Sediment Characterization to Support Dredging Activities for Lake Roaming Rock, Roaming Shores, OH

Prepared for:

RoamRock Association

Prepared by:

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1.0 Introduction

At the request of RoamRock Association, Inc. (RoamRock), EnviroScience Inc. conducted a Sediment Characterization Study on October 17, 2011 to support dredging activities of Lake Roaming Rock, a 550-acre lake located in Ashtabula County in Northeast Ohio.

Soils and other materials are naturally eroded from upland areas and mobilized by wind, rain, and streams, then enter drainages and are carried downstream. Sediment entering Lake Roaming Rock comes from a variety of natural and human sources, with human-related land uses such as open construction, industrial and residential development, impervious surface, and poorly managed pasture and cropland accounting for the large majority of the sediment that has been deposited since the reservoir was constructed in the late 1960s.

A sedimentation survey conducted by EnviroScience in 2010 noted that overall lake depths have changed little since 1978, and that the overall rate of sedimentation in Lake Roaming Rock is relatively low compared to most Ohio reservoirs. However, the study also noted that a number of the lake's coves were heavily impacted by sediment, including Fisherman's Cove on the southeast end of the lake and Terrace Cove on the northwest end of the lake.

Positive benefits as a result of the removal of sediments include restoring recreational access for boating, greater access for swimming, removal of nutrient-rich sediments, reducing aquatic plant growth, and reducing sediment re-suspension by winds and waves. Removing nutrient-rich sediments can directly improve water quality and reduce algae blooms. Dredging in areas of rooted aquatic plants can reduce plant growth directly and can reduce future growth if new depths are deeper than sunlight can reach. In years where ice cover is extensive, dredging can improve fish survival by reducing oxygen-demanding sediments and creating additional deep water areas.

For these reasons, the RoamRock Association intends to explore the feasibility of dredging and has requested that EnviroScience sample the sediment as part of a dredging feasibility study.

2.0 Project Objectives

The objectives of this project included:

1. Sampling accumulated sediments from six locations that are likely candidates for dredging based on information collected in the 2010 sediment survey.

2. Collect samples from the sediment surface to the hardpan in such a way that the characteristics of various layers can be determined if necessary.

3. Analyze the sediment samples for a suite of analytical and geophysical characteristics to provide information needed for disposal and sediment basin design, respectively.

4. Compare the results of the analysis to applicable standards and identify factors which may limit disposal and dewatering options.

3.0 Sampling Methods

EnviroScience collected sediment core samples on October 17, 2011from six locations as mapped in Figure 1.1 and 1.2. Two inch diameter cores were collected using a 36" hand coring device manufactured by Wildco®. Sampling equipment was cleaned and decontaminated between locations as specified in Ohio EPA's Sediment Sampling Guide and Methodologies, 2nd Edition.

Sediment samples from the coring device were separated into equal segments with a portion being collected from each visually-identified layer of the sample. Portions of each core were composited and submitted to Precision Analytical and ProGeotech, Inc. laboratories for analysis. The remaining amounts from each sampling site were placed in sample containers and retained for future reference.

Water quality data were recorded at each site with a YSI 556 Multiparameter System (Table 1-A). Site depths, GPS points, and reference photos were also recorded at each sampling location.

4.0 Sampling Results

At each site, metal analysis by ICP (as tabulated in Table 1 and Figures 1-6 of Appendix B) was not found to exceed Ohio EPA sediment quality guidelines in freshwater ecosystems that reflect Threshold Effect Concentrations (TECs). In a separate analysis, mercury was not detected at the reporting limit. Additionally, Oil & Grease were not detected at the reporting limit.

Polychlorinated biphenyls (PCBs) detected included Decachlorobiphenyl ranging from (80.6 to 94.4) with a Reporting Detection Limit of 30-150. Also included was Tetrachloro-m-xylene ranging from (78.1 to 93.8) with a Reporting Detection Limit of 30-150. These results are characteristic of Level II contamination in accordance with the EPA's advisory concentration limits.

