46	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.2-0.6	black, silty clay, soft, moist
GGB-38	6/12/18	1.2	0.3	2	0.6	30	0-0.3	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.3-0.6	dark gray, silty clay, cohesive, soft
GGB-40	6/13/18	1.8	0.2	2	0.5	25	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.2-0.4	black, silty clay, soft, moist
							0.4-0.5	dark gray, silty clay, cohesive, firmer
GGB-44	6/12/18	1.4	0.4	1.6	0.6	38	0-0.4	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.4-0.6	dark gray, silty clay, cohesive, moist
GGB-45	6/12/18	1.3	0.2	1.9	0.3	16	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.2-0.3	black, silt, soft, cohesive, moist
GGB-46	6/12/18	3.2	0.4	3.2	1	31	0-0.4	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.4-1.0	dark gray, silty clay, cohesive
GGB-47	6/12/18	3.2	0.3	3	0.7	23	0-0.3	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.3-0.7	dark gray, silt, soft, moist
GGB-48	6/13/18	1.4	-	0	0	0	0	no recovery
GGB-54	6/13/18	2.0	0.2	1.3	0.7	54	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.2-0.3	black, silt, soft, moist
							0.3-0.7	dark gray, silt, cohesive
GGB-55	6/15/18	3.5	0.8	3.5	2.5	71	0-0.8	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.8-2.0	black, silt, soft, moist
							2.0-2.5	dark gray, silty clay, cohesive, moist
GGB-56	6/15/18	4.4	0.6	3.5	2	57	0-0.6	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.6-1.3	black, silt, soft, moist
							1.3-2.0	dark gray, silty clay, cohesive, firm
GGB-57	6/15/18	2.5	0.2	2.5	1	40	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.2-1.0	black, silt, soft, moist
GGB-58	6/18/18	5.2	1.0	5.2	2.9	56	0-1.0	black, very fine-grained gelatinous sediment, non-cohesive, wet
							1.0-2.2	black, silt, soft, moist
							2.2-2.9	black, silty clay, firm, moist
GGB-59	6/18/18	3.7	0.3	3.7	1.7	46	0-0.3	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.3-1.3	black, silt, soft, moist
							1.3-1.7	dark gray, silty clay, firm
GGB-60	6/18/18	3.4	0.4	3.4	1.9	56	0-0.4	black, very fine-grained gelatinous sediment, non-cohesive, wet

Sample Location	Date Collected	Measured Sediment Thickness (feet)[1]	Gelatinous Sediment Thickness (feet)	Core Driven (feet)[1]	Core Recovery (feet)	Core Recovery Percent	Core Section (feet)[2]	Core Section Description
							0.4-1.3	black, silt, soft, moist
							1.3-1.9	gray, clay, cohesive, firm
GGB-68	6/18/18	4.3	0.6	4.3	1.9	44	0-0.6	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.6-1.5	black, silt, soft, moist
							1.5-1.9	dark gray, silty clay, firm
GGB-69	6/18/18	4.4	0.8	4.4	2.4	55	0-0.8	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.8-1.4	dark gray/black, silt, soft, moist
							1.4-2.4	dark gray, silty clay, cohesive, firm
GGB-73	6/15/18	2.2	0.2	2.2	0.8	36	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet, trace brown silt
							0.2-0.4	dark gray, silty clay, soft, moist
							0.4-0.8	gray, sandy clay, firm
GGB-74	6/18/18	3.7	0.2	3.7	1	27	0-0.2	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.2-0.8	dark gray/black, silty clay, cohesive, wet
							0.8-1.0	gray, sandy clay, firm
GGB-77	6/15/18	4.3	1.3	4.3	2.3	53	0-1.3	black, very fine-grained gelatinous sediment, non-cohesive, wet
							1.3-1.8	black, silt, soft, wet
							1.8-2.3	dark gray, silty clay, firm
GGB-78	6/14/18	4.0	0.6	4	1.8	45	0-0.6	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.6-1.3	black, silt, soft, wet
							1.3-1.8	dark gray, silty clay, firm
GGB-81	6/14/18	5.2	0.3	5.2	1.6	31	0-0.3	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.3-1.1	black, silt, soft, wet
							1.1-1.6	dark gray, silty clay, firm
GGB-82	6/14/18	4.9	0.6	4.9	2.2	45	0-0.6	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.6-1.7	black, silt, soft, moist
							1.7-2.2	dark gray, silty clay, firm
GGB-89	6/14/18	4.6	1.0	4.6	2.6	57	0-1.0	black, very fine-grained gelatinous sediment, non-cohesive, wet
							1.0-2.1	black, silt, soft, wet
							2.1-2.6	black, silty clay, firm
GGB-96	6/14/18	4.5	1.6	4.5	2.9	64	0-1.6	black, very fine-grained gelatinous sediment, non-cohesive, wet
							1.6-2.0	black, silt, soft, wet
							2.0-2.9	black, silty clay, firm
GGB-97	6/14/18	6	0.9	5	2.2	44	0-0.9	black, very fine-grained gelatinous sediment, non-cohesive, wet
							0.9-1.7	black, silt, soft, wet
							1.7-2.2	black, silty clay, firm

Notes:

(1) - Based on 2016 sampling event, except samples GGB-96 & 97

(2) - Measured in feet from top of recovered sample

Table 4
Sediment Mercury Analytical Results
Gruber's Grove Bay Sediment Sampling Report

Sample Location	Date Collected	Lab Sample ID	Sample Interval (feet)[(1)]	Mercury Concentration (mg/kg)
GGB-02	6/11/18	02-2-18	0.5 - 1.1	0.068
GGB-05	6/11/18	05-2-18	0.5 - 1.3	**0.8**
GGB-06	6/12/18	06-2-18	0.5 - 0.8	**6.1**
GGB-08	6/12/18	08-2-18	0.5 - 0.9	<0.003
GGB-10	6/12/18	10-1-18	0 - 0.5	**4**
	6/12/18	10-2-18	0.5 - 1.5	**0.45**
	6/12/18	10-3-18	1.5	0.077
GGB-14	6/12/18	14-2-18	0.5 - 0.8	0.11
	6/12/18	14-3-18	0.9	0.087
GGB-15	6/12/18	15-2-18	0.5 - 0.8	**1.3**
GGB-20	6/13/18	20-2-18	0.5 - 1.1	0.12
GGB-21	6/13/18	21-2-18	0.5 - 1.5	**4.3**
	6/13/18	21-3-18	1.5	0.01
GGB-22	6/13/18	22-1-18	0 - 0.5	**3.6**
	6/13/18	22-1-18(D)	0 - 0.5	**3.1**
	6/13/18	22-2-18	0.5 - 1.1	0.12
GGB-25	6/13/18	25-2-18	0.5 - 1.0	0.16
GGB-25R	6/13/18	25R-2-18	0.5 - 1.0	**1**
GGB-26	6/13/18	26-2-18	0.5 - 1.0	0.056
	6/13/18	26-2-18(D)	0.5 - 1.0	0.12
GGB-27	6/13/18	27-2-18	0.5	0.25
GGB-28	6/13/18	28-2-18	0.5 - 0.8	**8.8**
GGB-33	6/14/18	33-2-18	0.5 - 1.5	**3**
	6/14/18	33-3-18	1.5 - 2.4	**2.7**
	6/14/18	33-4-18	2.5	0.0093
GGB-37	6/12/18	37-2-18	0.5 - 0.6	0.18
GGB-38	6/12/18	38-2-18	0.5 - 0.6	0.14
GGB-40	6/13/18	40-2-18	0.5	**0.56**
GGB-44	6/12/18	44-2-18	0.5 - 0.6	0.082
GGB-45	6/12/18	45-1-18	0 - 0.3	**0.56**
GGB-46	6/12/18	46-1-18	0 - 0.5	**1.8**
	6/12/18	46-2-18	0.5 - 1.0	0.17
GGB-47	6/12/18	47-2-18	0.5 - 0.7	0.14
GGB-48	6/13/18	No Recovery		
GGB-54	6/13/18	54-2-18	0.5 - 0.7	0.1
GGB-55	6/15/18	55-2-18	0.5 - 1.5	0.25
	6/15/18	55-3-18	1.5 - 2.4	**3.1**
	6/15/18	55-4-18	2.4 - 2.5	0.043
GGB-56	6/15/18	56-2-18	0.5 - 1.5	**12.4**
	6/15/18	56-3-18	1.5 - 2.0	0.16

Sample Location	Date Collected	Lab Sample ID	Sample Interval (feet)[(1)]	Mercury Concentration (mg/kg)
GGB-57	6/15/18	57-2-18	0.5 - 1.0	0.15
GGB-58	6/18/18	58-1-18	0 - 0.5	**1.4**
	6/18/18	58-2-18	0.5 - 1.5	**1.9**
	6/18/18	58-2-18(D)	0.5 - 1.5	**1.8**
	6/18/18	58-3-18	1.5 - 2.8	**4.3**
	6/18/18	58-4-18	2.8 - 2.9	0.078
GGB-59	6/18/18	59-2-18	0.5 - 1.5	**1.8**
	6/18/18	59-3-18	1.5 - 1.7	0.063
GGB-60	6/18/18	60-2-18	0.5 - 1.5	**3.4**
	6/18/18	60-3-18	1.5 - 1.9	0.038
GGB-68	6/18/18	68-2-18	0.5 - 1.5	**2.5**
	6/18/18	68-3-18	1.5 - 1.9	0.11
GGB-69	6/18/18	69-2-18	0.5 -1.5	**2.7**
	6/18/18	69-3-18	1.5 - 2.4	0.092
GGB-73	6/15/18	73-2-18	0.5 - 0.8	0.051
GGB-74	6/18/18	74-2-18	0.5 - 1.0	**0.48**
GGB-77	6/15/18	77-1-18	0 - 0.5	**1.1**
	6/15/18	77-1-18(D)	0 - 0.5	**0.98**
	6/15/18	77-2-18	0.5 - 1.5	**0.81**
	6/15/18	77-3-18	1.5 - 2.2	**1.1**
	6/15/18	77-4-18	2.2 - 2.3	0.11
GGB-78	6/14/18	78-1-18	0 - 0.5	**0.37**
	6/14/18	78-2-18	0.5 - 1.5	**0.72**
	6/14/18	78-3-18	1.5 - 1.8	0.13
GGB-81	6/14/18	81-2-18	0.5 - 1.5	**3**
	6/14/18	81-3-18	1.5 - 1.6	0.035
GGB-82	6/14/18	82-2-18	0.5 -1.5	**2.3**
	6/14/18	82-3-18	1.5 - 2.2	0.13
GGB-89	6/14/18	89-1-18	0 - 0.5	**0.97**
	6/14/18	89-2-18	0.5 - 1.5	**0.98**
	6/14/18	89-3-18	1.5 - 2.5	**2.8**
	6/14/18	89-4-18	2.5 - 2.6	0.074
GGB-96	6/14/18	96-1-18	0 - 0.5	**0.52**
	6/14/18	96-2-18	0.5 - 1.5	**0.56**
	6/14/18	96-2-18(D)	0.5 - 1.5	**0.5**
	6/14/18	96-3-18	1.5 - 2.5	**2.5**
	6/14/18	96-4-18	2.5 - 2.9	0.098
GGB-97	6/14/18	97-1-18	0 - 0.5	0.36
	6/14/18	97-2-18	0.5 - 1.5	**2.2**
	6/14/18	97-3-18	1.5 - 2.2	**1.5**

Notes:
(1) - Measured in feet from top of recovered sample
(D) - Identifies a field duplicate sample
Mercury concentrations are in milligrams per kilogram (mg/kg) dry
No Recovery - Indicates sample could not be obtained for laboratory analysis
Bolded mercury concentrations are above the MPBC = 0.36 mg/kg

Table 5
Percent Solids Comparison
Gruber's Grove Bay Sediment Sampling Report

Sample Location	Date Collected	Lab Sample ID	Sample Interval (feet)[(1)]	Mercury Concentration (mg/kg)	Percent Solids
GGB-02	6/11/18	02-2-18	0.5 - 1.1	0.068	68
GGB-05	6/11/18	05-2-18	0.5 - 1.3	0.8	49.5
GGB-06	6/12/18	06-2-18	0.5 - 0.8	6.1	25.4
GGB-08	6/12/18	08-2-18	0.5 - 0.9	<0.003	69.3
GGB-10	6/12/18	10-1-18	0 - 0.5	4	13.5
	6/12/18	10-2-18	0.5 - 1.5	0.45	38.7
	6/12/18	10-3-18	1.5	0.077	62.6
GGB-14	6/12/18	14-2-18	0.5 - 0.8	0.11	64.5
	6/12/18	14-3-18	0.9	0.087	66.6
GGB-15	6/12/18	15-2-18	0.5 - 0.8	1.3	54.3
GGB-20	6/13/18	20-2-18	0.5 - 1.1	0.12	63.2
GGB-21	6/13/18	21-2-18	0.5 - 1.5	4.3	27
	6/13/18	21-3-18	1.5	0.01	63.7
GGB-22	6/13/18	22-1-18	0 - 0.5	3.6	23.7
	6/13/18	22-1-18(D)	0 - 0.5	3.1	24.1
	6/13/18	22-2-18	0.5 - 1.1	0.12	61
GGB-25	6/13/18	25-2-18	0.5 - 1.0	0.16	55.3
GGB-25R	6/13/18	25R-2-18	0.5 - 1.0	1	42.2
GGB-26	6/13/18	26-2-18	0.5 - 1.0	0.056	63.7
	6/13/18	26-2-18(D)	0.5 - 1.0	0.12	61.5
GGB-27	6/13/18	27-2-18	0.5	0.25	61.7
GGB-28	6/13/18	28-2-18	0.5 - 0.8	8.8	28.9
GGB-33	6/14/18	33-2-18	0.5 - 1.5	3	17.7
	6/14/18	33-3-18	1.5 - 2.4	2.7	28.5
	6/14/18	33-4-18	2.5	0.0093	60.8
GGB-37	6/12/18	37-2-18	0.5 - 0.6	0.18	55.9
GGB-38	6/12/18	38-2-18	0.5 - 0.6	0.14	55.5
GGB-40	6/13/18	40-2-18	0.5	0.56	49.9
GGB-44	6/12/18	44-2-18	0.5 - 0.6	0.082	51.9
GGB-45	6/12/18	45-1-18	0 - 0.3	0.56	42.8
GGB-46	6/12/18	46-1-18	0 - 0.5	1.8	30.9
	6/12/18	46-2-18	0.5 - 1.0	0.17	46.6
GGB-47	6/12/18	47-2-18	0.5 - 0.7	0.14	52.2
GGB-48	6/13/18	No Recovery			
GGB-54	6/13/18	54-2-18	0.5 - 0.7	0.1	70.1
GGB-55	6/15/18	55-2-18	0.5 - 1.5	0.25	19.6
	6/15/18	55-3-18	1.5 - 2.4	3.1	26.1
	6/15/18	55-4-18	2.4 - 2.5	0.043	53.4
GGB-56	6/15/18	56-2-18	0.5 - 1.5	12.4	23.3
	6/15/18	56-3-18	1.5 - 2.0	0.16	54.9
GGB-57	6/15/18	57-2-18	0.5 - 1.0	0.15	56.5

