APPENDIX D. GRINDSTONE RIVER DAM REMOVAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

Dredge Material Analysis





DREDGE MATERIAL ANALYSIS

GRINDSTONE RIVER DAM REMOVAL PROJECT

HINCKLEY, MINNESOTA

OCTOBER 22, 2021

Prepared for: Minnesota Department of Natural Resources 1568 Highway 2 Two Harbors, MN 55612

WSB PROJECT NO. 018664-000



GRINDSTONE RIVER DAM REMOVAL PROJECT GRINDSTONE RIVER HINCKLEY, MINNESOTA

For:

MINNESOTA DEPARTMENT OF NATURAL RESOURCES 1568 HIGHWAY 2 TWO HARBORS, MN 55612

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1. Introduction

WSB was retained by the Minnesota Department of Natural Resources (Client) to conduct a dredge materials analysis of the Grindstone River Dam reservoir sediment in Hinckley, Minnesota (the Site). A Project Location Map is included as **Figure 1**.

The purpose of dredge material analysis is to determine potential sediment impacts in preparation for the removal of the Grindstone River Dam with a primary focus on the finer grained sediment in the reservoir. Coarse sediment material (e.g. sand, gravel, pebble) is unlikely to be contaminated, as pollutants do not generally adhere to these types of coarser sediment. The results will be used to assist with the completion of an Environmental Impact Statement and for future environmental planning and budgeting for the proposed dam removal project.

This dredge material analysis has been prepared exclusively for the Client. No additional parties can rely on the information in this report without written permission from WSB.

1.1 Previous Site Evaluation

Prior to onsite investigation activities, WSB performed a site evaluation to identify past industrial activities near the Site. The site evaluation was conducted using the resources as outlined in the MPCA guidance "Managing Dredged Materials" and no additional pollutant concerns were identified. Based upon this Site evaluation, the baseline sediment parameter list and polycyclic aromatic hydrocarbons (PAHs) were the only parameters submitted for laboratory analysis for this project.

1.2 Scope of Work

The following tasks were conducted as part of this dredge material analysis to evaluate the current reservoir sediment conditions at the Property:

- Completed a public utility locate through Gopher State One Call (GSOC) service prior to sediment core advancement at the Site.
- Advanced seven (7) mechanical sediment core samples (C-1 through C-7) to depths ranging from 4-9 feet below grade using a pontoon mounted push probe drill rig for sediment sample collection.
- Assessed core samples for distinctive layering and visual and/or olfactory indications of contamination and screened soil samples for organic vapors using a photoionization detector (PID) equipped with a 10.6 eV lamp. Soil/sediment types and profiles were recorded on sediment core logs in general accordance with the Unified Soil Classification System (USCS).
- Utilized Global Positioning System (GPS) technology to record sediment core sample locations.
- Collected and submitted sediment samples for one or more of the following laboratory analyses:
 - Sieve Analysis with Hydrometer using ASTM D-422 Method
 - Arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc using EPA Method 6020B
 - Mercury using EPA Method 7471B
 - PAHs (including quinoline) using EPA Method 8270D

- Polychlorinated biphenyls (PCBs) (total) using EPA Method 8082A
- Nitrate + Nitrite by EPA Method 9056A
- Ammonia as Nitrogen by EPA Method 350.1
- Total Kjeldahl Nitrogen by EPA Method 351.2
- Total Phosphorus as Phosphorus by EPA Method 365.1
- Chromium III by EPA Method 7196A
- Chromium VI by EPA Method 7196A
- Total Organic Carbon by EPA Method Lloyd Kahn
- Prepared report detailing field observations, laboratory results, conclusions, and recommendations.

Details of the tasks completed during this investigation are discussed in the following sections and general field methods and procedures are included as **Appendix A**.

1.3 Limitations and Work Plan Deviations

Where necessary, modifications to the scope of work were made based upon field observations, discussions with the Client, and other limiting factors which are explained below. The following is a list of deviations from the proposed scope of work:

Additional Sample

• It was anticipated that six sediment cores would be advanced at the Site, but a seventh core location was added by the Client.