Geophysical results in Appendix C include grain size distribution typical of lacustrine environments. Soil matrices were composed of silt (from 47.6 to 73.4%), sand (from 2.6 to 34.3%), clay (from 17.6 to 31.3%), and gravel (from 0 to 11.0%). Organic matter ranged from 2.0 to 7.6% (Table 2-C).

5.0 Discussion & Recommendations

Sediment samples collected at six sites for use in dredging and dredge spoil management decisions did not meet or exceed criteria associated with established action levels. Based on survey results in 2011, it is the recommendation of EnviroScience that the RoamRock Association continue with proposed dredging activities in accordance with Section 10 and Section 404 regulations of the US Army Corps of Engineers and Ohio EPA Individual 401 Water Quality Certification.

Please contact EnviroScience at (800) 940-4025 or at mhilovsky@enviroscienceinc.com with questions regarding this report.

Lake Management Division
EnviroScience, Inc.

1.1

RS6

RS5

RS4

Figure 1.1. Sediment Sampling Locations.
Lake Roaming Rock..

Sediment Sampling Location

800 400 0 800 Feet

200 100 0 200 Meters

Coordinate System: NAD 1983 StatePlane Ohio North FIPS 3401 Feet

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1.2

RS3

RS1

RS2

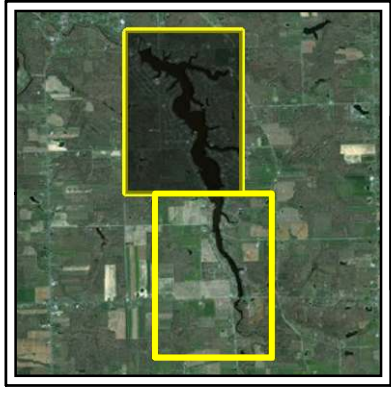

Figure 1.2. Sediment Sampling Locations.
Lake Roaming Rock..

Sediment Sampling Location

800 400 0 800 Feet

200 100 0 200 Meters

Coordinate System: NAD 1983 StatePlane Ohio North FIPS 3401 Feet

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Appendix A

Table 1-A. Roaming Shores Water Quality and Site Data

Site	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	pH	Site Depth (ft.)
RS1	10.17	0.184	81.1	9.13	8.43	3.5'
RS2	10.69	0.218	87.3	9.64	8.13	4.08'
RS3	10.63	0.212	76.3	8.43	8.12	2.5'
RS4	10.38	0.162	89.0	9.97	7.67	2.5'
RS5	13.31	0.19	53.6	5.59	7.54	2.58'
RS6	13.00	0.169	85.9	8.95	8.00	4.00'

Appendix B

Table 1-B. Roaming Shores Sediment Quality Guidelines in Freshwater Ecosystems that Reflect Threshold Effect Concentrations (TECs)

Metals (mg/Kg)	RS1	RS2	RS3	RS4	RS5	RS6	OEPA TECs
Arsenic	5.25	3.76	5.77	4.01	4.77	3.28	9.79
Cadmium	0.875	0.609	0.594	0.592	0.511	0.531	0.99
Chromium	9.20	7.31	7.19	8.27	9.04	7.86	43.4
Copper	23.7	15.1	13.5	15.2	14.1	15.8	31.6
Lead	9.81	8.93	7.55	7.46	6.53	6.93	35.8
Nickel	14.40	9.37	8.53	10.20	9.97	9.88	22.7
Zinc	59.90	48.30	39.10	45.40	40.00	42.00	121
Mercury	ND	ND	ND	ND	ND	ND	0.18

Qualifiers:
DF Dilution Factor
ND Not Detected at the Reporting Limit
RL Reporting Detection Limit (PQL)