Sample Location	Date Collected	Lab Sample ID	Sample Interval (feet)[(1)]	Mercury Concentration (mg/kg)	Percent Solids
GGB-58	6/18/18	58-1-18	0 - 0.5	1.4	14.4
	6/18/18	58-2-18	0.5 - 1.5	1.9	18.7
	6/18/18	58-2-18(D)	0.5 - 1.5	1.8	17.9
	6/18/18	58-3-18	1.5 - 2.8	4.3	23.9
	6/18/18	58-4-18	2.8 - 2.9	0.078	59.4
GGB-59	6/18/18	59-2-18	0.5 - 1.5	1.8	30.3
	6/18/18	59-3-18	1.5 - 1.7	0.063	65.4
GGB-60	6/18/18	60-2-18	0.5 - 1.5	3.4	26.8
	6/18/18	60-3-18	1.5 - 1.9	0.038	62.6
GGB-68	6/18/18	68-2-18	0.5 - 1.5	2.5	25.0
	6/18/18	68-3-18	1.5 - 1.9	0.11	62.8
GGB-69	6/18/18	69-2-18	0.5 -1.5	2.7	26.5
	6/18/18	69-3-18	1.5 - 2.4	0.092	64.4
GGB-73	6/15/18	73-2-18	0.5 - 0.8	0.051	81.4
GGB-74	6/18/18	74-2-18	0.5 - 1.0	0.48	51.6
GGB-77	6/15/18	77-1-18	0 - 0.5	1.1	14.9
	6/15/18	77-1-18(D)	0 - 0.5	0.98	16.4
	6/15/18	77-2-18	0.5 - 1.5	0.81	18.5
	6/15/18	77-3-18	1.5 - 2.2	1.1	33.4
	6/15/18	77-4-18	2.2 - 2.3	0.11	55.4
GGB-78	6/14/18	78-1-18	0 - 0.5	0.37	12.5
	6/14/18	78-2-18	0.5 - 1.5	0.72	14.5
	6/14/18	78-3-18	1.5 - 1.8	0.13	56.7
GGB-81	6/14/18	81-2-18	0.5 - 1.5	3	37.1
	6/14/18	81-3-18	1.5 - 1.6	0.035	58.0
GGB-82	6/14/18	82-2-18	0.5 -1.5	2.3	25.1
	6/14/18	82-3-18	1.5 - 2.2	0.13	49.4
GGB-89	6/14/18	89-1-18	0 - 0.5	0.97	15.1
	6/14/18	89-2-18	0.5 - 1.5	0.98	20.0
	6/14/18	89-3-18	1.5 - 2.5	2.8	30.6
	6/14/18	89-4-18	2.5 - 2.6	0.074	55.9
GGB-96	6/14/18	96-1-18	0 - 0.5	0.52	11.3
	6/14/18	96-2-18	0.5 - 1.5	0.56	13.7
	6/14/18	96-2-18(D)	0.5 - 1.5	0.5	13.5
	6/14/18	96-3-18	1.5 - 2.5	2.5	25.5
	6/14/18	96-4-18	2.5 - 2.9	0.098	50.4
GGB-97	6/14/18	97-1-18	0 - 0.5	0.36	12.4
	6/14/18	97-2-18	0.5 - 1.5	2.2	22.8
	6/14/18	97-3-18	1.5 - 2.2	1.5	45.3

Notes:
(1) - Measured in feet from top of recovered sample
Percent Solids values are in percent (%)
(D) - Identifies a field duplicate sample
No Recovery - Indicates sample could not be obtained for laboratory analysis
Bolded mercury concentrations are above the MPBC = 0.36 mg/kg

Table 6
Equipment Blank Mercury Analytical Results
Gruber's Grove Bay Sediment Sampling Report

Sample ID	Date Sampled	Mercury Concentration (µg/l)	Analytical Qualifier	LOD (µg/l)	LOQ (µg/l)
Rinse-01	6/11/18	<0.03	U	0.03	0.12
Rinse-02	6/12/18	<0.03	UM	0.03	0.12
Rinse-03	6/13/18	<0.03	U	0.03	0.12
Rinse-04	6/14/18	<0.03	U	0.03	0.12
Rinse-05	6/15/18	<0.03	U	0.03	0.12
Rinse-06	6/18/18	<0.03	U	0.03	0.12

Notes:
Mercury concentrations are in micrograms per liter (µg/l)
Equipment blanks were collected using distilled water mixed with the sample preparation bowls, spoons & sampler core tip
LOD = Limit of detection
LOQ = Limit of quantitation
M = Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits
U = Mercury concentration below LOD

Table 7
Sediment Mercury Analytical Results (Resampled)
Gruber's Grove Bay Sediment Sampling Report

Sample Location	Date Collected	Lab Sample ID	Sample Interval (feet)[(1)]	Mercury Concentration (mg/kg)
GGB-10	2/9/16	10-1	0 - 0.5	**4.6**
	6/12/18	10-1-18	0 - 0.5	**4**
GGB-22	2/9/16	22-1	0 - 0.5	**6.3**
	6/13/18	22-1-18	0 - 0.5	**3.6**
	6/13/18	22-1-18(D)	0 - 0.5	**3.1**
GGB-46	2/5/16	46-1	0 - 0.5	**1.7**
	6/12/18	46-1-18	0 - 0.5	**1.8**
GGB-58	2/5/16	58-1	0 - 0.5	**3.4**
	6/18/18	58-1-18	0 - 0.5	**1.4**
GGB-77	2/4/16	77-1	0 - 0.5	**2.1**
	6/15/18	77-1-18	0 - 0.5	**1.1**
	6/15/18	77-1-18(D)	0 - 0.5	**0.98**
GGB-78	2/4/16	78-1	0 - 0.5	**0.52**
	6/14/18	78-1-18	0 - 0.5	**0.37**
GGB-89	2/4/16	89-1	0 - 0.5	**0.85**
	6/14/18	89-1-18	0 - 0.5	**0.97**

Notes:

(1) - Measured in feet from top of recovered sample

(D) - Identifies a field duplicate sample

Mercury concentrations are in milligrams per kilogram (mg/kg) dry

Bolded mercury concentrations are above the MPBC = 0.36 mg/kg

Appendix A

Correspondence

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
Box 7921
Madison WI 53707-7921

Scott Walker, Governor
Cathy Stepp, Secretary
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

August 11, 2017

Robert (Mike) Sitton
S7273 Bluff Road
Merrimac WI 53561

Subject: Badger Army Ammunition Plant – Baraboo, Wisconsin
Grubers Grove Sediment
BRRTS #02-57-001002

Dear Mike:

We have reviewed the Gruber's Grove Bay Sediment Sampling Report submitted on behalf of the Army in July 2016. The report documented levels of mercury in the sediment of the bay that pose an unacceptable risk to aquatic life. The mercury in the sediment is the result of discharges from the Badger Army Ammunition Plant which constitutes a discharge of a hazardous substance regulated under Wis. Stat. ch. 292 (Wisconsin Spills Law). The causer of the discharge must take action necessary to restore the environment. The July 2016 report has defined the degree and extent of the impact to the river sufficient to support an evaluation of remedial actions necessary to restore the river. The Army should either revise their Remedial Action Plan (RAP) to ensure that the chosen remedial action (dredging) is protective or, if that is not feasible, perform an evaluation to identify alternative remedial actions necessary to address the discharge, per Wis. Adm. Code ch. NR 722.

We would like to meet with you to discuss the next steps for the Army to continue to make progress on the site. The meeting should cover a general schedule (and any plans that are available) for the restoration of the portions of the river impacted by the discharge from the ammunition plant. We propose to meet either at the WDNR Central Office or at the former Badger AAP. Please provide us with your preferred meeting location and availability for the period of September 4 through September 15.

Please feel free to call me at 608-267-7570 or email me if you need additional information.

Sincerely,

Jason B. Lowery
Hydrogeologist
Remediation & Redevelopment Program

Copy: Bill Fitzpatrick, Scott Inman, and Steve Martin, DNR (email)

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
Box 7921
Madison WI 53707-7921

Scott Walker, Governor
Daniel L. Meyer, Secretary
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

January 23, 2018

Robert (Mike) Sitton
S7273 Bluff Road
Merrimac WI 53561

[sent electronically]

Subject: Badger Army Ammunition Plant – Baraboo, Wisconsin
BRRTS #02-57-001002

Dear Mike:

Thank you for meeting with Department staff on the Gruber's Grove Bay (GGB) sediment sampling results. As we discussed in our August 11, 2017 letter and at the meeting, the Army's 2016 report documented levels of mercury in the sediment of the bay that continue to pose an unacceptable risk to aquatic life, after the last dredging project. The purpose of this letter is to provide you with more details as to an acceptable course of action consistent with Wisconsin's Spill Law (Wis. Stats. § 292) that would result in the state's satisfaction with the environmental quality of sediment in GGB and support a request to the Environmental Protection Agency to remove the GGB from the Clean Water Act Impaired Waters list.

In order to facilitate this process, we would like you to outline a remedial action design and construction process for our approval. This process would include preparation of:

- A Wis. Adm. Code § NR 722 remedial actions options report to evaluate remedial actions to reduce the risk posed by contaminants of concern (COCs) in GGB, consistent with the Wis. Admin. Code § NR 700 rule series.
- A schedule of activities.
- List of key contacts for those involved in the site investigation and remedial action options analysis.

In July of 2016, the Department received a "Gruber's Grove Bay Sediment Sampling Report – Final" which was prepared by SpecPro, Inc. on behalf of the Army. As we discussed at our October 13th meeting the report documented a continuing concern with levels of mercury remaining in the bay and that our goal of restoring adequate benthic habitat from both a chemical and physical standpoint has not yet been achieved.

We believe that further action is needed to assess remedial actions that can successfully address COCs in GGB. The Army last attempted to remediate GGB in 2006 with a dredging project that had difficulty in efficiently removing the targeted sediment above the remedial action level (RAL). An RAL was set for mercury which the data showed was a co-occurring contaminant with other COCs identified at GGB. While the 2006 project removed significant quantities of mercury contaminated sediment, large quantities of dredged residuals containing significant concentrations of mercury were left behind. The presence of the dredge residuals was documented by sediment sampling and a diver survey in 2007. The diver survey documented dredge wind rows of up to three feet thick in the sediment residuals indicating significant

quantities of the targeted inventory were left behind. Sampling for sediment chemistry showed mercury concentrations of up to 9 ppm which are well above the RAL of 0.36 ppm.

The objective at Gruber's Grove was to remove low density sediment that contained the mercury discharged by the Badger Plant. In reviewing the dredging data it appears that much of the material dredged in 2006 was the higher density native materials that were located below the mercury contaminated sediment. The Department believes that the project goals are achievable using more modern dredging equipment and contracting specifications specific to modern environmental dredging techniques. We have successfully used dredging equipment to remove low density contaminated sediment on the Fox River, Sheboygan River and other sites over the past decade. Contractors with experience in environmental dredging could be helpful in developing plans and specifications for insuring a future removal can meet the requirements for restoring Grubers Grove Bay and delisting this site.

We continue to enjoy our open working relationship with you and the Army and appreciate you efforts to attain our mutual goals of removing Gruber's Grove Bay from the state's list of impaired waters and to achieve closure for the site. Please contact us regarding this letter so that we may plan for future actions.

Regards,

Bill Fitzpatrick, P.E., P.G.
Engineer- Remediation & Redevelopment Program
phone:(608) 266-9267
William.Fitzpatrick@Wisconsin.gov

DEPARTMENT OF THE ARMY
BADGER ARMY AMMUNITION PLANT
S7273 BLUFF ROAD
MERRIMAC, WISCONSIN 53561

February 20, 2018

SUBJECT: Badger Army Ammunition Plant - Gruber's Grove Bay Sediment

Mr. Bill Fitzpatrick, P.E., P.G.
Wisconsin Department of Natural Resources - South Central Region
3911 Fish Hatchery Road
Fitchburg, WI 53711-5397

Dear Mr. Fitzpatrick:

The Army is in receipt of your 23 January 2018 letter regarding sediments within Gruber's Grove Bay. In September 2000, the Army used our Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authority to select the remedial actions for sediments in Gruber's Grove Bay. The CERCLA Decision Document, conducted in close coordination with WDNR, identified cleanup goals and selected the remedy, which allowed the Army to move forward with dredging to remove contaminated sediments. To date, the Army has removed approximately 150,000 cubic yards of sediment in two separate dredge events with the agreed upon cleanup goal of reaching 0.36 mg/kg (background levels) for mercury in the sediments in Gruber's Grove Bay. Residual contamination assessments conducted in 2009 and July 2016 estimate the remaining volume of sediment between 7000-12000 cubic yards with a surface weighted average concentration (SWAC) of 1.1 mg/kg. Based on sediment volumes previously removed and the reduction in SWAC since 2001, we believe residual sediments comprise roughly 5-10% of the original contaminated volume and that mercury mass has been reduced by over 98%. After implementing two prior dredging efforts, sediment sampling data demonstrate a downward trend of total mercury in Gruber's Grove Bay sediments; however, the cleanup goal established in the Gruber's Grove Bay Decision Document have not been met.

To increase the likelihood that additional remedial actions conducted pursuant to the Decision Document will achieve the cleanup goal, we believe additional CERCLA documentation may be required. Initially, we propose preparing a work plan addendum followed by additional sediment sampling in order to delineate the concentrations over depth in the hot spot areas that were last sampled in January 2016. We would use the sediment sampling results to focus additional dredging efforts on the residual volume of contaminated sediment. While the sediment sampling is ongoing, the Army will evaluate dredging methods that may be more effective than methods used previously. Once the sampling and review of dredging technologies is complete, we can develop a more robust schedule of activities that would include additional sediment dredging, evaluating dredged sediment disposal options, and a confirmation sampling plan.