Equipment Failure

• It was anticipated that the sampling would be completed in one mobilization to the Site. The pontoon drill rig broke during the first sampling event on August 17, 2021 resulting in a second mobilization on September 7, 2021 to complete the remainder of the sampling.

Core Depths

• It was anticipated that each sediment core would be advanced to 15 feet below grade or shallower if natural lake bottom (native) was encountered. Sediment core C-5 hit refusal at five feet below top of sediment and natural lake bottom was not encountered based upon field observations.

Laboratory Analysis

- It was anticipated that up to 12 samples would be submitted for sieve analysis with hydrometer. Based on field observations, 10 sieve analysis with hydrometer samples were submitted and analyzed.
- It was anticipated that up to six sediment samples (one per core) will be analyzed for the parameters described in **Section 1.2**. Based on the sieve analysis with hydrometer results, 10 sediment samples were analyzed per MPCA guidance and Client recommendations.
- Quinoline analysis was not included in the initial scope/cost for PAH analysis. Quinoline was added and analyzed for 8 of the 10 sediment samples based on MPCA staff recommendations.

Additional discussion of select work plan deviations are included in the results section of this report.

2. Investigation

A total of seven (7) mechanical sediment cores (C-1 through C-7) were advanced at the Site on August 17, 2021 and September 7, 2021 to investigate potential impacts to the Grindstone Reservoir sediment. Six of the cores were advanced on the northern river channel and one was advanced on the southern river channel at the Site. All core locations were advanced in the assumed deepest area of the river (thawleg) at locations pre-approved by the Client. The core advancement was completed by Coleman Engineering Company (Coleman) of Iron Mountain, Michigan using a Geoprobe G40 hydraulic hammer attached to a 26-foot pontoon boat. The sediment core locations are included on **Figure 2**.

2.1 Sediment Classification and Field Screening

Sediment profiles were assessed at two or two-and-a half foot intervals and labeled according to the methods and procedures detailed in **Appendix A**. Each sample was visually examined for evidence of contamination, distinctive layering, debris, field classified, and screened for organic vapors using a PID equipped with a 10.6 eV lamp. Sediment core logs are included as **Appendix B**.

2.2 Soil Sampling

In general, sediment samples were collected in accordance with the MPCA's guidance document "Managing Dredge Materials" and other conversations discussed with the Minnesota DNR. Each distinct layer observed in the assumed dredge materials was submitted to the laboratory for analysis. At least one sediment sample was collected and submitted for laboratory analysis from each core advanced during this investigation, and two sediment samples were collected and submitted if a distinctive layer was identified in finer sediment (non-native material). A total of ten (10) sediment samples were collected and submitted to Eurofins Laboratory of Cedar Falls, Iowa (Eurofins) for sieve analysis with hydrometer. If sieve analysis with hydrometer results identified less than 93% of the sediment is coarser than silt (retained on a #200 sieve), the samples were also analyzed for the parameters listed in **Section 1.2**.

3. Results

3.1 Field Observations

The water depth encountered at the core sample locations ranged from 2 to 6 feet below top of water. The sediment cores were advanced to depths ranging from 4 to 9 feet below top of sediment. The shallow sediment encountered consisted of sandy silt, silty sand, or sandy clay from 0.5 to 6 feet below top of sediment which was underlain by native medium to coarse sand and gravel. No obvious sign of contamination (e.g. odor, staining, debris, etc.) was observed in the sediment core samples.

Native sediment was encountered at all sample core locations except for C-5 which hit refusal at 5 feet below top of sediment. No native sediment was encountered or collected at sample location C-5. Additionally, refusal was encountered at all sediment core sample locations except for C-7.

One elevated photoionization detector (PID) headspace reading greater than 10 parts per million (ppm) was encountered at sediment core sample C-4 (from 6.5 to 9 feet below top of sediment) at a concentration of 20.4 parts per million ppm. No petroleum or chemical odor was noted for this sample interval. No other PID concentrations were recorded above 10 ppm. Sediment core logs with PID screening results are included in **Appendix B**.

