June 13, 2016

Ms. Melissa Eldridge
Ionia Conservation District
431 Swartz Court, #300
Ionia, Michigan 48846

RE: **Letter Report**
Sediment Sampling and Analytical Results
Lyons Dam Removal and Grand River Restoration Project
Lyons Dam on the Grand River, Ionia County, Michigan
Amec Foster Wheeler Project Number: 3293161661

Dear Ms. Eldridge:

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) was retained by the Ionia Conservation District (ICD), in coordination with the United States Fish and Wildlife Service (USFWS), to prepare an Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA), for the proposed partial removal of Lyons Dam and the Grand River Restoration Project (proposed action). The scope of work included the preparation and implementation of a Sediment Sampling and Analysis Plan (SSAP) (Amec Foster Wheeler, 2016). The SSAP is provided as Appendix A. The proposed action will:

- Remove approximately 2.5 meters (m) of the 4 m high by 84 m wide Lyons Dam;
- Close the adjacent fish ladder, and
- Restore high gradient habitat of the Grand River near Lyons, Michigan.

It is assumed that the proposed action will lower the surface level of the river by 2 to 4 feet (ft) after removal of the dam.

As part of the EA process, Amec Foster Wheeler reviewed existing sediment data (physical and chemical properties) as provided by the ICD, USFWS, Ellen Rivers Partners, and other project stakeholders (e.g., Michigan Department of Natural Resources [MDNR], etc.). Based on the review of the design plans and the Michigan Department of Environmental Quality (MDEQ) Joint Permit Application for the proposed action, it was determined that there are upstream backwater areas and streambanks that will most likely become exposed once the dam is partially removed. Sediment from these areas has not been chemically analyzed to assess potential risks that may result if these areas become exposed bottomlands or are mobilized during the proposed action. Similarly, sediment from the existing raceway, which will be required to be dewatered as part of the proposed action, had not previously been tested.

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Amec Foster Wheeler collected shallow sediment samples from five backwater areas (Backwater Areas 1 through 5) and the existing raceway to assess the identified data gaps. Sample locations were selected to be representative of the sediment deposits resulting from the presence of the dam, as shown on the attached Figure 1: Sediment Sampling Locations. The sediment sampling was performed as a screening process to identify constituents of potential concern (COPCs) that may occur once the sediment is exposed and dewatered. Previous sediment characterization reportedly did not identify any COPCs[1,2,3].

SEDIMENT SAMPLING AND ANALYSIS

Amec Foster Wheeler collected six composite sediment samples from Backwater Areas 1 through 5 (BW-01-Composite through BW-05-Composite) and from the raceway (RW-01-Composite) (Figure 1) on March 22, 2016 for laboratory analysis of COPCs.

The sediment samples were composited in the field from five individual cores gathered within each sample area. Three of the five sediment cores used for compositing were collected along a perpendicular transect of each backwater at its approximate midpoint; two within no more than 10 ft of each bank, and one in the mid-channel. The remaining two sediment cores were collected at the upstream and downstream area of the backwater channel. Since it is assumed that the surface water level in the river will recede by no more than 2 to 4 ft, no sediment cores were collected at a depth of more than 5 ft below surface water. Sediment samples collected for the analysis of volatile organic compounds (VOCs) were not composited, but collected directly from a single core. Thus, at the mid-channel location, two cores were collected (one for compositing and one specifically for analysis of VOCs). Sediment samples for VOC analyses were collected at a standard depth interval of 6 inches below surface water.

Each core sample was collected by advancing a Lexan® sample tube using manual methods from a standard depth interval of 0 to 1 ft below the base of the water column, or to refusal, whichever was encountered first. Following core retrieval, Amec Foster Wheeler logged the sediments. Procedures for collecting sediment using a Lexan® tubing core sampling methods are presented in the attached SSAP, Standard Operation Procedure (SOP) SOP-F4: Sediment Sampling Procedures (Appendix A). SOP-F4 includes sampling procedures for collecting sediment core samples for VOC analysis, which does not allow compositing. The core samples were composited in the field using the methods outlined in the attached SOP-F6: Soil Sampling Procedures (Appendix A).

1. Michigan Department of Natural Resources, Great Lakes and Environmental Assessment Section; Surface water Quality Division - Interoffice Communication: Lyons Dam Sediment Samples, Grand River. March 27, 1995.
2. STS Consultants, Ltd, 2000; *Phase 100 Study for the Removal of Lyons Dam*, May 8, 2000.
3. Prein&Newhof, 2004; *Dam Removal Evaluation Study, Lyons Dam, Grand River*, June, 2004.

The coordinates (latitude and longitude) of each sediment sample location was determined during sample collection with the aid of a hand held Global Positioning System unit. The approximate location of the sediment samples are presented in Figure 1.