We expect to modify our current contract to allow us to begin the sampling efforts in the May/June 2018 timeframe. We will update the sampling and analysis plan and produce a data report for joint review following the laboratory analysis.

We will continue our close coordination with your office. Hopefully this approach will allow us to leverage today's improved technology and meet the remedial goal for this site.

We look forward to a meeting to discuss the next steps with your staff. Please feel free to contact me at (608)434-5374 or email at .

Robert M. Sitton

Commander's Represenative

DEPARTMENT OF THE ARMY
BADGER ARMY AMMUNITION PLANT
S7273 BLUFF ROAD
MERRIMAC, WISCONSIN 53561

June 6, 2018

SUBJECT: Gruber's Grove Bay Sediment Sampling Work Plan Addendum
Badger Army Ammunition Plant

Mr. Bill Fitzpatrick, P.E., P.G.
Wisconsin Department of Natural Resources
101 S. Webster Street
Box 7921
Madison, WI 53707-7921

Dear Mr. Fitzpatrick:

Per your letter dated January 23, 2018 regarding mercury contaminated sediment in Gruber's Grove Bay (GGB), the Army will be collecting additional sediment samples to delineate the horizontal and vertical mercury concentrations. This letter outlines the scope and schedule of the sediment sampling investigation.

The following outline of sediment sampling activities serves as an Addendum to the November 2015 Gruber's Grove Bay Remedial Investigation Work Plan. The sediment sampling conducted by the Army during February 2016 utilized the procedures outlined in the November 2015 work plan. The November 2015 work plan serves as a guide for the sediment sampling activities presented herein. The same sediment sampling methods, sampling equipment, sediment evaluation, documentation procedures, decontamination procedures, quality assurance and quality control procedures, and data analysis methods used during the 2016 sediment sampling investigation will be used. Any deviation from those procedures are outlined below.

The Army has requested SpecPro Professional Services, LLC (SPS) to conduct the sediment sampling within GGB during June 2018. SPS also conducted the February 2016 sediment sampling investigation. SPS will commence the sediment sampling on June 11, 2018. SPS expects to complete the field work by June 20, 2018. Upon review of the laboratory data, SPS will prepare a summary report that will be submitted to the Wisconsin Department of Natural Resources (WDNR).

The February 2016 sediment investigation characterized the mercury concentrations in the upper 6 inches of residual soft sediment. Sediment below 6 inches was not analyzed for mercury during the February 2016 investigation. The mercury concentrations were compared to the Most Probable Background Concentration (MPBC) of 0.36 milligrams per kilogram (mg/kg). The sediment sampling that will be conducted during June 2018 will evaluate the mercury concentrations below 6 inches and down to the native clay/silt sediment. This investigation will help define the vertical extent of mercury concentrations above the MPBC within GGB.

Figure 1 (enclosure) provides a layout of the estimated 41 sediment sample locations being proposed in GGB. Figure 2 (enclosure) shows the estimated 41 sediment sample locations and the bathymetric contours (water surface to top of sediment). Thirty-nine of the 41 proposed sediment

sample locations were previously evaluated during the 2016 investigation. At each proposed location, the piston-type coring sampler will be driven until firm sediment is encountered. Based on the 2016 investigation, the butterfly valve core tip on end of the sampler will provide the best sample recovery. Vertical sediment samples will be analyzed for mercury from the following recovered sediment core intervals (when available): 6 to 18 inches, 18 to 30 inches, and 30 inches to maximum depth. The proposed sample locations shown on Figure 1 were chosen based on the 2016 mercury concentrations and the measured soft sediment below 6 inches.

To help define the horizontal extent of mercury concentrations above the MPBC, an attempt to collect sediment at sample location GGB-48 will be made. During the 2016 sampling event, sediment could not be recovered from GGB-48 for mercury analysis even though 1.4 feet sediment was measured in the field. If sediment is recovered from GGB-48, the samples will be analyzed for mercury from the 0 to 6 inch and 6 to 18 inch intervals.

As shown on Figure 1, the mercury concentration in GGB-89 (0-6 inches) was above the MPBC of 0.36 mg/kg. The Army has chosen to further define both the horizontal and vertical mercury concentrations south of GGB-89. The top of sediment at GGB-89 was measured in 2016 to be 20.9 feet below the water surface. Sediment samples will be collected from further into the Wisconsin River at GGB-96 and GGB-97. Additional sample locations may be collected south and/or southeast of GGB-96 and GGB-97. These additional locations will only be collected if the sampling equipment and methods allow due to an increase in sediment depth. If sediment is recovered from GGB-96, GGB-97, or these additional locations, the samples will be analyzed for mercury from the following available intervals: 0 to 6 inches, 6 to 18 inches, 18 to 30 inches, and 30 inches to maximum depth.

Sediment thickness measurements (probing) will not be conducted where previous sediment samples were collected in 2016. Any new sampling location will have sediment thickness measurements collected.

Per the WDNR's request, six locations from the 2016 sediment investigation will be resampled and the sediment from the 0 to 6 inch depth will be analyzed for mercury. This will total 10% of the 2016 sediment investigation samples. Sampling locations will be distributed throughout GGB where higher mercury concentrations were detected.

For quality assurance, duplicate samples will be randomly selected at a rate of one per 10 sediment sample locations and analyzed for mercury. The original retrieved sediment core will be split vertically into two equal portions during sample dissection. Both the original and duplicate portions will be separately homogenized and placed into separate laboratory-supplied containers.

One random sampling location will have a replicate sediment core collected. The replicate sediment core will be collected within two feet of the original sample location. Sediment from the replicate location will also be analyzed for mercury.

An equipment blank or rinse blank water sample will be collected each sampling day and analyzed for mercury. These rinse blanks will evaluate the decontamination procedures of the sampling equipment.

SPS will utilize a pontoon boat to navigate to each sample location and use the boat as a work platform for sediment sampling. SPS will utilize a Trimble Geo 7X GPS with a Trimble Zephyr GNSS antenna to determine the sample locations. The GPS unit has a published centimetric accuracy while using real-time differential correction.

Please do not hesitate to contact me at 608-434-5374 if you have any questions.

Sincerely,

Robert M. Sitton
Commander's Representative

Enclosure
Copy furn: Jason Lowery, Wisconsin Department of Natural Resources
Bryan Lynch, Army Environmental Command
SpecPro Professional Services, LLC

Legend

GGB-01

- Proposed Sample - 2018
- Sample Collected - 2016
- No Sample Collected - 2016

2016 Mercury Concentrations

- 0.36 - 1.49 mg/kg
- 1.5 - 3.0 mg/kg
- 3.0 - 6.3 mg/kg

- 2006 Dredged Extent
- Road
- Building
- Wisconsin River

Wisconsin River

Figure 1

Proposed Sampling Locations - 2018
Gruber's Grove Bay Sediment Sampling
Badger Army Ammunition Plant

Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Vertical Datum: North American Vertical Datum 88 (NAVD 88)
Units: Foot US

0 130 260 520 780 1,040 Feet

SPS SPECPRO PROFESSIONAL SERVICES

1 inch = 195 feet

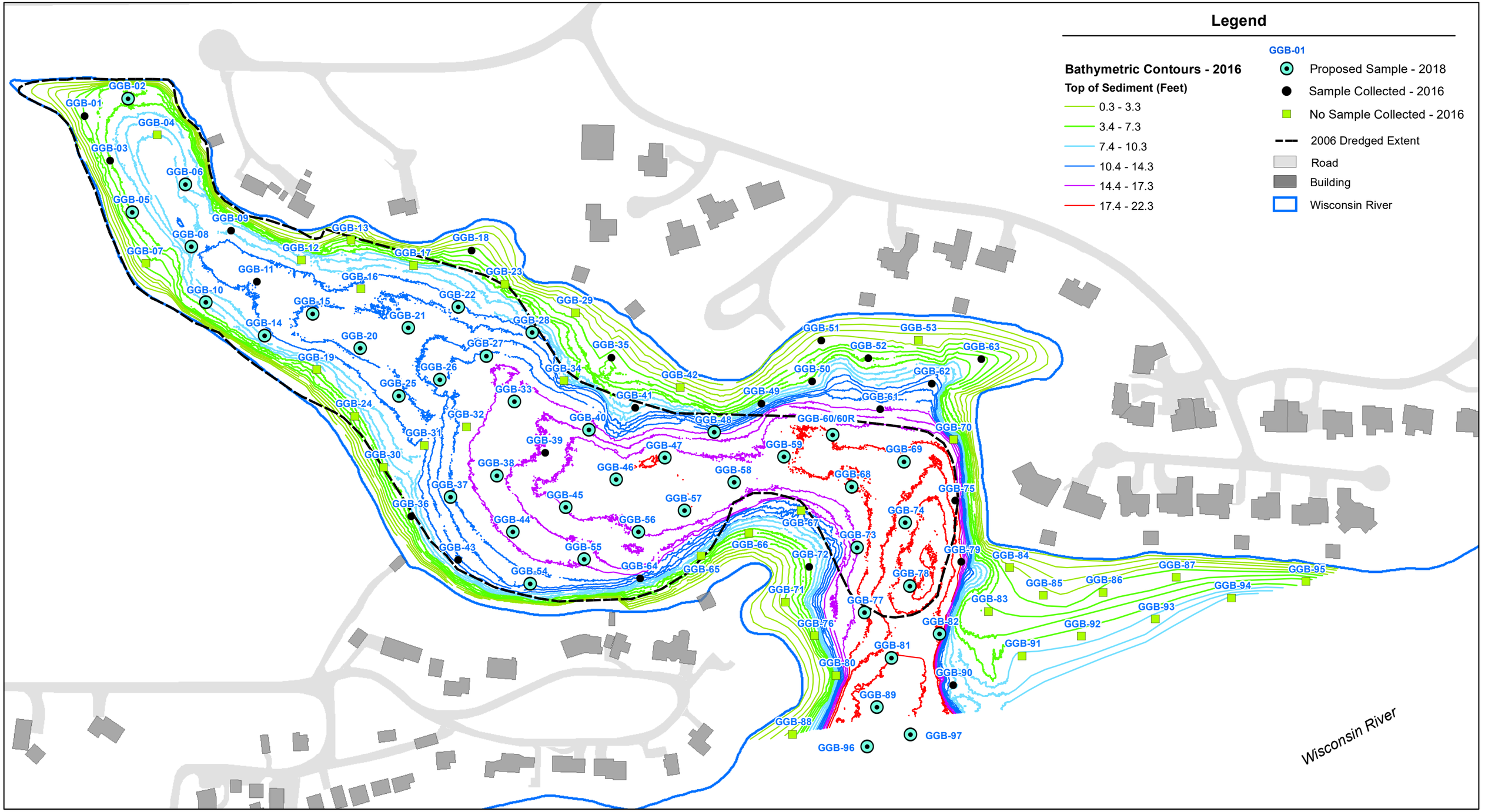


Figure 2

Bathymetric Contours
Gruber's Grove Bay Sediment Sampling
Badger Army Ammunition Plant

Bathymetric contour survey (sediment depth) conducted by Veolia ES Special Services, Inc. on 10/10/12.
Depths of GGB were obtained via multi-beam sonar survey.
Contours were updated with 2016 sediment depth measurements collected with manual probe.

Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Vertical Datum: North American Vertical Datum 88 (NAVD 88)
Units: Foot US

0 130 260 520 780 1,040 Feet

SPS SPECPRO PROFESSIONAL SERVICES

1 inch = 195 feet

Joel L. Janssen

From: Fitzpatrick, William - DNR <William.Fitzpatrick@wisconsin.gov>
Sent: Tuesday, June 19, 2018 1:29 PM
To: Sitton, Robert M CIV USARMY HQDA ACSIM (US); Joel L. Janssen; Lynch, Bryan Patrick CIV USARMY IMCOM AEC (US) (bryan.p.lynch.civ@mail.mil)
Cc: Amrhein, James F - DNR; Martin, Steven L - DNR; Lowery, Jason B - DNR; Inman, Scott T - DNR; Killian, James - DNR
Subject: RE: Gruber's Grove Bay Work Plan

Mike,
Below are comments on the June 6, 2018 Sediment Sampling Work Plan Addendum. If you have questions or we need to discuss, please let me know.

-Bill

1) Sampling QA- Past sampling has shown that the sediment in the bay consists of 0.1 to 1.0 foot of very low density gelatinous sediment on the top of the sediment column with higher density sediment below. In general the lower density sediment tend to have the higher mercury concentrations. Proper sediment sampling must capture the low density sediment and the higher density sediment to adequately characterize the degree and extent of the mercury. In the 2016 sediment sampling report the measurement of the top of sediment was described:

   "*The top of soft sediment was measured using a six-inch diameter clear plastic plate attached to a threaded hollow PVC pipe with a 3/4-inch diameter. The threaded pipe allowed additional sections to be screwed together in deeper portions of GGB. The bottom five feet of the PVC pipe was perforated to allow water to pass through the pipe. The pipe string with the plate was allowed to slowly sink as it filled with water until it came to rest at the top of the sediment. Once a depth measurement was made, a quick-clamp device was attached to the pipe to mark the water surface. The PVC pipe, marked at the water interface, was removed from the hole and measured with an engineer's tape to within 0.1 feet. The difference between the water surface and ice surface was also measured at each sampling location*". (From: Gruber's Grove Bay Badger Army Ammunition Plant Sediment Sampling Report July 2016, SPS, LLC Page 6 of 15)

   The Department reviewers were concerned that the 2018 sampling event, performed from a boat, might not have the same quality control for measuring the top of sediment in order to anticipate where the sediment core piston should be set during sampling. We ask that the 2018 sediment sampling report describe in detail the measures taken to insure that the sediment samples accurately recovered and sampled sediment from the bay.

2) Grab sample- The 2016 sediment sampling report and the June 6, 2018 Sampling Work Plan Addendum noted sample locations where soft sediment was measured by probing but no sediment were recovered in the sampling. There are a number of potential reasons for non-recovery of sediment during sampling. Deep water and difficulty in holding a fixed position over the sampling point can contribute to the time for recovering the piston corer and potential for losses of the sediment from the sampler. We suggest that the sampling plan should have a backup plan for obtaining a grab sample from locations where core sampling is unsuccessful. A dredge type of sampler such as a ponar or Ekman may provide a means for recovering a sample and potential data on the distribution of mercury contamination from locations where coring is unsuccessful. Of course care must be used to capture as representative of a sample as possible given the low density of the sediment surface at this site.