3.2 Sediment Analytical Results

A total of ten (10) sediment samples were collected and submitted for laboratory analysis. Analytical results are summarized in **Table 1**, which also includes applicable MPCA Level 1 Soil Reference Values (SRVs) and Level 2 SRVs. A copy of the laboratory analytical report is included in **Appendix C** and a Regulatory Exceedance map is included as **Figure 2**. Below is a summary of the sediment/dredge material results:

- #200 sieve analysis results ranged between 28.4% and 76.9% of sediment retained, requiring additional analysis.
- No PAHs, PCBs, or Nitrate + Nitrite concentrations were detected above laboratory reporting limits in any of the sediment samples.
- Multiple metals including cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, chromium III, and chromium VI were detected above laboratory reporting limits in one or more samples, but all were below the Level 1 and Level 2 SRVs.
- Arsenic was detected in all sample submitted for analysis. Arsenic also exceeded the Level 1 SRV in one sample C-5 (0'-3') at a concentration of 10.4 mg/kg and the Level 2 SRV in samples C-1 (0'-0.5'), C-2 (0'-1'), and C-6 (0-0.75') at concentrations of 24.8mg/kg, 24.4 mg/kg, and 28.4 mg/kg respectively.
- Ammonia Nitrogen was detected in two of the 10 samples with analytical results ranging between 146 mg/kg (C-5 (3'-5')) and 196 mg/kg (C-5 (0'-3')). No Level 1 or Level 2 SRVs are established for Ammonia.
- Total Kjeldahl Nitrogen, Total Organic Carbon, and Total Phosphorus were detected in all sample submitted for analysis. No Level 1 or Level 2 SRVs are established for all three parameters.

4. Discussion and Conclusions

This dredge materials analysis was conducted to evaluate current sediment conditions at the Grindstone Reservoir in Hinckley, MN. The following discussion and conclusion information is provided:

- Sediment consisting of sandy silt, silty sand, or sandy clay was encountered at the sample core locations ranging from 0.5 to 6 feet below top of sediment. No obvious sign of contamination (e.g. odor, staining, debris, etc.) was identified in the field during sample collection. However, an elevated PID headspace reading of 20.4 ppm was encountered at sample core C-4 from 6.5 to 9 feet below top of sediment. The cause of the elevated PID at this location is unknown.
- Arsenic was the only parameter identified during the investigation that exceeded regulatory criteria. Arsenic was detected at concentrations above the Level 1 SRV in one of the sediment samples (C-5 (0'-3')) and above the Level 2 SRVs in three of the sediment samples (C-1 (0'-0.5'), C-2 (0'-1'), and C-6 (0-0.75')) submitted for laboratory analysis. The MPCA's Managing Dredged Materials guidance document separates dredged material into three categories (Level 1, Level 2, and Level 3). Level 1 dredge material (no SRV exceedance) is suitable for use and reuse on properties with a residential or recreational use category, Level 2 dredge material (Level 1 SRV exceedance) is suitable for reuse on properties with an industrial use category and Level 3 dredge material (level 2 SRV exceedance) is not suitable for use or reuse and must be disposed of at an appropriate solid waste facility.
- The detected arsenic concentrations at select core samples exceeds the native background levels for Pine County Minnesota (average 4.1 mg/kg). Therefore, the elevated arsenic detections are assumed to be anthropogenic in nature. The cause of the arsenic impacts to sediment at the Site is unknown.
- If the sediment material at/near core sample locations C-1, C-2, C-5 and C-6 are disturbed or dredged as part of the dam removal project, the material will need be managed in accordance with MPCA guidance.

5. Recommendations

Based on the results of this dredge material analysis investigation, WSB provides the following recommendations:

- Hire an environmental consultant to assist with the management of regulated sediment (Level 2 and Level 3 dredged material) that will be disturbed during the dam removal project. The consultant will ensure all disturbed sediment is managed in accordance with state, local, and federal regulations during the project.
- Consider completing additional sediment core sampling at the Site prior to initiating the dam removal project. The additional sampling should target areas planned for sediment disturbance and which have not been previously sampled for characterization purposes. The results of the additional sampling will be useful to further delineate the regulated areas impacted with arsenic (e.g. Level 2 and Level 3 dredge material) from the unregulated areas (e.g. Level 1 dredge material). Further, the additional sampling will be useful for future project planning and budgeting purposes.