Figure 1-B. Analysis at RS1

Analyses	Result	RL	Qual	Units
METALS ANALYSIS BY ICP				**SW6010B**
Arsenic	5.25	0.470		mg/Kg
Cadmium	0.875	0.470		mg/Kg
Chromium	9.20	0.470		mg/Kg
Copper	23.7	0.470		mg/Kg
Lead	9.81	0.470		mg/Kg
Nickel	14.4	0.470		mg/Kg
Zinc	59.9	0.470		mg/Kg
MERCURY, SOLID				**SW7471A**
Mercury	ND	0.0488		mg/Kg
PCBS, SOLID/OIL				**SW8082**
POLYCHLORINATED BIPHENYLS (PCBS), SOLID				
Aroclor 1016	ND	0.459		mg/Kg
Aroclor 1221	ND	0.459		mg/Kg
Aroclor 1232	ND	0.459		mg/Kg
Aroclor 1242	ND	0.459		mg/Kg
Aroclor 1248	ND	0.459		mg/Kg
Aroclor 1254	ND	0.459		mg/Kg
Aroclor 1260	ND	0.459		mg/Kg
Surr: Decachlorobiphenyl	91.0	30-150		%REC
Surr: Tetrachloro-m-xylene	78.1	30-150		%REC
OIL & GREASE, SOLID				**E1664**
Oil & Grease, Total	ND	479		mg/Kg
SOLIDS, TOTAL (PERCENT)				**A2540B**
Total Solids	51.9	0.00100		%

Figure 2-B. Analysis at RS2

Analyses	Result	RL	Qual	Units
METALS ANALYSIS BY ICP				**SW6010B**
Arsenic	3.76	0.480		mg/Kg
Cadmium	0.609	0.480		mg/Kg
Chromium	7.31	0.480		mg/Kg
Copper	15.1	0.480		mg/Kg
Lead	8.93	0.480		mg/Kg
Nickel	9.37	0.480		mg/Kg
Zinc	48.3	0.480		mg/Kg
MERCURY, SOLID				**SW7471A**
Mercury	ND	0.0494		mg/Kg
PCBS, SOLID/OIL				**SW8082**
POLYCHLORINATED BIPHENYLS (PCBS), SOLID				
Aroclor 1016	ND	0.679		mg/Kg
Aroclor 1221	ND	0.679		mg/Kg
Aroclor 1232	ND	0.679		mg/Kg
Aroclor 1242	ND	0.679		mg/Kg
Aroclor 1248	ND	0.679		mg/Kg
Aroclor 1254	ND	0.679		mg/Kg
Aroclor 1260	ND	0.679		mg/Kg
Surr: Decachlorobiphenyl	80.6	30-150		%REC
Surr: Tetrachloro-m-xylene	93.8	30-150		%REC
OIL & GREASE, SOLID				**E1664**
Oil & Grease, Total	ND	488		mg/Kg
SOLIDS, TOTAL (PERCENT)				**A2540B**
Total Solids	50.2	0.00100		%

Figure 3-B. Analysis at RS3

Analyses	Result	RL	Qual	Units
METALS ANALYSIS BY ICP				**SW6010B**
Arsenic	5.77	0.461		mg/Kg
Cadmium	0.594	0.461		mg/Kg
Chromium	7.19	0.461		mg/Kg
Copper	13.5	0.461		mg/Kg
Lead	7.55	0.461		mg/Kg
Nickel	8.53	0.461		mg/Kg
Zinc	39.1	0.461		mg/Kg
MERCURY, SOLID				**SW7471A**
Mercury	ND	0.0500		mg/Kg
PCBS, SOLID/OIL				**SW8082**
POLYCHLORINATED BIPHENYLS (PCBS), SOLID				
Aroclor 1016	ND	0.476		mg/Kg
Aroclor 1221	ND	0.476		mg/Kg
Aroclor 1232	ND	0.476		mg/Kg
Aroclor 1242	ND	0.476		mg/Kg
Aroclor 1248	ND	0.476		mg/Kg
Aroclor 1254	ND	0.476		mg/Kg
Aroclor 1260	ND	0.476		mg/Kg
Surr: Decachlorobiphenyl	90.4	30-150		%REC
Surr: Tetrachloro-m-xylene	79.9	30-150		%REC
OIL & GREASE, SOLID				**E1664**
Oil & Grease, Total	ND	485		mg/Kg
SOLIDS, TOTAL (PERCENT)				**A2540B**
Total Solids	42.8	0.00100		%