We are committed to service excellence.
Visit our survey at http://dnr.wi.gov/customersurvey to evaluate how I did.

Bill Fitzpatrick, P.E., P.G.
Engineer- Remediation & Redevelopment Program
Wisconsin Department of Natural Resources
101 S. Webster Street
P.O. Box 7921
Madison, WI 53707-7921
phone:(608) 266-9267
e-mail: William.Fitzpatrick@Wisconsin.gov


dnr.wi.gov


Appendix B

Sediment Sampling Photographs

Pontoon boat used for sampling

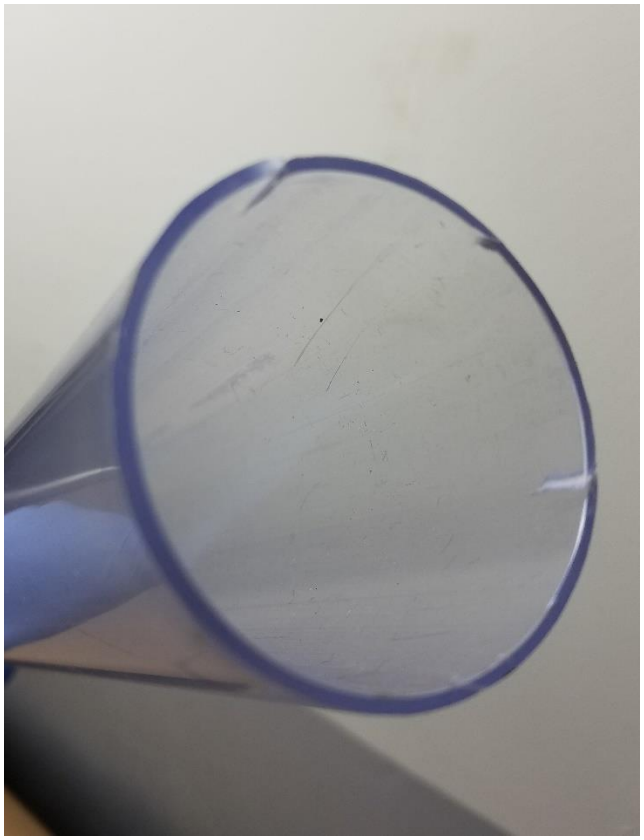
Sediment core preparation area in field trailer

Field trailer for sample preparation

Decontamination area

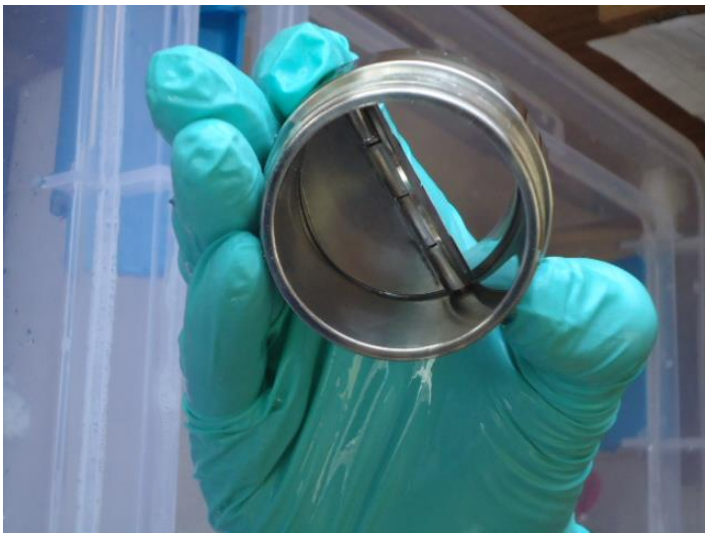
Probe for measuring the top of the sediment

AMS multi-stage sediment sampler - 2-foot section



2-inch diameter semi-clear plastic disposable liner

Inner dual piston within the plastic liner



Butterfly valve tip core

Pontoon boat with sampling rod

Storage system to keep samplers vertical during transport to field trailer

Plastic liner displaying sediment sample and retained water

Laboratory sample preparation.

Decontamination activities

Appendix C

GPS Survey Equipment Specifications

Geo 7 Series

HANDHELD

READY FOR ANYTHING

The Trimble® Geo 7X handheld is from the Trimble GeoExplorer® series family of integrated, rugged, and high-accuracy GNSS handhelds. As a streamlined solution that enables faster and more productive data collection, the Geo 7X is ideal for organizations, such as utility companies, municipalities, and environmental agencies, requiring mobile data collection and asset management solutions.

Eliminate Physical Barriers to Field Success

When physically occupying a position is not possible due to dangerous conditions or right-of-way challenges, turn to Trimble Flightwave™ technology integrated in the Geo 7X. Utilizing the detachable Geo 7 rangefinder accessory, Flightwave workflows enable scale and location measurement of field assets at distances up to 120 m without a reflector. Flightwave measurements integrate directly into Trimble data collection software—simply point and shoot to get the position—even where there are obstacles such as traffic or private land access limitations.

Trimble Floodlight™ satellite shadow reduction technology keeps you working when heavy overhead cover, such as trees and buildings, obstruct GNSS satellite reception. Now you can work with fewer disruptions and obtain high quality data faster and at less cost.

Smart Data Collection, Smart Investment

By providing compatibility with existing and currently planned GNSS constellations, the Geo 7X delivers reliable GNSS tracking of current signals to some—protecting your investment as Trimble continues to provide reliability into the future.

Achieve better accuracy in real-time without the reliance of a traditional reference station-based infrastructure or VRS network through Trimble RTX™ correction service options available with the Trimble Geo 7X. Trimble RTX correction services leverage real-time data from an established tracking station network to compute and deliver high-accuracy positions to the GNSS handheld nearly anywhere on the globe. A range of Trimble RTX correction services offered with the Trimble Geo 7X provide internet-delivered, high-accuracy GNSS positioning wherever cellular communications are available so you can obtain the accuracy you need—from submeter to centimeter level.

Compatible with the breadth of Trimble GIS field and office software, the Geo 7X gives you flexible end-to-end data collection solutions and workflow choices: from the field-proven Trimble TerraSync™ and Positions™ software to the customizable data collection workflows of Trimble TerraFlex™ software.

Everything You Need to Work

With a powerful 1.0 GHz processor, 256 MB RAM, 4 GB of onboard storage, IP65 rating, and sunlight-optimized display, the Geo 7X is a high performance device designed to work hard in the environments that you do. The built-in 5 MP camera with enhanced zoom operation, and geo-tagging capability enables information about an asset, event, or site to be easily captured. And with the integrated dual-mode cellular modem, you can stay connected for continuous network and Internet access to real-time map data, web-based services, Trimble VRS™ and RTX corrections, and live update of field information.

Be truly productive with the Trimble Geo 7 series. No matter what gets in your way.

Key Features

- Easy and productive asset data capture with remote mapping and measurement
- Capture more positions and increased accuracy in tough GNSS environments
- Compatible with existing and planned GNSS constellations to maximize investment
- Flexible software options to collect, process, and manage data with simple, connected workflows

Geo 7 Series HANDHELD

PHYSICAL DIMENSIONS

Geo 7X handheld (H x W x D)	234 mm x 99 mm x 56 mm (9.2 in x 3.9 in x 2.2 in)
Geo 7X handheld with rangefinder	1080 g

GNSS, ORIENTATION, AND DISTANCE[1]

GNSS sensor	L1/L2 GNSS receiver and antenna
Chipset	Trimble Maxwell™ 6 (up to 220 channels)
Systems[2]	GPS, GLONASS, Galileo, BeiDou, QZSS
SBAS	WAAS, EGNOS, MSAS, GAGAN, SBAS+
Floodlight	Yes
Receiver protocols	NMEA, TSIP2
Update rate	1 Hz
Time to first fix	< 45 seconds (typically)
Real-time correction protocols	RTCM2.x/RTCM3.x/CMR+/CMRx
Real-time Centimeter mode accuracy[3]	
Horizontal	1 cm + 1 ppm HRMS
Vertical	1.5 cm + 2 ppm VRMS
Postprocessed Centimeter mode accuracy[3]	
Horizontal	1 cm + 1 ppm HRMS
Vertical	1.5 cm + 1 ppm VRMS
H-Star™ accuracy (real-time or postprocessed)	10 cm + 1 ppm HRMS
Code DGNSS accuracy (real-time)	75 cm + 1 ppm HRMS
Code DGNSS accuracy (postprocessed)	50 cm + 1 ppm HRMS
SBAS accuracy	<100 cm
CenterPoint® RTX (via cellular)[1,2,4]	
Horizontal	4 cm HRMS
Vertical	10 cm VRMS
FieldPoint RTX™ (via cellular)[1,5]	10 cm HRMS
RangePoint™ RTX (via cellular)[1]	30 cm HRMS
ViewPoint RTX™ (via cellular)[1]	50 cm HRMS
Orientation sensors[8]	3-axis gyro, magnetometer, accelerometer
Heading accuracy	±1.5°
Inclination accuracy	±0.5°
Roll accuracy	±0.5°
Distance sensor	Laser rangefinder module
Communication protocols	NMEA or Trimble proprietary
Passive range	Up to 120 m
Reflective range	Up to 200 m
Accuracy[6]	±0.05 m
Range precision	0.01 m

NETWORK AND WIRELESS CONNECTIVITY

GSM/GPRS/EDGE	850 / 900 / 1800 / 1900 MHz
UMTS/HSPA+	800 / 850 / 900 / 1900 / 2100 MHz
CDMA/EV-DO Rev A	800 / 1900 MHz (Verizon certified)
Wi-Fi	802.11b/g
Bluetooth profiles	BT 2.0 +EDR (SPP, OPP, FTP, PAN, A2DP, DUN, HID)

POWER AND BATTERY[7]

Type	Rechargeable, removable Li-Ion
Capacity	11.1V 2,500 mAH
Charge time	< 4 hours (typical)
Real time DGNSS usage (via integrated 3G/3.5G)	Up to 7 hours
Real time DGNSS usage (via Bluetooth)	Up to 9.5 hours
Autonomous GNSS usage	Up to 10.5 hours
Non-GNSS use	Up to 24 hours
Standby	Up to 50 days

SYSTEM CPU, MEMORY, AND CAMERA

CPU	Texas Instruments DM3730 1 GHz + GPU
Memory	4 GB user memory + SD slot (up to 32 GB), 256 MB RAM
Camera	5 MP

DISPLAY AND TOUCH PANEL

Display	4.2" VGA (640 x 480) LED transflective
Touch panel	Resistive touch panel with polarized light filter
Brightness	280 cd/m²

OS

Microsoft® Windows® Embedded Handheld version 6.5 Professional
English (U.S.), Chinese (Simplified), Chinese (Traditional), French, German, Italian, Japanese, Korean, Spanish, Portuguese (Brazil), Russian

SYSTEM REQUIREMENTS

Syncing with a PC requires Windows 7, Windows Vista, or Windows XP Home or Professional with Service Pack 3 or later. Some field applications and services require mobile internet access.

ENVIRONMENTAL USE

Operating ambient temperature	-4° to 140° F (-20° to 60° C)
Storage temperature	-22° to 158° F (-30° to 70° C)
Relative humidity	95% non-condensing
Maximum operating altitude	29,000 ft (9,000 m)
Maximum storage altitude	40,000 ft (12,000 m)
Water/dust ingress	IP66
Functional shock	MIL-STD-810G Method 516.6 Procedure I
Drop	4 ft (1.22 m)
Vibration	MIL-STD-810-G Method 514.6 Procedure I

SOFTWARE COMPATIBILITY

Please refer to the **Product Compatibility** list.
(www.trimble.com/mappingGIS/productcompatibility)

1. Accuracy and reliability may be subject to anomalies due to multipath, obstructions, satellite geometry, and atmospheric conditions. Always follow recommended GNSS data collection practices. Specified Centimeter accuracy can normally be achieved for baselines of 30 km or less. Specified H-Star accuracy can normally be achieved for baseline lengths of 100 km or less. Centimeter and H-Star accuracy is typically achieved within 2 minutes. CenterPoint RTX accuracy is typically achieved within 5 minutes in select regions, and within 30 minutes worldwide. FieldPoint RTX's accuracy is typically achieved within 5 minutes in select regions, and within 15 minutes worldwide. ViewPoint RTX accuracy is typically achieved within 5 minutes. RangePoint RTX accuracy is typically achieved within 5 minutes using external antenna and 10 minutes using internal antenna.
2. Galileo and BeiDou single frequency, not used for RTK.
3. Stated accuracy is with Trimble Zephyr™ Model 2 / 3 GNSS antenna. Requires the Geo 7 series Centimeter Option.
4. Requires Zephyr 2 or 3 antenna and CM option.
5. Stated accuracy is only with Tornado or Zephyr 2 or 3 antennas.
6. 1 sigma, @ 20 C, to Kodak Grey card at 50 m.
7. Actual run time will vary with conditions and environment of use.
8. 1 sigma. Accuracy and reliability may be subject to anomalies due to sensor calibration quality, temperature, and presence of local magnetic disturbances. Always follow recommended sensor calibration and operation practices.

Specifications subject to change without notice.

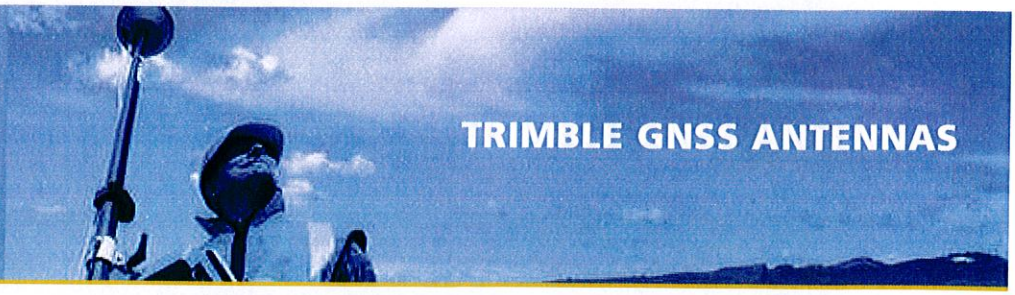
Contact your local Trimble Authorized Distribution Partner for more information.