6. Limitations

The conclusions and recommendations provided in this report are based on field observations and sediment sample analysis completed for this investigation. The services performed by WSB have been conducted with the level of care and skill ordinarily exercised by reputable members of the profession practicing in the same locality under similar budget and time constraints. No other warranty is made or intended.

FIGURES











DEPARTMENT OF NATURAL RESOURCES Figure 2 includes an aerial photograph of the Grindstone River Reservoir located in Hinckley, MN. Further, the seven sediment core sample locations are depicted on the photograph, as well as the four core sample locations were arsenic concentrations exceed the MPCA's Level 1 and/or Level 2 soil reference values.



TABLES

Table 1 - Dredge Material Analytical Results Grindstone River Hinkley, Minnesota WSB Project Number: 018664-000

WSB													
Sample ID (Depth Interval)	CAS#	C-1 (0'-0.5')	C-2 (0'-1')	C-2 (1'-3')	C-3 (0'-3.5')	C-4 (0'-2.5')	C-4 (4.5'-6')	C-5 (0'-3')	C-5 (3'-5')	C-6 (0'-0.75')	C-7 (0'-3')	Level 1 SRV (mg/kg)	Level 2 SRV (mg/kg)
Sample Date		9/7/2021	9/7/2021	9/7/2021	9/7/2021	8/17/2021	9/7/2021	9/7/2021	9/7/2021	9/7/2021	8/17/2021		
Sieve Analysis with Hydrometer Analysis													
% Retained on #200 Sieve	ASTM D-422	34.1	29.6	76.9	37.9	49.6	63.3	33.2	51.6	28.4	60.6	NE	NE
Polycyclic Aromatic Hydrocarbons (PAHs)					~								
All Analyzed PAHs (including quinoline)	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Polychlorinated Biphenyls (PCBs)												1	
All Analyzed PCBs	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Metals											-		
Arsenic	7440-38-2	24.8	24.4	5.22	5.86	5.25	5.98	10.4	8.05	28.4	7.58	9	20
Cadmium	7440-43-9	<2.50	<2.35	<0.751	<1.03	<0.638	<0.480	< 0.941	0.660	<2.71	< 0.710	25	200
Chromium	7440-47-3	31.8	35.7	21.0	24.1	20.3	18.1	37.6	67.3	32.2	26.2	44,000/87 ^A	100,000/650 ^A
Copper	7440-50-8	30.6	34.0	14.5	18.7	16.3	14.3	23.2	77.1	31.4	18.9	100	9,000
Lead	7439-92-1	17.2	19.2	3.87	6.08	5.41	2.56	13.8	6.90	18.0	7.08	300	700
Mercury	7439-97-6	0.158	0.134	0.0370	0.0622	0.0299	<0.0227	0.0829	0.0599	0.142	<0.0256	0.5	1.5
Nickel	7440-02-0	25.1	27.0	14.9	14.8	15.3	11.6	20.2	31.3	24.5	22.9	560	2,500
Selenium	7782-49-2	<7.50	<7.06	<2.25	<3.10	<1.91	1.71	<2.82	1.85	<8.12	3.00	160	1,300
Zinc	7440-66-6	175	198	86.0	83.0	89.1	50.1	120	61.5	178	80.2	8,700	75,000
Chromium, trivalent	16065-83-1	31.8	35.7	21.0	24.1	19.7	18.1	37.6	67.3	32.2	26.2	44,000	100,000.0
Chromium, hexavalent	18540-29-9	<2.38	<2.25	<0.812	<0.957	0.642	<0.514	<1.08	<0.545	<2.59	< 0.643	87	650.0
Other						·							
Ammonia Nitrogen	7664-41-7	<289	<262	<96.1	<114	<70.6	<61.9	195	146	<318	<78.2	NE	NE
Total Kjeldahl Nitrogen	STL00296	12400	10600	2220	5710	2530	820	5110	1860	11000	735	NE	NE
Total Phosphorus	7723-14-0	1720	1660	392	924	643	245	1100	706	2190	484	NE	NE
Total Organic Carbon	7440-44-0	247000	212000	52300	79800	25800	36400	50100	15900	272000	9720	NE	NE
Nitrate Nitrite as N	STL00217	<57.4	<55.1	<20.3	<23.6	<14.0	<12.2	<26.0	<13.3	<61.2	<16.2	NE	NE