Figure 4-B. Analysis at RS4

Analyses	Result	RL	Qual	Units
METALS ANALYSIS BY ICP				**SW6010B**
Arsenic	4.01	0.489		mg/Kg
Cadmium	0.592	0.489		mg/Kg
Chromium	8.27	0.489		mg/Kg
Copper	15.2	0.489		mg/Kg
Lead	7.46	0.489		mg/Kg
Nickel	10.2	0.489		mg/Kg
Zinc	45.4	0.489		mg/Kg
MERCURY, SOLID				**SW7471A**
Mercury	ND	0.0491		mg/Kg
PCBS, SOLID/OIL				**SW8082**
POLYCHLORINATED BIPHENYLS (PCBS), SOLID				
Aroclor 1016	ND	0.439		mg/Kg
Aroclor 1221	ND	0.439		mg/Kg
Aroclor 1232	ND	0.439		mg/Kg
Aroclor 1242	ND	0.439		mg/Kg
Aroclor 1248	ND	0.439		mg/Kg
Aroclor 1254	ND	0.439		mg/Kg
Aroclor 1260	ND	0.439		mg/Kg
Surr: Decachlorobiphenyl	94.4	30-150		%REC
Surr: Tetrachloro-m-xylene	82.0	30-150		%REC
OIL & GREASE, SOLID				**E1664**
Oil & Grease, Total	ND	495		mg/Kg
SOLIDS, TOTAL (PERCENT)				**A2540B**
Total Solids	60.0	0.00100		%

Figure 5-B. Analysis at RS5

Analyses	Result	RL	Qual	Units
METALS ANALYSIS BY ICP				**SW6010B**
Arsenic	4.77	0.460		mg/Kg
Cadmium	0.511	0.460		mg/Kg
Chromium	9.04	0.460		mg/Kg
Copper	14.1	0.460		mg/Kg
Lead	6.53	0.460		mg/Kg
Nickel	9.97	0.460		mg/Kg
Zinc	40.0	0.460		mg/Kg
MERCURY, SOLID				**SW7471A**
Mercury	ND	0.0499		mg/Kg
PCBS, SOLID/OIL				**SW8082**
POLYCHLORINATED BIPHENYLS (PCBS), SOLID				
Aroclor 1016	ND	0.588		mg/Kg
Aroclor 1221	ND	0.588		mg/Kg
Aroclor 1232	ND	0.588		mg/Kg
Aroclor 1242	ND	0.588		mg/Kg
Aroclor 1248	ND	0.588		mg/Kg
Aroclor 1254	ND	0.588		mg/Kg
Aroclor 1260	ND	0.588		mg/Kg
Surr: Decachlorobiphenyl	93.8	30-150		%REC
Surr: Tetrachloro-m-xylene	80.5	30-150		%REC
OIL & GREASE, SOLID				**E1664**
Oil & Grease, Total	ND	489		mg/Kg
SOLIDS, TOTAL (PERCENT)				**A2540B**
Total Solids	46.8	0.00100		%

Figure 6-B. Analysis at RS6

Analyses	Result	RL	Qual	Units
METALS ANALYSIS BY ICP				**SW6010B**
Arsenic	3.28	0.483		mg/Kg
Cadmium	0.531	0.483		mg/Kg
Chromium	7.86	0.483		mg/Kg
Copper	15.8	0.483		mg/Kg
Lead	6.93	0.483		mg/Kg
Nickel	9.88	0.483		mg/Kg
Zinc	42.0	0.483		mg/Kg
MERCURY, SOLID				**SW7471A**
Mercury	ND	0.0499		mg/Kg
PCBS, SOLID/OIL				**SW8082**
POLYCHLORINATED BIPHENYLS (PCBS), SOLID				
Aroclor 1016	ND	0.534		mg/Kg
Aroclor 1221	ND	0.534		mg/Kg
Aroclor 1232	ND	0.534		mg/Kg
Aroclor 1242	ND	0.534		mg/Kg
Aroclor 1248	ND	0.534		mg/Kg
Aroclor 1254	ND	0.534		mg/Kg
Aroclor 1260	ND	0.534		mg/Kg
Surr: Decachlorobiphenyl	88.1	30-150		%REC
Surr: Tetrachloro-m-xylene	80.0	30-150		%REC
OIL & GREASE, SOLID				**E1664**
Oil & Grease, Total	ND	484		mg/Kg
SOLIDS, TOTAL (PERCENT)				**A2540B**
Total Solids	61.0	0.00100		%