NORTH AMERICA
Trimble Inc.
10368 Westmoor Drive
Westminster CO 80021
USA

EUROPE
Trimble Germany GmbH
Am Prime Parc 11
65479 Raunheim
GERMANY

ASIA-PACIFIC
Trimble Navigation
Singapore PTE Limited
3 HarbourFront Place
#13-02 HarbourFront Tower Two
Singapore 099254
SINGAPORE

DATASHEET



TRIMBLE GNSS ANTENNAS

KEY FEATURES

- Comprehensive GNSS support, including GPS Modernization signals, GLONASS, and Galileo
- Robust low-elevation satellite tracking
- Minimized multipath
- Sub-millimeter phase center repeatability
- Ideal for fixed reference stations and GNSS infrastructure networks

The new Trimble® Zephyr™ 2 and Zephyr Geodetic™ 2 antennas break new ground in GNSS surveying antenna technology. Both antennas support modular Trimble systems such as the Trimble® R7 GNSS and Trimble® 5700 GPS receivers, and can be used as part of the Trimble GNSS Infrastructure solution.

TRIMBLE ZEPHYR 2

The Trimble Zephyr 2 GNSS antenna is typically used in roving applications. It minimizes multipath, and offers robust low elevation tracking and sub-millimeter phase center repeatability.

A Trimble GNSS rover comprising the rugged Zephyr 2 and a receiver such as the Trimble R7 GNSS is extremely flexible: Attach the antenna to the top of a pole, wear it on the purpose-built Trimble backpack, or drive with the Zephyr 2 mounted on the roof of a vehicle. The Trimble Zephyr 2 supports the way you want to work.

TRIMBLE ZEPHYR GEODETIC 2

The Trimble Zephyr Geodetic 2 antenna is ideal for control work. The Zephyr Geodetic 2 incorporates a large Trimble Stealth™ Ground Plane, which literally burns up multipath energy using technology similar to that used by Stealth aircraft to hide from radar.

The Zephyr Geodetic 2 antenna's quality performance and extreme accuracy are achieved through sub-millimeter phase center repeatability, robust low-elevation tracking and significantly reduced ground-based multipath.

The Zephyr Geodetic 2 is extremely rugged. It is protected by weather-resistant materials and a low profile design, so when the antenna is used for a permanent installation, you can count on many years of continuous operation without the need for a radome.

COMPREHENSIVE GNSS SUPPORT

The Trimble Zephyr 2 and Zephyr Geodetic 2 antennas offer full support for coming and near-future GNSS signals, including GPS L2C and L5, GLONASS, and even Galileo. This technology future-proofing, in combination with the rugged durability of each antenna, means any investment in a Trimble Zephyr GNSS antenna will last for many years.

The Trimble Zephyr Geodetic 2 antenna is shown as part of a Trimble R7 GNSS base station.

Trimble

TRIMBLE GNSS ANTENNAS

PERFORMANCE

Trimble Zephyr Geodetic 2 and Trimble Zephyr 2 Antennas

- Broad GNSS Frequency Tracking Band Including:
  - GPS: L1, L2, L5
  - GLONASS: L1, L2, L3
  - Galileo: E1, E2, E5, E6
  - SBAS: WAAS, EGNOS, QZSS, Gagan, MSAS, and OmniStar
- Quality signal tracking, even below 5 degrees elevation
- Four point antenna feed for phase center stability and enhanced polarization
- TNC female signal connector
- Small cross-sectional area to reduce wind loading
- 13 dB amplifier margin supports cable runs of over 60 m without special coaxial cable or in-line amplifiers
- North orientation marking on exterior
- 50 dB signal gain for reliable tracking in difficult environments
- Low voltage, low power consumption
- Integral low noise amplifier
- 5/8" x 11 female threaded stainless steel mount point
- Powered by GNSS receiver via coaxial cable
- Advanced LNA (low noise amplifier) to reduce jamming by high power out-of-band transmitters

Zephyr Geodetic 2 Antenna Only

- Trimble Stealth Ground Plane – integrated lightweight stealth technology with enhanced right hand circular polarization to reduce multipath interference
- Supplementary radome not required (available if desired)

HARDWARE

Dimensions

Zephyr 2	16.5 cm diameter x 7.6 cm height (6.5 in diameter x 3 in height)
Zephyr Geodetic 2	34.3 cm diameter x 7.6 cm height (13.5 in diameter x 3 in height)

Weight

Zephyr 2	0.64 kg (1.4 lb)
Zephyr Geodetic 2	1.36 kg (3 lb)
Operating Temperature	–40 °C to +70 °C (–40 °F to +158 °F)
Humidity	100% humidity proof, fully sealed
Shock and Vibration	Tested and meets the following environmental standards:
Shock	MIL-STD-810-F to survive a 2 m (6.56 ft) drop onto concrete
Vibration	MIL-STD-810-F on each axis
Input Voltage	3.5 V DC to 20 V DC
Input Current	125 mA maximum

PN 022543-381A (07/07)

Specifications subject to change without notice.

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NORTH AMERICA
Trimble Engineering
& Construction Group
5475 Kellenburger Road
Dayton, Ohio 45424-1099 • USA
800-538-7800 (Toll Free)
+1-937-245-5154 Phone
+1-937-233-9441 Fax

EUROPE
Trimble GmbH
Am Prime Parc 11
65479 Raunheim • GERMANY
+49-6142-2100-0 Phone
+49-6142-2100-550 Fax

ASIA-PACIFIC
Trimble Navigation
Singapore Pty Limited
80 Marine Parade Road
#22-06, Parkway Parade
Singapore 449269 • SINGAPORE
+65-6348-2212 Phone
+65-6348-2232 Fax

Trimble

www.trimble.com

WISCORS Frequently Asked Questions

Q: How do I sign up for access to the WISCORS Real-Time Network?

All new users must register for access. Be sure to provide all the requested information. New user requests are typically approved within 2 business days.

Upon approval of the submitted request, a confirmation email will be sent and will include:

1. Organization, User Name and Password.
2. IP Address and Port Number.
3. A list of the mount points currently available.

Your equipment vendor can help you with the setup of your device.

WisDOT is responsible for developing, operating, and maintaining the WISCORS Network and its associated Infrastructure. WisDOT does not have the resources to assist with questions related to configuration or trouble-shooting of End-User equipment.

Q: We have registered for WISCORS, but don't know the login and password. Can you send me the login and password information?

The web server does not include a self-service password reset or password reminder.

To request your login credentials, email the WISCORS Team and request a "Password Reminder" message be sent to the email address associated with your account.

Q: We have an active WISCORS login, but we have recently added new rovers. How do we add Additional Logins for multiple devices?

If you have one device and several operators who might use it, you only need to register for one login.

If you have multiple devices that will be connected to the Network simultaneously, each device will need a unique login.

This can be accomplished by one of two ways:

1. New users with your Organization can register via the WISCORS web server.
    a. Each registered user will be issued a unique login.
    b. Allows for multiple users with an organization to be sent notifications regarding Network status and other announcements.

2. Additional logins can be created for a user with a registered account.
    a. Email the WISCORS Team with the number of login(s), along with the preferred password(s) and we can create these additional login(s) for you.
    b. Allows for one Point of Contact and requires only one email address.

Q: What is the Horizontal Reference Frame and Adjustment used by WISCORS?

As of March 2013, the WISCORS Network base station coordinates are closely aligned with the North American Datum of 1983 (2011) epoch 2010.00.

View the reference frame, datum tag, and horizontal coordinates using the web server Sensor Map.

Select the base station using either the Sensor Map icon or the station pick list on the right side of the page. Then click "Info" for the individual details of each base station.

Q: CORS Reference Station data and Virtual Reference Station data

Reference Data for post processing is made available to registered users as a public service. To download Reference Data from the WISCORS web server, a registered user is required to have an active subscription to Reference Data Download services.

Please contact the WISCORS Team and request Reference Data Shop Services be activated for your login. Be sure to include your Organization and Username with your request.

Continuously Operating Reference Station (CORS) data is available for 180 calendar days. Virtual Reference Station (VRS) data is available for 60 calendar days.

Reference Data Shop orders generated using the WISCORS web server are retained for 30 days. Users can return to the web server anytime within 30 days to retrieve a previously generated Reference Data Shop order.

Customizable Reference Data is not available after these thresholds have been surpassed.

Q: Does the WISCORS Network make available a Single Base mount point?

Yes. Users with a properly configured device can choose to receive Single Base corrections (RTCM31 or CMRplusGNSS data format). The selection of the nearest available base station from which the corrections are derived is determined automatically by the software based upon the NMEA position of the rover provided during the login authentication process.

Consult with your equipment vendor for recommendations regarding the use of Single Base corrections.

Q: Why doesn't the Sensor Map display in my web browser?

The WISCORS Network web server is hosted by WisDOT using a secure web URL (https). The base map is hosted by a third party using a non-secure web URL (http).

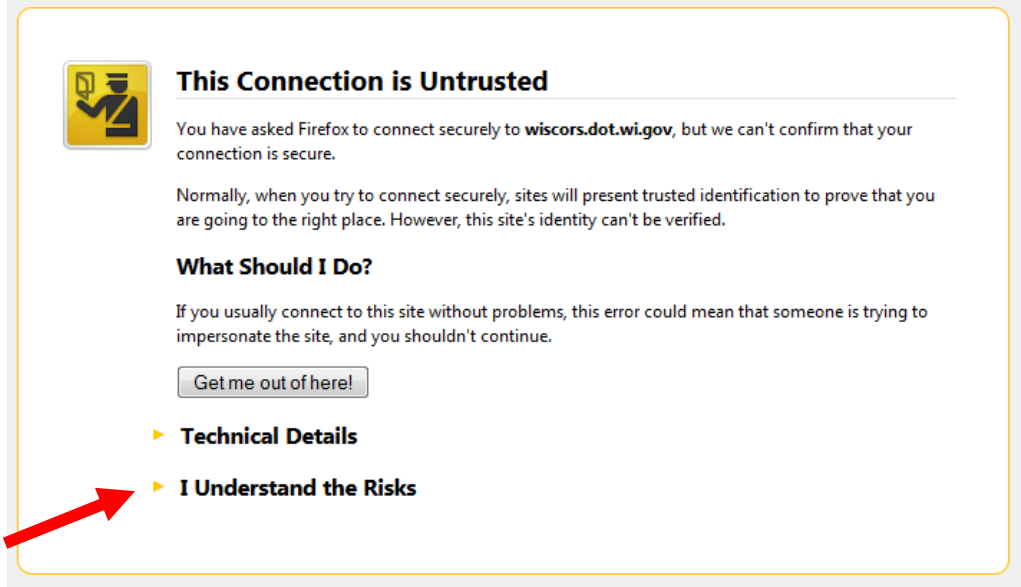
As a default security setting, 'mixed content' is not allowed on most web browsers, however, the following tips and suggestions may help allow the various web browsers to display the Sensor Map.

Always consult with your organization's IT Administrator regarding policies related to your web browser settings.

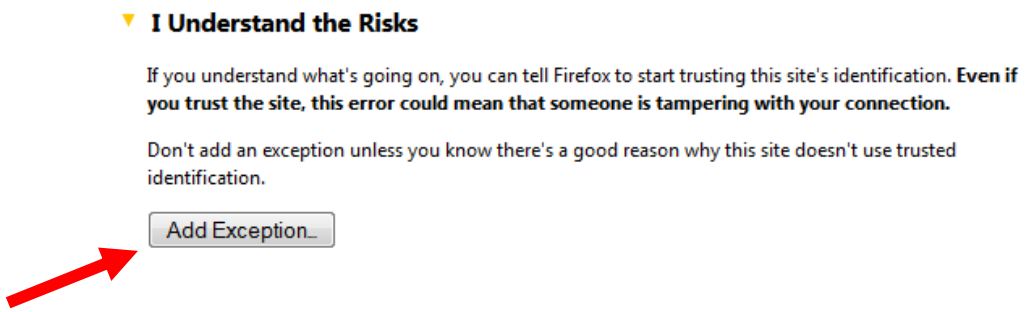
Mozilla Firefox:

Depending upon the version of Mozilla Firefox and browser settings, the required steps and screen images may vary from the images depicted. Therefore, each of the steps depicted may not be required by all users.

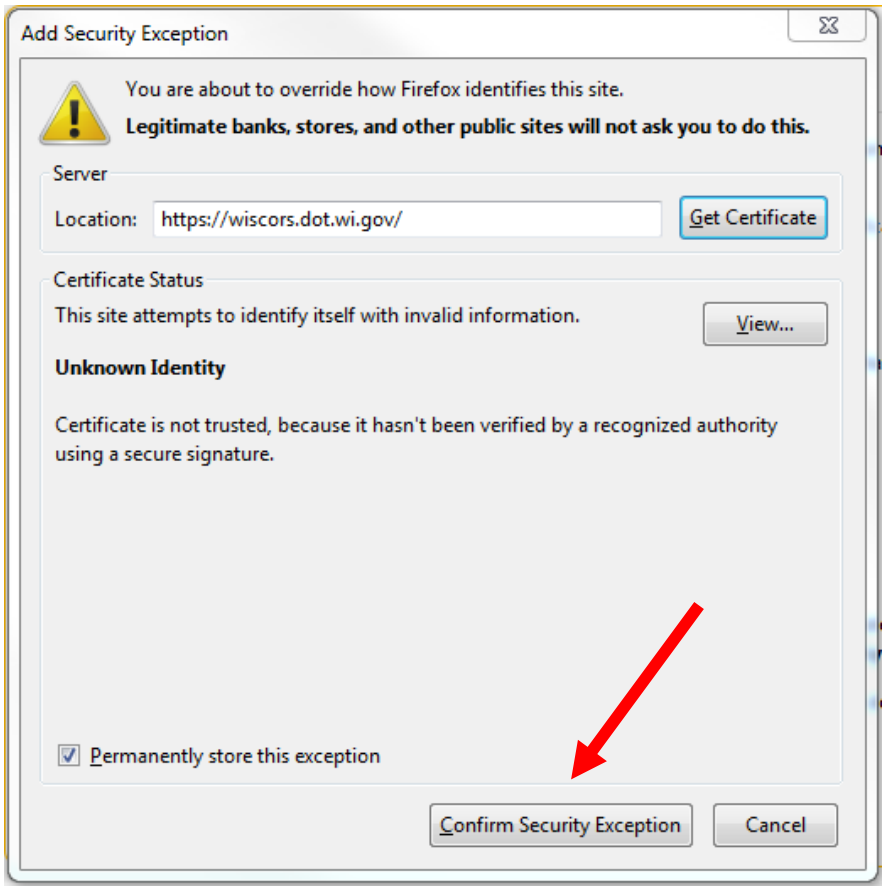
Step 1: Open Mozilla Firefox and navigate to the WISCORS Network web server. The user may be prompted with the following message:



Step 2: Expand "I Understand the Risks" and click "Add Exception…"

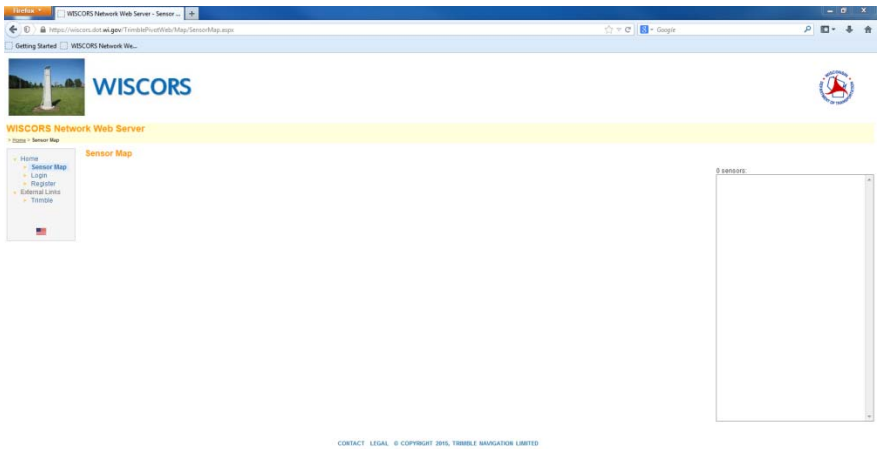


Step 3: Copy/Paste the web address to the “Location” cell and check the box “Permanently store this exception.” Click the box “Confirm Security Exception.”