Notes: All results reported in mill grams per kilogram (mg/kg)

BOLD = Concentration is greater than or equal to laboratory reporting limit

< = Analyte not detected greater than or equal to laboratory reporting limit shown

ND = Analyte not detected above laboratory reporting limits

NA - Not Analyzed

NE = Not Established A = Values are for Chromium III / Chromium VI

SRV = Soil Reference Value

Green = Value is greater than or equal to Level 1 SRV Orange = Value is greater than or equal to Level 2 SRV

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Appendix A Methods and Procedures

METHODOLOGIES AND PROCEDURES

I. Hydraulic Push Probe Sediment Core

Prior to offshore coring activities, subsurface utility lines were marked by Gopher State One Call, Minnesota's on-call utility locating service. Coring installations were accomplished using a pontoonmounted drill rig. Subsurface soil/sediment sampling was conducted using a Geoprobe GH40 hydraulic sampling hammer to drive a 2-inch outside diameter, stainless-steel rod to the desired sampling depth. A dual tube system consisting of an outer drive case lined with an acetate sleeve, was used to collect soil/sediment samples at 5-foot intervals. A new acetate sleeve was used for each 5-foot interval. Samples were collected continuously from each coring location for field logging and screening for volatile organic vapor concentrations. To avoid cross contamination, the outer drive casing was cleaned between sampling intervals utilizing an Alconox solution and rinsed with potable water.

II. Calibration of MiniRAE Lite Model 7300 PID

Prior to each field usage, the MiniRAE Lite PID was calibrated in the field using a 100-ppm isobutylene standard in accordance with the instructions outlined in the MiniRAE Lite User's Manual. The results were recorded on the calibration log located in the PID carrying case along with the date, time, and project information. An additional calibration verification check was conducted by attaching the calibration gas to the instrument and then removing to make sure the instrument reading returned to zero.

III. Field Log Preparation

Blank sediment core logs were used to document sediment/soil conditions encounter during the field activities. The sample interval, recovery, and PID volatile organic compound readings were recorded for each sample interval. In general, the methods outlined in the *Standard Practice for Description and Identification of Soils* (ASTM D2488-93) and the MPCA Managing Dredged Materials guidance were used to describe soil and/or sediment. The sediment/soil descriptions were described in the following order:

A description of the main soil/sediment group within the sample (e.g., silty sand, clay, silt, etc.). Optional. If coarse-grained material (i.e., sand or gravel), include a brief description of the predominant particle grain size(s) (e.g., fine, medium, coarse).

Optional. If fine grained material (i.e., clay or silt), describe the consistency based on finger pressure (e.g., very soft = thumb will penetrate more than 1 inch, soft = thumb will penetrate about 1 inch, firm = thumb will penetrate about 1⁄4 inch, hard = thumb will not indent, but thumbnail will easily make a mark, very hard = thumbnail will not indent).

If another soil/sediment group is present in the sample describe its concentration with an adjective based on the percentages present within the sample (i.e., trace = < 5%, few = 5 to 10%, little = 10 to 25%, some = 30 to 45 %).

Describe the overall moisture of the soil/sediment sample using the terms dry, moist, or wet (do not use the term "saturated").

Describe the color of the main soil/sediment group (e.g., brown, gray, etc.).

Be sure to note the presence of any unusual occurrences (e.g., bricks, glass, debris, petroleum odor). Include the specific depth interval of the occurrence of unique material in the description or in the Remarks.

If the soil/sediment material is fill or probable fill, note in parenthesis [e.g., (fill), (probable fill).

Soil/sediment description examples:

Silty sand, fine to medium grained, with few gravel, moist, dark brown. Sandy clay with trace gravel, soft, wet, gray, petroleum odor (fill).



The sediment depth from top of water was recorded on the log in the "notes" section. In addition, the sample name, analysis, and time of all samples collected for analytical analysis were also recorded in the "remarks" column.