Appendix C

Roaming Shores Solids Analysis of Sediment Samples

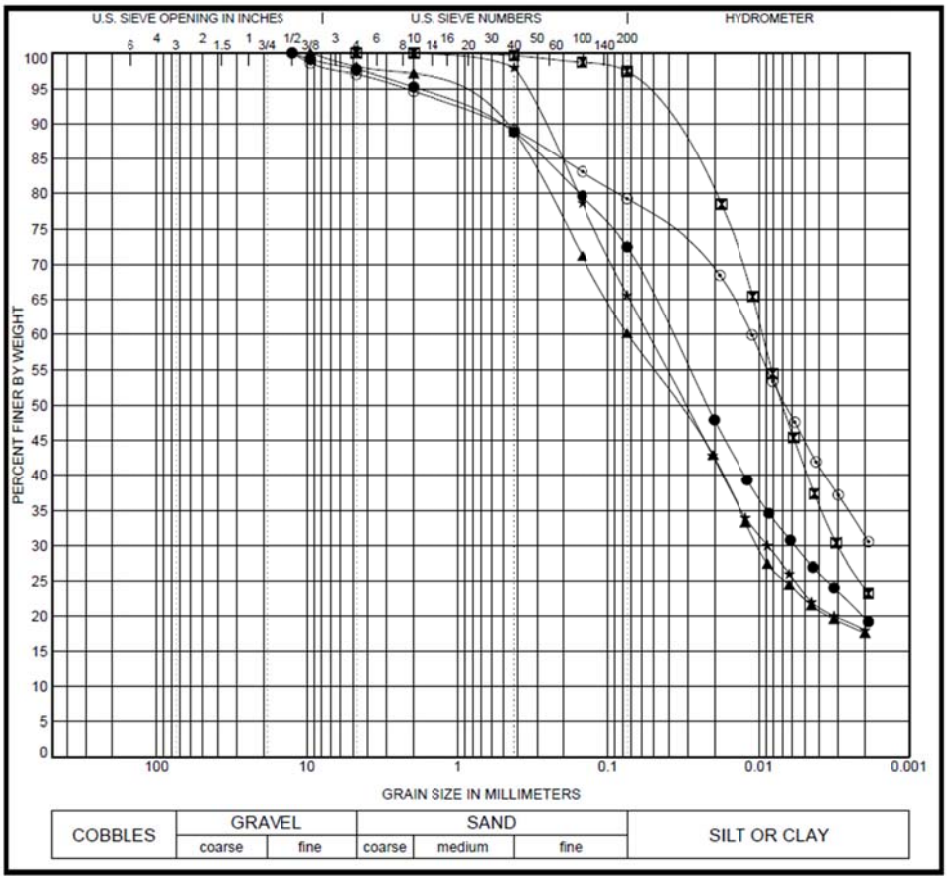
Table 1-C Summary of Geophysical Laboratory Results

Boring Number	Sample Number	Depth (feet)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plast. Index	Specific Gravity	Agg. %	C Sand %	M Sand %	F Sand %	Silt %	Silt&Clay Comb.	Clay %
RS-1	-	1.0	61.5				2.630	2.3	2.4	6.4	16.4	52.8	72.5	19.7
RS-2	-	1.0	101.1				2.609	0.0	0.0	0.3	2.2	73.4	97.4	24.0
RS-3	-	1.0	29.7				2.696	1.9	1.0	8.3	28.7	42.5	60.2	17.6
RS-4	-	1.0	31.0				2.767	0.0	0.0	2.0	32.3	47.6	65.7	18.1
RS-5	-	1.0	65.4				2.648	3.0	2.4	5.5	9.8	48.0	79.3	31.3
RS-6	-	1.0	70.4				2.674	11.0	5.0	3.6	11.9	50.5	68.6	18.1