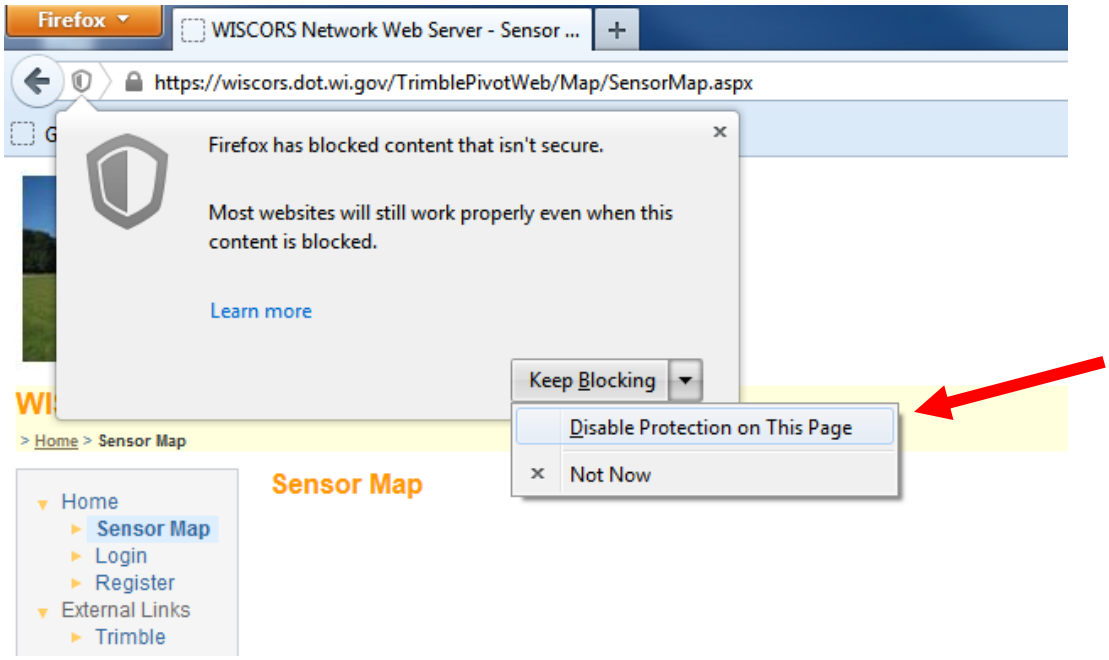
Step 4: Close the Mozilla Firefox web browser. Open Mozilla Firefox.

Step 5: Navigate to the WISCORS Network web server. Click the ‘Sensor Map’ link and the WISCORS web server page will load, but the map element will still be blocked and will show 0 sensors available.

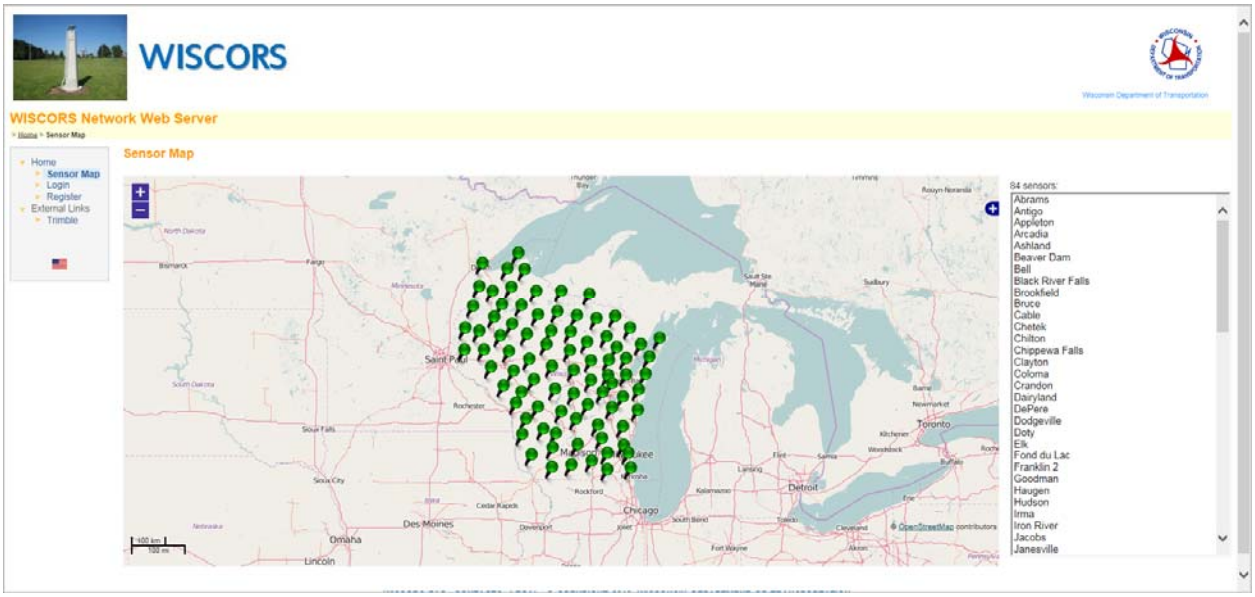


Step 6: Left click on the small shield located on the left side of the address bar.

Change the selection from “Keep Blocking” to “Disable Protection on This Page.”



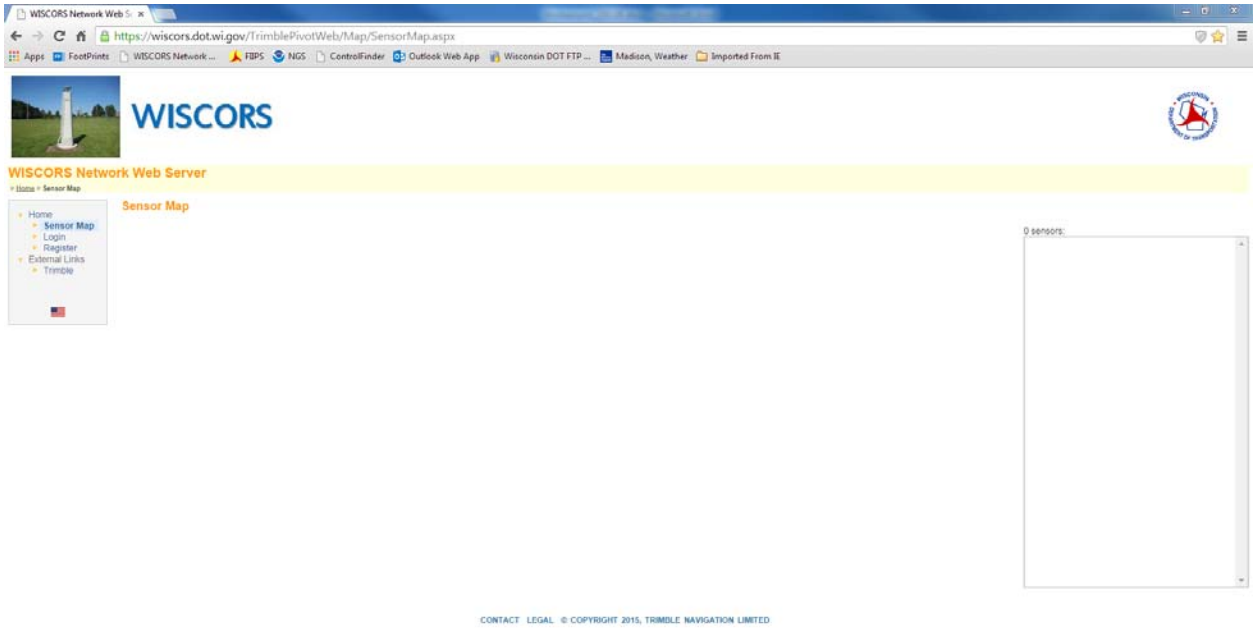
The base map and WISCORS station symbols will now load.



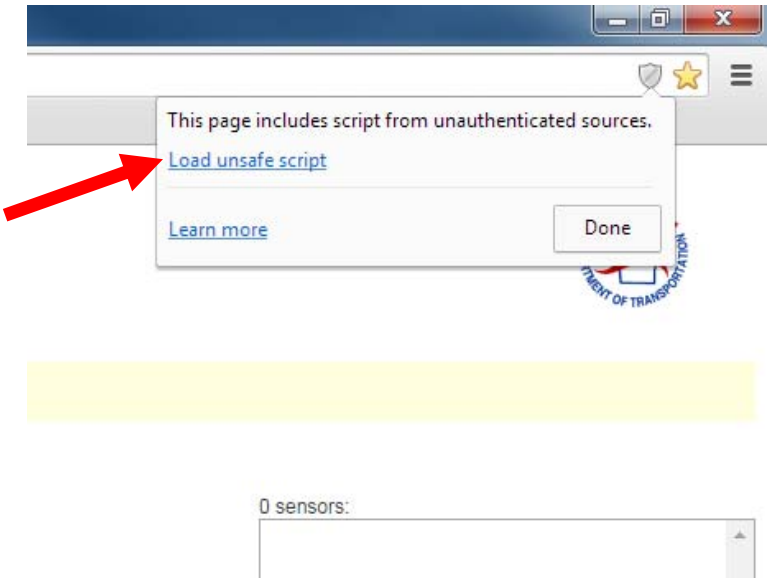
Note: The shield’s setting will have to be disabled each time the Firefox browser window is closed and later reopened.

Google Chrome:

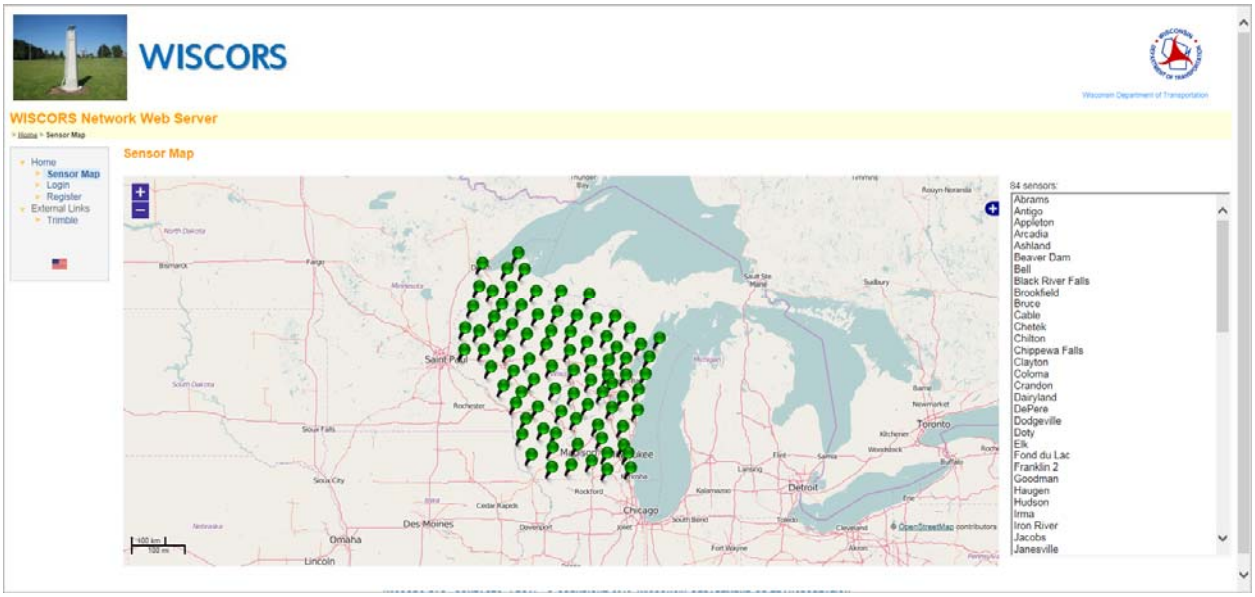
Step 1: Open Google Chrome and navigate to the WISCORS Network web server. Click the 'Sensor Map' link and the WISCORS web server page will load, but the map element will still be blocked and will show 0 sensors available.



Step 2: Click on the small shield icon on the right side of the address bar and select "Load unsafe script."



The base map and WISCORS station symbols will now load.



Note: The shield's setting will have to be changed each time the Google Chrome browser window is closed and reopened.

Internet Explorer:

Step 1: Open Internet Explorer and navigate to the WISCORS Network web server. Click the 'Sensor Map' link and the browser prompts with a warning "Only secure content is displayed."

Step 2: Click the "Show all content" box and the Sensor Map will display.

Note: The "Show all content" box will have to be clicked each time the Sensor Map is displayed.