Laboratory sample collection documentation examples:

SP-2 (2-4') Metals, PAH, VOC @ 9:00 SB-2 (4-6') DRO, GRO, VOC @ 9:30

IV. Sediment Sample Collection, Screening, and Analysis

Core samples were managed in general accordance with ASTM E1391-03 Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediment for Toxicological Testing and for Selection of Samples Used to Collect Benthic Invertebrates and in compliance with sampling methods as outlined in the MPCA Managing Dredged Materials guidance. Sediment samples were classified in the field consistent with the Unified Soil Classification System (USCS). Additionally, samples were visually inspected for existence of strata formation, and a written description including position, length, odor, texture, and color of the strata was provided.

Core samples collected during sampling activities were also screened for the presence of organic vapors using a PID equipped with a 10.6 or 11.7 electron volt (eV) lamp. The PID was calibrated prior to daily field activities to an isobutylene standard for readings in parts per million benzene on a volume/volume basis. For each sample, a clean polyethylene bag will be half filled with soil/sediment and immediately sealed. The bag will be shaken for approximately 15 seconds and then stored for a minimum of 10 minutes for headspace development. The bag will then be shaken for another 15 seconds and the PID probe will be inserted through a small opening in the bag. The highest PID reading within approximately 2 seconds after insertion will be recorded for each sample. A new pair of disposable nitrile gloves was used during the collection of each sample to reduce cross contamination. Soil/sediment sampling tools were decontaminated with Alconox detergent (or similar) and rinsed with potable water prior to each sample collection.

Core samples were advanced to the proposed dredge depth plus two feet and were analyzed from each distinct layer in the materials to be dredged. If no strata formation existed, core samples were divided into two-foot segments, and each segment was analyzed for the required chemical and characteristics. Soil/sediment samples selected for laboratory analysis were placed in laboratory-prepared containers, labeled, stored on ice, and shipped with the chain of custody form to a Minnesota-Department of Health certified laboratory. The respective sample containers will be labeled with the following information:

Unique sample number Site name Name of sampler Time and date Desired analysis



Appendix B Sediment Core Logs

Soil Boring Log Page 1 of 1 Boring Identification: C-1

Client: Minnesota Department Of Natural Resources

Project Name: Grindstone River Dam Removal Project

Address: Grindstone River - Hinkley, MN

Boring Location: See Location Map

Date: 9/07/21

Drilling Method: Pontoon Push Probe

WSB Project Number: 018664-000

	Depth (ft.)	USCS	Symbol		Soil Descripti	ion		WL	Recovery (ft.)	Well Installation Details	PID Reading (ppm)	Notes
AL.GPJ	1	ML		Sandy silt, black (Native) Medium wet, no odor	with organics, w	et, no odor with gravel,	, brown,				0.5	C-1 (0'-0.5') - Base Line Parameter List + PAHs @ 1145
3B.GDT - 10/21/21 08:02 - K:\018684-000\ADMIN\DOCS\GINT LOGS\BORING LOG FIN/	2	SW							1.5		0.6	
AL BORING LOG 2 - WSI					End of Boring	4.0'.						Refusal at 4'
MENT.	Water Level Measurement (ft.)		rement (ft.)	Screen	Ground Surface	Water Sampling	Soil Samplir	Start: 9	/7/2021 11:30	:00 AM E	nd: 9/7/2021 12:00:00 PM	
/IRON	Data		Time	Water	(ft)	Elevation (ft)	Method	Metho	Driller:	Sealing Time/L		.ogger: DR
SB ENV	Date Time		Depth	-		NA	Pontoo Push Probe	Notes: 2	2' to sediment	from top of	water	
Ň								11000				