Table 2-C Organic Matter Content of Soil

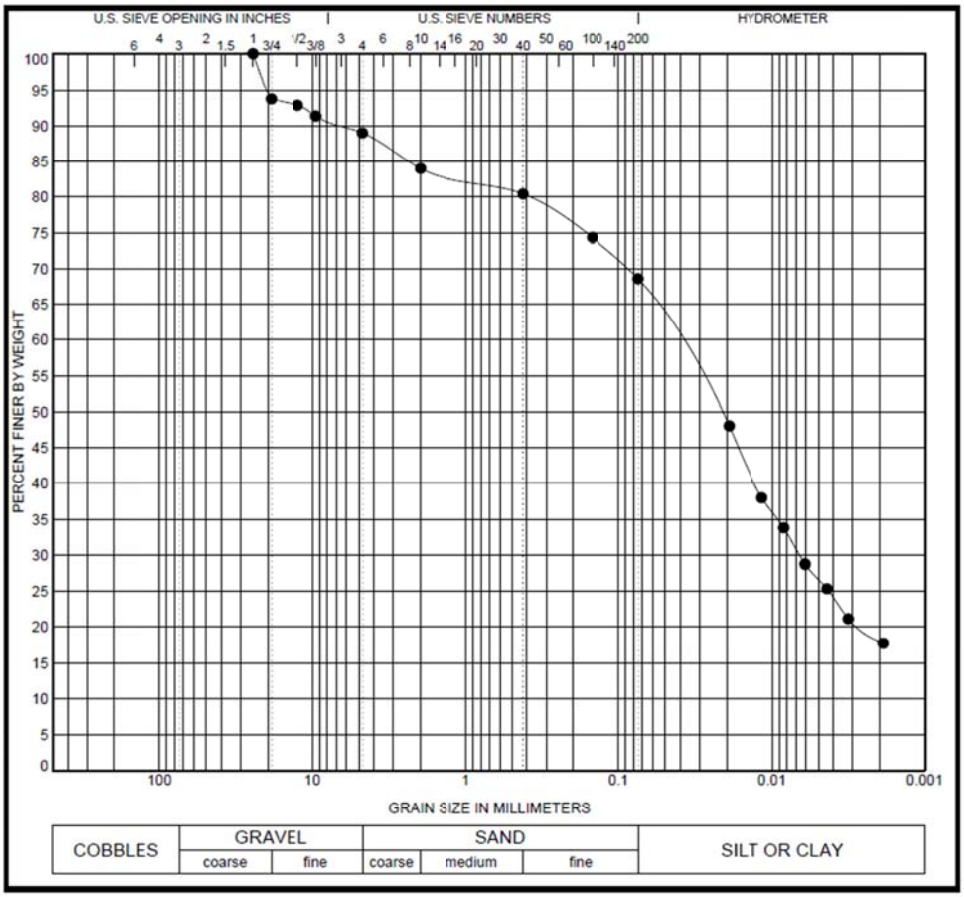
Sample	Depth (ft.)	Oven Dried Moisture Content (%)	Furnace Temperature (°C)	Ash Content (%)	Organic Matter (%)
RS-1	1.0	62	440	95.9	4.1
RS-2	1.0	101	440	94.9	5.1
RS-3	1.0	30	440	98.0	2.0
RS-4	1.0	31	440	97.7	2.3
RS-5	1.0	65	440	92.4	7.6
RS-6	1.0	70	440	94.0	6.0

Figure 1-C Grain Size Distribution, RS1-RS5



Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt&Clay	%Silt	%Clay
●	RS-1 1.0	12.5	0.038	0.006		2.3	25.2		52.8	19.7
⊠	RS-2 1.0	4.75	0.009	0.003		0.0	2.6		73.4	24.0
▲	RS-3 1.0	9.5	0.074	0.01		1.9	37.9		42.5	17.6
★	RS-4 1.0	4.75	0.054	0.009		0.0	34.3		47.6	18.1
⊙	RS-5 1.0	12.5	0.011			3.0	17.8		48.0	31.3

Figure 2-C Grain Size Distribution, RS6



Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt&Clay	%Silt	%Clay
● **RS-6**	**1.0**	**25**	**0.042**	**0.007**		**11.0**	**20.4**		**50.5**	**18.1**