Note: It is also possible to disable this prompt:

https://support.microsoft.com/en-us/kb/2625928

Q: If you are having problems accessing the WISCORS Network, before attempting to contact WisDOT, please consider the following:

Login deactivation

1. Every login must be associated with a valid email address.
2. Every login is renewed in advance of its annual service date, provided the email address associated with the login remains a valid email address.
3. If your email address is no longer valid or the person who registered for the account has left your organization, the login may have been deactivated.
4. If your login has been deactivated due to an invalid email address, contact the WISCORS Team to update this information.

Other possible causes and suggestions (in no particular order):

1. Every rover device connected to the network requires a unique login. Confirm that another rover with your organization is not already connected to the network using the same login.
2. Power cycle your equipment. A 'Power down' and 'Power up' of the equipment may resolve some connectivity and communication issues.
3. Verify the login and password configured for the device.
4. Verify the IP Address and Port Number are correct.
5. Confirm that your modem or device is able to access the internet by navigating to a web site or another IP Address.
6. The NMEA position of the rover must be within 100 kilometers (about 62 miles) of the nearest base station to authenticate on the WISCORS Network. Attempts to test equipment configurations from outside of Wisconsin may fail for this reason.
7. The equipment vendor remains your best resource for support for your specific equipment and application.

Q: Systems Maintenance Fee

Please direct any questions, concerns, or comments regarding WisDOT's proposed Systems Maintenance Fee to Ray Kumapayi (WisDOT Chief Surveying and Mapping Engineer) and Jacob Rockweiler (WisDOT Height Modernization Program Manager).

Appendix D

Sediment Sampling Equipment Information

Sludge & Sediment Samplers

Similar in design to core sampler (page 18), sludge & sediment samplers come with core and auger tips that are fitted with one-way valves for the retention of high-quality soil core samples in non-cohesive, saturated materials. These samplers are made in two diameters (2 1/4" and 3 1/4") and are available in lengths of 8", 10", and 12". They include a solid cap, valved core tip, valved auger tip, sludge cylinder body, universal slip wrench, plastic liner, and end caps. The solid cap, cylinder body, and tips are made of stainless steel.

Sludge & Sediment Samplers Replacement Parts

Part #	Diameter	Length	Item	Material	Weight	Price
428.10	2 1/4"		5/8" Threaded, Sludge Solid Cap	SST	1.4 lb	$ 141.30
428.15	3 1/4"		5/8" Threaded, Sludge Solid Cap	SST	2.3 lb	$ 142.50
328.10	2 1/4"		Quick Connect, Sludge Solid Cap	SST	1.7 lb	$ 166.00
328.15	3 1/4"		Quick Connect, Sludge Solid Cap	SST	2.6 lb	$ 170.10
428.07	2 1/4"		Valved Core Tip	SST	0.7 lb	$ 207.50
428.17	3 1/4"		Valved Core Tip	SST	1.0 lb	$ 206.40
428.08	2 1/4"		Valved Auger Tip	SST	0.9 lb	$ 247.40
428.16	3 1/4"		Valved Auger Tip	SST	1.4 lb	$ 248.50
428.09	2 1/4"	8"	Cylinder Body	SST	1.7 lb	$ 138.80
428.24	2 1/4"	10"	Cylinder Body	SST	2.1 lb	$ 148.20
428.26	3 1/4"	10"	Cylinder Body	SST	3.1 lb	$ 152.00
428.28	3 1/4"	12"	Cylinder Body	SST	3.8 lb	$ 152.80
422.03	2"	8"	Plastic Liner		0.2 lb	$ 4.60
422.04	2"	10"	Plastic Liner		0.2 lb	$ 5.10
422.01	3"	10"	Plastic Liner		0.3 lb	$ 6.30
422.02	3"	12"	Plastic Liner		0.4 lb	$7.60
418.10	2"		Plastic End Cap		0.1 lb	$ 0.50 ea
418.09	3"		Plastic End Cap		0.1 lb	$ 0.60 ea

5/8" Threaded, Sludge & Sediment Samplers

Part #	Diameter	Length	Material	Weight	Price
428.11	2 1/4"	8"	SST	6.0 lb.	$ 643.80
428.12	2 1/4"	10"	SST	6.3 lb.	$ 656.40
428.13	3 1/4"	10"	SST	9.2 lb.	$ 658.90
428.01	3 1/4"	12"	SST	9.9 lb.	$ 654.20

Quick Connect Sludge & Sediment Samplers

Part #	Diameter	Length	Material	Weight	Price
328.12	2 1/4"	8"	SST	6.8 lb.	$ 680.60
328.13	3 1/4"	10"	SST	9.6 lb.	$ 686.30
328.01	3 1/4"	12"	SST	10.3 lb.	$ 698.00

Multi-Stage Sludge & Sediment Sampler

This sampler uses a disposable plastic core catcher and a rubber check flap on a special top cap to improve recovery of saturated materials.

During deployment of the sampler, the check flap on the top cap opens to allow excess air and water to escape through the four holes that are machined through the top cap. Air and water are able to easily pass through the sampler.

When the sampler reaches the sediment, the saturated materials are able to push through the core catcher and into the liner inside of the sampler body as the sampler is driven downward. The venting action of the check flap and cap prevents pressure buildup and allows the sample to enter the liner.

During retrieval of the filled sampler, the core catcher will be pressed closed by the weight of the sediment. This helps prevent the material from escaping through the bottom of the sampler. At the same time, the check flap will cover the holes through the top cap – which creates suction inside the sampler. This suction also helps to retain the collected sample in the sampler body.

The multi-stage sampler includes a check flap, top cap, core tip, 12" multi-stage base section, 2" x 12" plastic liner, two 2" end caps, 2" core catcher, and a universal slip wrench. The cap, base section, and core tip are all made of stainless steel.

Optional extension sections may be added onto the base section. Additional liners or longer liners may be used in the extended sampler. See below for details. Optional valved core and auger tips are also available to help improve the quality of samples collected in very non-cohesive, saturated materials. A complete multi-stage sampling kit is also available. See page 57 for details.

5/8" Threaded, Multi-Stage Sludge & Sediment Sampler

Part #	Diameter	Length	Item	Material	Weight	Price
403.31	2 3/8"	12"	Mutli-Stage Sludge & Sediment Sampler	SST	9.7 lb.	$ 551.80

*Notes: All components are included in the multi-stage sludge & sampling kit. See page 57 for replacement parts.

#403.31

Information Available on AMS Website | Product Video Available on YouTube | Information Available on AMS Facebook Page

Multi-Stage Valved Core Tip

The multi-stage valved core tip is made of 300 series stainless steel. The one-way valve helps retain samples.

Part #	Diameter	Material	Weight	Price
403.28	2 3/8"	SST	0.8 lb.	$ 212.80

Multi-Stage Valved Auger Tip

The multi-stage valved core tip is made of 300 series stainless steel. The one-way valve helps retain samples.

Part #	Diameter	Material	Weight	Price
403.29	2 3/8"	SST	0.8 lb.	$ 245.60

Multi-Stage Extension Section

The multi-stage core sampler extensions have a female top thread and a male bottom thread which allow them to connect to the multi-stage sampler body as well as to each other. These extension sections allow the sampler body to become up to 48"-long and to collect longer samples into one or multiple liners. They are made of 300 series stainless steel.

Part #	Diameter	Length	Material	Weight	Price
403.23	2 3/8"	12"	SST	3.9lb.	$ 201.20

Multi-Stage Sludge & Sediment Sampling Kit

This sampling kit provides all of the components needed o collect sludge and sediment samples up to 4' in length. The 12" base section and three extension sections allow you to assemble a sampler that is 12", 24", 36", or 48" in length. It also comes with three 4' extensions that allow you to deploy the sampler through 12' of water before reaching the sediment.

The kit includes all of the components of the multi-stage sludge & sediment sampler (page 58), 12" multi-stage base section, three 12" multi-stage extension sections, 2" multi-stage core tip, 2" multi-stage valved core tip, three 4' extensions, 2" x 12" OD plastic liner, two 2" end caps, 2" core catcher, universal slip wrench, two crescent wrenches, 18" rubber-coated cross handle, slide hammer, and deluxe carrying case. The top cap, core tip, valved core tip, multi-stage sampler, multi-stage extension sections, and extensions are made of stainless steel.

Liners are available in 24", 36", and 48" lengths.

#209.41

5/8" Threaded, Multi-Stage Sludge & Sediment Sampling Kit

Part #	Diameter	Item	Weight	Price
209.41	2 3/8"	Sludge & Sediment Sampling Kit	65.1 lb.	$ 1,695.80

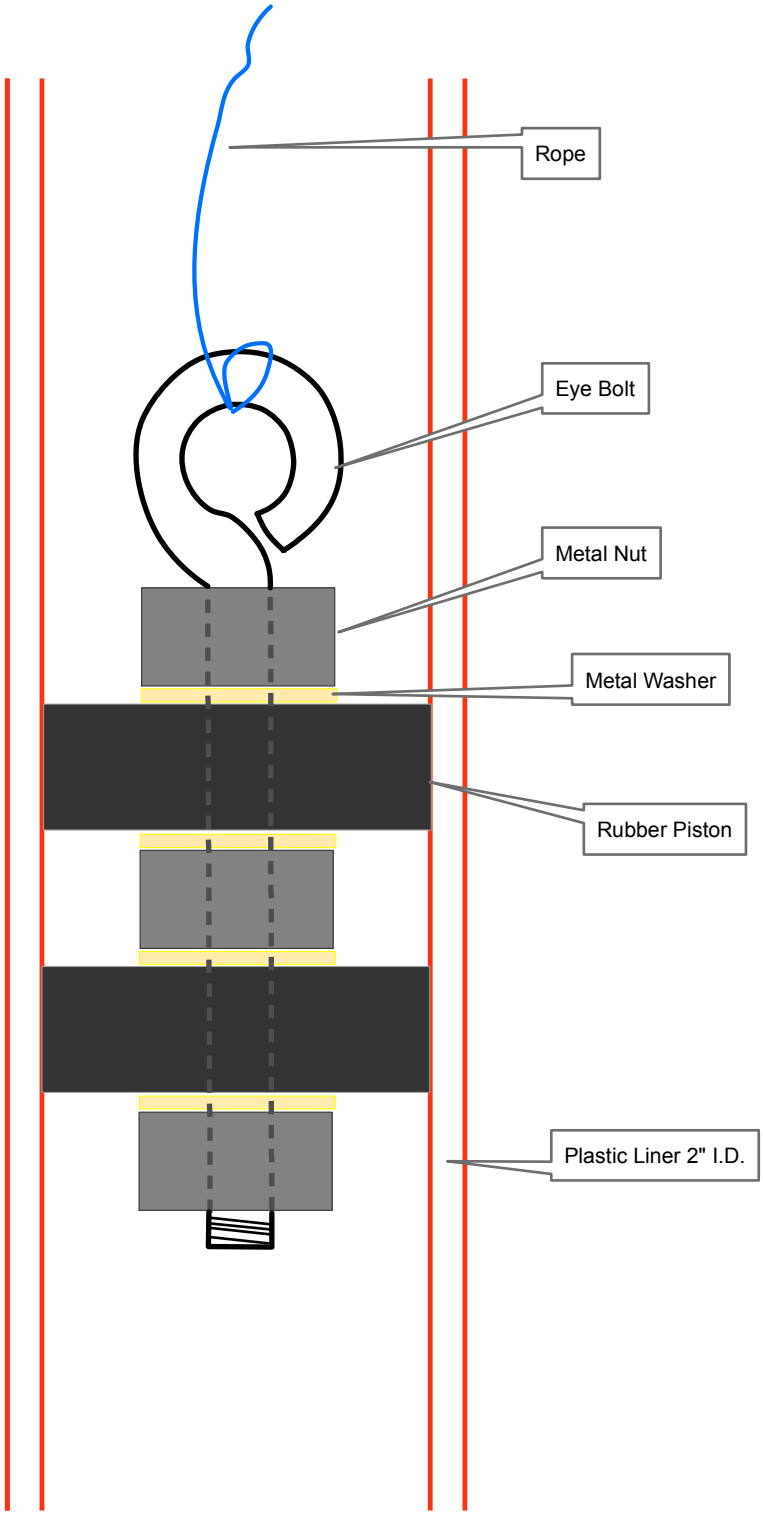
Multi-Stage Sludge & Sediment Sampling Kit Replacement Parts & Accessories

Part #	Diameter	Diameter	Item	Material	Weight	Price
403.24	2"	12"	Multi-Stage Sampler Base	SST	4.4 lb.	$ 201.20
403.23		12"	Multi-Stage Extension Section	SST	4.0 lb.	$ 201.20
403.19			Core Tip	SST	0.8 lb.	$ 160.70
403.28			Valved Core Tip	SST	0.9 lb.	$ 212.80
403.29			Valved Auger Tip	SST	0.9 lb.	$ 245.60
403.21			Top Cap & Check Flap	SST	1.2 lb.	$ 134.30
409.09		4'	5/8" Thread Extension	SST	2.1 lb.	$ 90.40
406.04		18"	5/8" Thread Cross Handle		1.3 lb.	$ 39.90
400.99			5/8" Reg. Slide Hammer		10.2 lb.	$ 173.80
421.10		12"	Crescent Wrench		1.4 lb.	$ 35.00
421.29			Universal Slip Wrench		1.4 lb.	$ 36.90
430.07	2"	12"	Nylon Brush		0.1 lb.	$ 13.90
430.01			Deluxe Carrying Case 1750		26.0 lb.	$ 250.30
404.91	2"		Plastic Core Catcher		0.1 lb.	$ 6.50
418.10	2"		Plastic End Cap		0.1 lb.	$ 0.50 ea
405.10	2"	12"	Plastic Liner		0.2 lb.	$ 5.50
425.20	2"	24"	Plastic Liner		0.3 lb.	$ 9.00
406.72	2"	36"	Plastic Liner		0.4 lb.	$ 11.60
406.73	2"	48"	Plastic Liner		0.5 lb.	$ 13.50

*Plastic, brass, stainless steel, and aluminium liners are available in various lengths. See page 78 for details. No returns are accepted for plastic liners.

This stainless steel sampler features a vented top cap with check flap, a one-way valved core tip, a multi-stage sampler base body, and three 12" extension sections.