Soil Boring Log

Client: Minnesota Department Of Natural Resources

Project Name: Grindstone River Dam Removal Project

Address: Grindstone River - Hinkley, MN

Boring Identification: C-2

Boring Location: See Location Map

Date: 9/07/21

Drilling Method: Pontoon Push Probe

Depth (ft.)	USC	6 Symbol		Soil Descripti	ion		WL	Recovery (ft.)	Well Installation Details	PID Reading (ppm)	Notes
_	ML		Sandy silt, black	moist, no odor							
2	SM		Silty sand with or	ganics, very dar	k brown, w	<i>r</i> et, no odor				0.8	C-2 (0'-1') Base Line Parameter list + PAHs @ 1035
								1.5			C-2 (1'-3') Base Line Parameter List +PAHs @
3			(Native) Medium brown, wet, no o	to coarse sand v dor	with gravel	, dark					1045
4										0.5	
5 ——	SW								-		-
6											
7 ——			(Native) Medium	sand, yellowish	brown, we	t, no odor		1.5		0.4	
, 	SP									0.3	-
8 ——				End of Boring	8.0'.						
Scroop Ground Water				Soil	Start: 9)/7/2021 10:30	:00 AM E	End: 9/7/2021 11:00:00 AM			
Water Level Measurement (ft.) Screen Surface Samp Depth Elevation Meth		Sampling Method	Samplir Metho	ng d Boring	Sealing Time/[Date:					
Date	Date Time Water				Pontoc	n Driller:	Coleman	L	.ogger: DR		
				-		NA	Push Probe	Notes:	3' to sediment	from top of	water

Soil Boring Log Page 1 of 1

Client: Minnesota Department Of Natural Resources

Project Name: Grindstone River Dam Removal Project

Address: Grindstone River - Hinkley, MN

Boring Identification: C-3

Boring Location: See Location Map

Date: 9/07/21

Drilling Method: Pontoon Push Probe

Depth (ft.)	USCS	6 Symbol		Soil Descript	ion		WL	Recovery (ft.)	Well Installation Details	PID Reading (ppm)	Notes
 1 2			Sandy silt with so	ome organics, bl	ack, moist,	no odor				0.5	C-3 (0'-3.5') - Base Line Paramater List + PAHs @0930
3	sw		(Native) Medium brown to dark ye	to coarse sand llowish brown, w	with some ret, no odor	gravel,		2.5		1.0	
5	GP		(Native) Gravel v	vith some clasts,	brown, we	et, no odor		0.25	-	0.0	-
				End of Boring	5.5'.						Refusal @ 5.5'
Water Level Measurement (ft.) Screen Ground Surface			Ground Surface	Water Sampling	Soil Samplir	ng Start: 9/	/7/2021 9:15:0	DO AM E	End: 9/7/2021 9:50:00 AM		
Date	Date Time Water		Water	(ft) Elevation Method Method r		Pontoo	n Driller: (Coleman	.ogger: DR		
			Depth			NA	Push	Notes: 3	3.3' to sedimer	nt from top o	of water

Soil Boring Log Page 1 of 1

Client: Minnesota Department Of Natural Resources

Project Name: Grindstone River Dam Removal Project

Address: Grindstone River - Hinkley, MN

Boring Identification: C-4

Boring Location: See Location Map

Date: 8/17/21

Drilling Method: Pontoon Push Probe

Depth (ft.)	USCS	Symbol		Soil Descripti	ion		WL	Recovery (ft.)	Well Installation Details	PID Reading (ppm)	Notes
 1 2	ML		Sandy silt with or	ganics, black, w	et, no odor			3		7.5	C-4 (0'-2.5') - Base Line Parameter List - 8/17/21 @ 830
3	SP		Medium to coarse	e sand, black, w	et, no odor					3.4	
5	ML		Sandy silt with or	ganics, black, w	et, no odor	-				7.2	C-4 (4.5'-6') - Base Line Parameter List - 9/7/21 @ 1000
7	SP		(Native) Medium odor	to coarse sand,	dark brown	n, wet, no		3			-
8	GP		odor	jraver with sand,	, dark brow	n, wei, no				20.1	
9 —				End of Boring	9.0'.						Refusal @ 9'
Water Level Measurement (ft.) Screen		Ground	Water Sampling	Soil Samplir	Start: 8	/17/2021 9:00	:00 AM E	Ind: 9/7/2021 9:05:00 AM			
***		Ci Medauli		Depth	Elevation	Method	Metho	Boring S	Sealing Time/I	Date:	
Date	Date Time Water (ft) (ft)		4	Pontoo	n Driller: (: Coleman Logger: DR					
			Борит			NA	Push Probe	Notes: 4	4' to sediment	from top of	water

Soil Boring Log Page 1 of 1

Client: Minnesota Department Of Natural Resources

Project Name: Grindstone River Dam Removal Project

Address: Grindstone River - Hinkley, MN

Boring Identification: C-5

Boring Location: See Location Map

Date: 9/07/21

Drilling Method: Pontoon Push Probe

Depth (ft.)	USC	S Symbol		Soil Descript	ion		WL	Recovery (ft.)	Well Installation Details	PID Reading (ppm)	Notes
 1 2	- ML		Fine Sandy Silt,	black, wet, no oc	lor					0.5	C-5 (0'-3') - Base Line Parameter List + PAHs @ 1230
3 4			Sandy clay with odor	gravel, black to g	rayish brov	νn, wet, no		1		0.7	C-5 (3'-5') - Base Line Parameter List + PAHs @1240
				End of Boring	5.0'.						Refusal @ 5'
Water Level Measurement (ft.)			Screen	Ground	Water Sampling	Soil Samplir	Start: 9	7/2021 12:15	:00 PM E	End: 9/7/2021 12:50:00 PM	
	Notor		Uepth (ft)	(ft) Surface Sampling Elevation Method		Metho	d Boring	Sealing Time/[e/Date:		
Date		Time	Depth			NA	Pontoo Push	Notes: 6	5' to sediment	from top of	water
							Probe				

Soil Boring Log Page 1 of 1

Client: Minnesota Department Of Natural Resources

Project Name: Grindstone River Dam Removal Project

Address: Grindstone River - Hinkley, MN

Boring Identification: C-6

Boring Location: See Location Map

Date: 9/07/21

Drilling Method: Pontoon Push Probe

Depth (ft.)	USCS	Symbol		Soil Descripti	ion		WL	Recovery (ft.)	Well Installation Details	PID Reading (ppm)	Notes
 1 2	SW		Sandy silt with or (Native) Medium brown, wet, no or	ganics, black, w to coarse sand v dor	et, no odor	, yellowish				0.3	C-6 (0'-0.75') - Base Line Parameter List + PAHs @ 1015
3			(Nativa) Madium	sand redich vel	low wet n	o odor		3.5			-
					iow, wei, ii					0.3	
4	SP										
5 ——				End of Boring	5.0'.						Refusal @ 5'
Water Level Measurement (ft.) Screen Ground Water Death Surface Sampling		Water Sampling	Soil Samplir	Start: 9/	7/2021 10:00	:00 AM E	nd: 9/7/2021 10:25:00 AM				
Date Time		Water	(ft)	Elevation	Method	Pontoo	n Driller: (Coleman		ogger: DR	
Date			Depth			NA	Push	Notes: 2	2.8' to sedimer	nt from top o	of water

Soil Boring Log Page 1 of 1

Client: Minnesota Department Of Natural Resources

Project Name: Grindstone River Dam Removal Project

Address: Grindstone River - Hinkley, MN

Boring Identification: C-7

Boring Location: See Location Map

Date: 8/17/21

Drilling Method: Pontoon Push Probe

Depth (ft.)	USCS	Symbol		Soil Descripti	ion		WL	Recovery (ft.)	Well Installation Details	PID Reading (ppm)	Notes
	ML		Fine sandy silt, b	lack, wet, no od	or						
1	SM		Medium to coarse	e sllty sand, darl	k brown, w	et, no odor				6.1	C-7 (0'-3') - Base Line Parameter List + PAHs @ 0830
2	CL		Silty sandy clay, o	dark brown, wet,	, no odor			15			
3 ——			(Notivo) Cravolu	ith come modiu	m cond. de	ark brown					
_	GW		wet, no odor	nin some media	m sanq, qa	ark diowit,				4.8	
4	SP		(Native) Medium odor	to coarse sand,	redish bro	wn, wet, no					
5				End of Boring	5.0'.						Refusal @ 5'
Water Level Measurement (ft.)			Screen	Ground Surface	Water Sampling	Soil Samplir	ng Start: 8/	/17/2021 8:15	:00 AM E	nd: 8/17/2021 9:50:00 AM	
			Water	_ Depth _ Elevation <u>Method</u>		Method	Metho	Boring Sealing Time/Date:			ogger: DR
Date Time		Depth			NA	Pontoo Push	Notes: 4	Notes: 4' to sediment from top of water			
							Probe				

Appendix C Laboratory Reports Please contact WSB for the lab reports