Core Piston Detail



Appendix E

Core Section Photographs

GGB-02 sediment core 2018

GGB-06 sediment core 2018

GGB-08 sediment core 2018

GGB-05 sediment core 2018

GGB-10 sediment core 2018

GGB-15 sediment core 2018

GGB-14 sediment core 2018

GGB-20 sediment core 2018

GGB-21 sediment core 2018

GGB-25 sediment core 2018

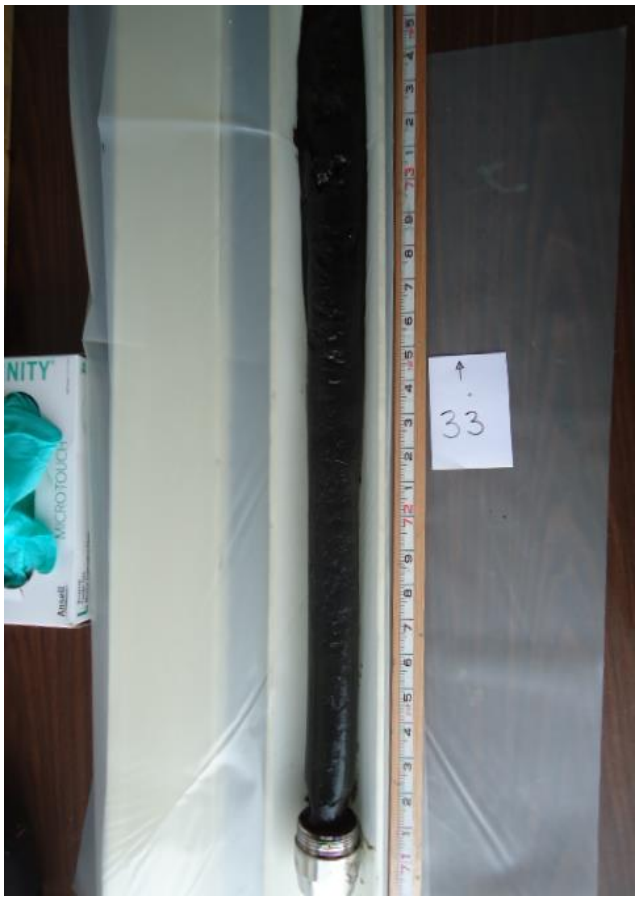
GGB-22 sediment core 2018

GGB-25R sediment core 2018 2018

GGB-26 sediment core 2018

GGB-28 sediment core 2018

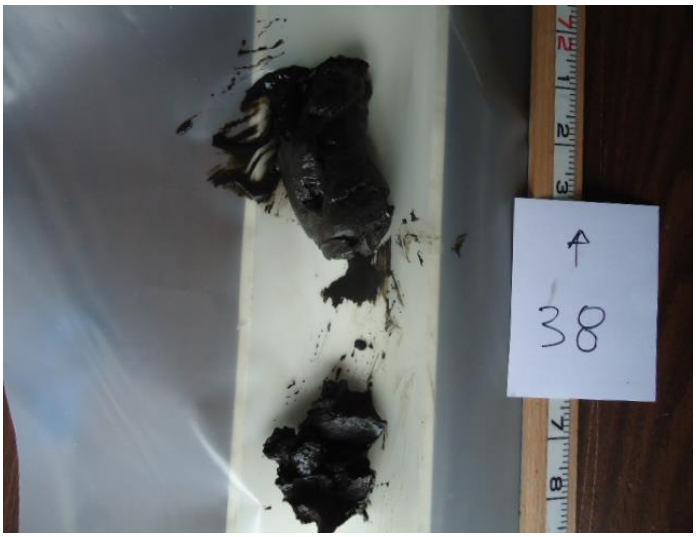
GGB-27 sediment core 2018



GGB-33 sediment core 2018

GGB-37 sediment core 2018

GGB-44 sediment core 2018



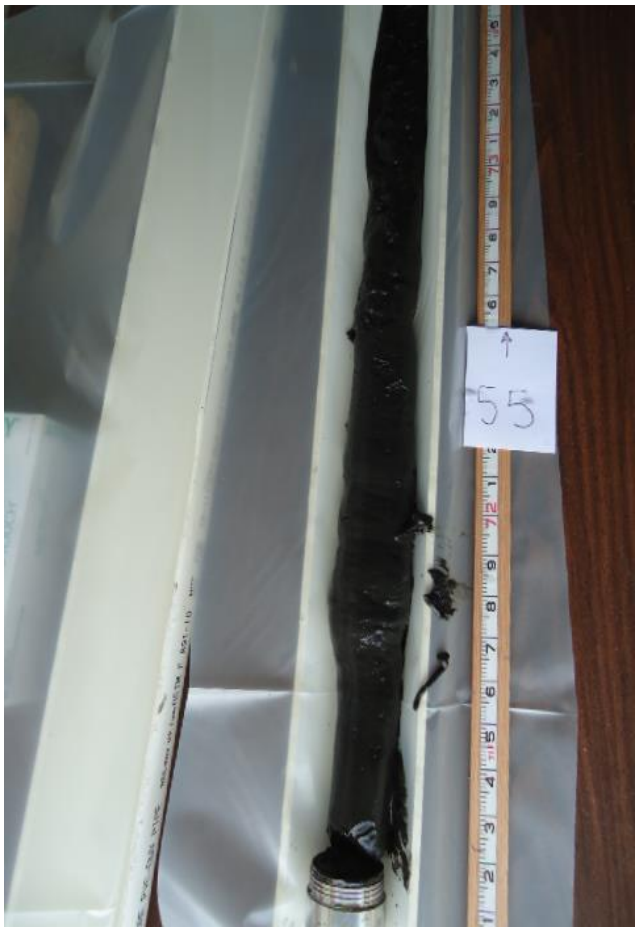
GGB-38 sediment core 2018

GGB-45 sediment core 2018

GGB-40 sediment core 2018

GGB-46 sediment core 2018

GGB-54 sediment core 2018



GGB-55 sediment core 2018

GGB-47 sediment core 2018

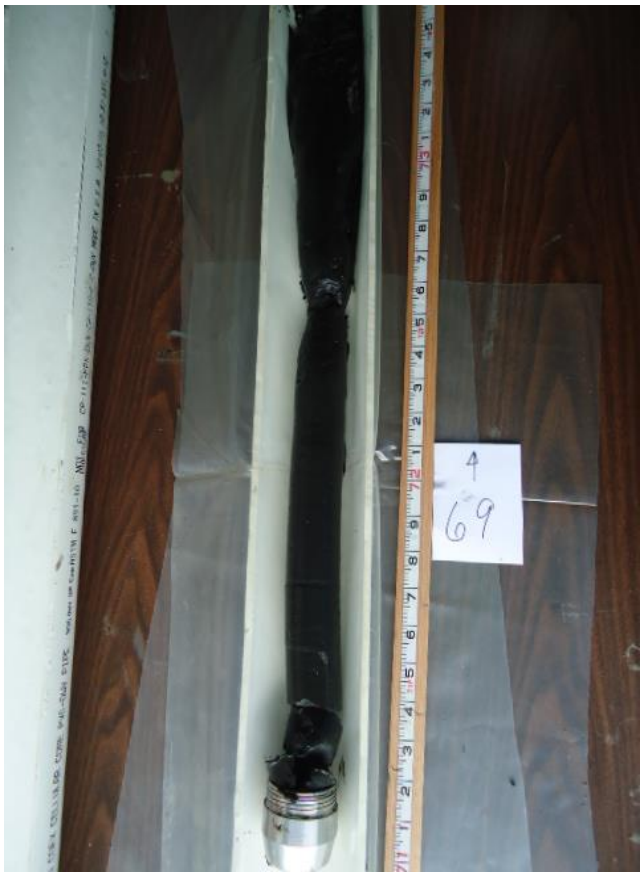
GGB-56 sediment core 2018

GGB-58 sediment core 2018

GGB-57 sediment core 2018

GGB-59 sediment core 2018

GGB-60 sediment core 2018



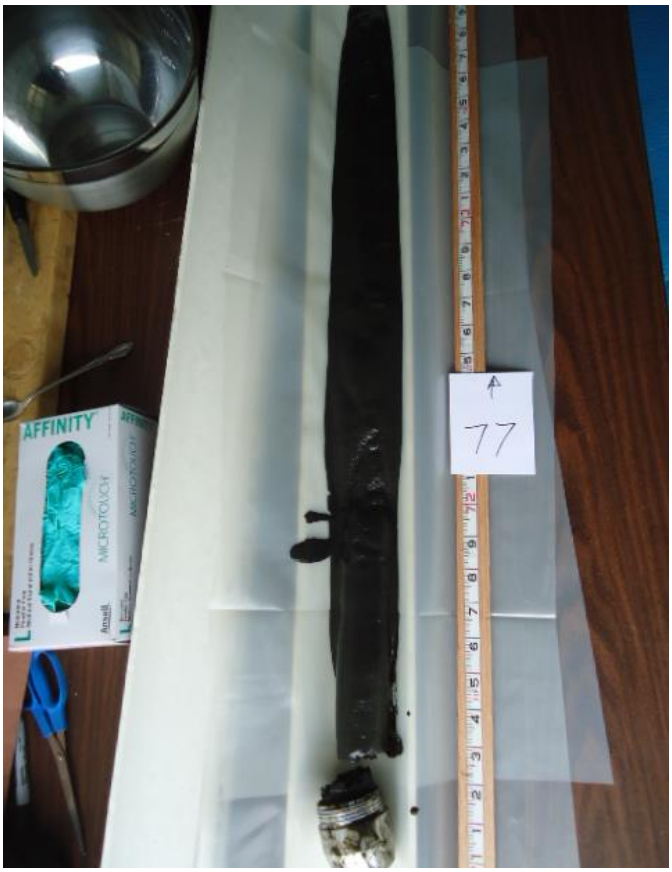
GGB-69 sediment core 2018

GGB-68 sediment core 2018

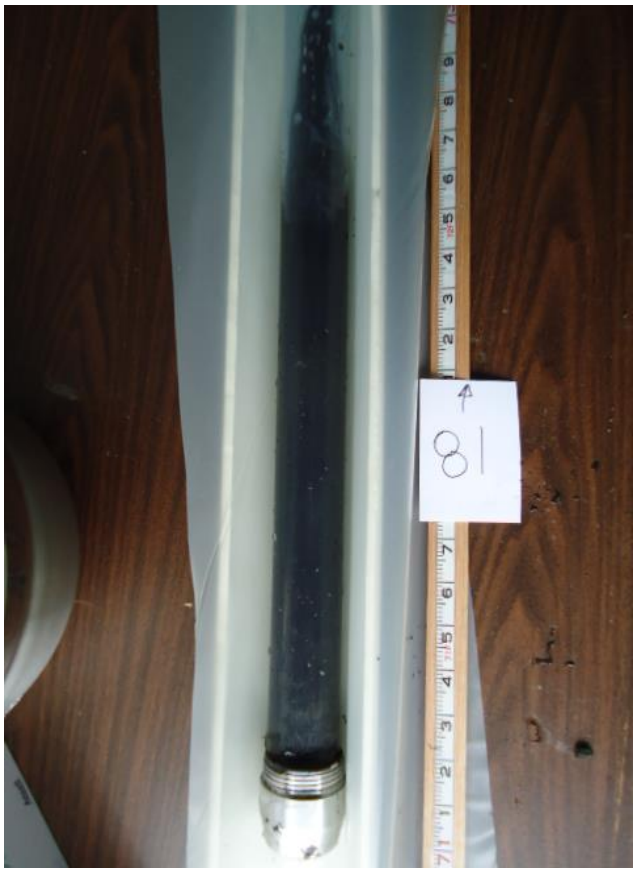
GGB-73 sediment core 2018

GGB-74 sediment core 2018

GGB-78 sediment core 2018



GGB-77 sediment core 2018



GGB-81 sediment core 2018

GGB-82 sediment core 2018

GGB-96 sediment core 2018

GGB-89 sediment core 2018

GGB-97 sediment core 2018

Appendix F

Representative Sediment Core Photo Log

Sediment Core Photo Log

GGB-10

Sample Interval (feet)	Mercury Concentration (mg/kg)	Core Section (feet)	Core Section Description
Core Recovery = 1.5 feet			
0 - 0.5	**4**	0 - 0.1	black, very fine-grained gelatinous sediment, non-cohesive, wet
0.5 - 1.5	**0.45**	0.1 - 1.1	black, silty clay, cohesive, soft
1.5	0.077	1.1 - 1.5	dark gray, silty clay, cohesive, firmer

Sediment Core Photo Log

GGB-22

Sample Interval (feet)	Mercury Concentration (mg/kg)	Core Section (feet)	Core Section Description
Core Recovery = 1.1 feet			
0 - 0.5	**3.6**	0 - 0.4	black, very fine-grained gelatinous sediment, non-cohesive, wet
0.5	**3.1**	0.4 - 1.1	black, silty clay, cohesive, firm
0.5 - 1.1	0.12		

Sediment Core Photo Log

GGB-58

Sample Interval (feet)	Mercury Concentration (mg/kg)	Core Section (feet)	Core Section Description
Core Recovery = 2.9 feet			
0 - 0.5	**1.4**	0 - 1.0	black, very fine-grained gelatinous sediment, non-cohesive, wet
0.5 - 1.5	**1.9** **1.8(D)**		
1.5 - 2.8	**4.3**	1.0 - 2.2	black, silt, soft, moist
2.8 - 2.9	0.078	2.2 - 2.9	black, silty clay, firm, moist

Sediment Core Photo Log

GGB-96

Sample Interval (feet)	Mercury Concentration (mg/kg)	Core Section (feet)	Core Section Description
Core Recovery = 2.9 feet			
0 - 0.5	**0.52**	0 - 1.6	black, very fine-grained gelatinous sediment, non-cohesive, wet
0.5 - 1.5	**0.56**		
1.5 - 2.5	**2.5**	1.6 - 2.0	black, silt, soft, wet
		2.0 - 2.9	black, silty clay, firm
2.5 - 2.9	0.098		

Sediment Core Photo Log

GGB-97

Sample Interval (feet)	Mercury Concentration (mg/kg)	Core Section (feet)	Core Section Description
Core Recovery = 2.2 feet			
0 - 0.5	0.36	0 - 0.9	black, very fine-grained gelatinous sediment, non-cohesive, wet
0.5 - 1.5	**2.2**	0.9 - 1.7	black, silt, soft, wet
1.5 - 2.2	**1.5**	1.7 - 2.2	black, silty clay, firm