Sample containerization, preservation, and handling procedures were performed in accordance with standard protocols, as described in SOP-F11: Field Sample Handling, Packing and Shipping Procedures (Appendix A). Sample containers were labeled and packaged in accordance with the procedures in SOP F-11: Field Sample Handling, Packing and Shipping Procedures (Appendix A) and dispatched to Brighton Analytical, Inc. of Brighton, Michigan (Brighton) for laboratory analysis. A separate, signed chain-of-custody record was enclosed with each sample cooler shipped to the laboratory.

Each of the composite core samples were submitted to Brighton and analyzed for semi-volatile organic compounds (SVOCs) by United States Environmental Protection Agency (USEPA) Method 8270D, Michigan-10 metals (arsenic, barium, cadmium, chrome, copper, lead, mercury, selenium, silver and zinc) by USEPA Methods 6020/7471A, polychlorinated biphenyls (PCBs)/pesticides by USEPA Method 8081B and 8082A, respectively; and herbicides by USEPA Method 8151A. One core sample (0 to 6 inches), was collected from the mid-channel location in each area (BW-01-003, BW-02-004, BW-03-004, BW-04-004, BW-05-004 and RW-01-004; see Figure 1), and a grab sample from near the base of the core (6 inches) was analyzed for VOCs by USEPA Method 8260B. One equipment blank (EB-1) was collected from the sampling equipment decontamination rinseate for analysis of Michigan-ten metals, SVOCs and VOCs. A laboratory-supplied trip blank accompanied the sample shipment to the laboratory and was analyzed for VOCs.

FIELD OBSERVATIONS

During sampling, the field crew maintained a dedicated field logbook consisting of a waterproof, bound notebook that contains a record of activities performed during sampling. The field book is included in the project file. Representative photographs are provided as Appendix B.

In general, the sediment consisted of brown to grey/dark grey silt to clayey silt, containing little organic material (including wood fragments) and less than five percent fine sand. The soils were wet and firm, but became soft at depth (1 ft). At Backwater Area 5, the sediment consisted of fine- to medium-grained sand, with minor (less than five percent) amounts of fine gravel, silt, and organic material.

There was no evidence of a sheen in the water during sediment sampling at any of the coring locations.

ANALYTICAL RESULTS

Detected sediment laboratory analytical results from the Backwater Areas and raceway are presented in Table 1: Summary of Sediment Analytical Results. The laboratory analytical report is provided as Appendix C. The analytical laboratory results did not indicate the presence of VOCs, SVOCs, PCBs, pesticides or herbicides at concentrations above their respective laboratory method detection limits (MDLs) in any of the sediment samples or quality assurance/quality control (QA/QC) samples (i.e., the equipment or trip blanks) submitted for laboratory analysis. Metals in sediments were the only compounds detected above their applicable MDLs (Table 1).

CONCLUSIONS

In order to evaluate the metals results, the metals analytical data were compared to the following criteria and screening levels:

- MDEQ Part 201 Generic Cleanup Criteria and Screening Levels (State Soil Default Background Levels and Soil Residential Direct Contact Criteria) dated December 30, 2013 (Generic Cleanup Criteria). It should be noted that these are soil criteria/screening levels; the MDEQ does not have published criteria for sediment.
- USEPA, Region V, Resource Conservation and Reclamation Act (RCRA) Ecological Screening Levels for Sediment (Eco-SSLs), Freshwater Ecosystems dated August 22, 2003.
- USEPA, *A Guide to Support the Assessment of Contaminated Sediments in Freshwater Ecosystems, Volume III,* December, 2002.

In Michigan, the Part 201 Generic Cleanup Criteria are not used for evaluating sediment quality. Rather, the MDEQ conducts site-specific remedial investigations to evaluate the potential impacts to aquatic life from sediments. Therefore, as a first step, sediments were sampled and the analytical results compared to the above-referenced USEPA Eco-SSLs, threshold effect concentrations (TEC) and probable effect concentrations (PEC) as presented in Table 1. The TEC is the concentration below which you would not expect significant impacts to aquatic life to occur. The PEC is the concentration above which impacts to aquatic life are likely to occur.

No results were found to exceed the published soil Direct Contact Criteria, suggesting that exposure of the bottomlands will not create an unintended human health risk. No results were found to exceed the PEC. The Eco-SSL and TEC were exceeded for cadmium and copper in two different locations (BW-01-Composite and RW-01-Composite, respectively):

- Cadmium was detected at 1,400 micrograms per kilogram (µg/kg), slightly above both the Statewide Default Background Level of 1,200 µg/kg and the TEC Eco-SLL of 990 µg/kg, but was detected below the Statewide Default Background Level and the Eco-

SSL/TEC in the duplicate sample collected from the BW-01-Composite location (790 µg/kg). The average concentration of cadmium detected in the seven sediment samples (including the duplicate) was 780 µg/kg.

- Copper was detected in the raceway sediment sample (RW-01 Composite) at 91,000 µg/kg, which is above the Statewide Default Background Level of 32,000 µg/kg and the TEC Eco-SSL of 31,600 µg/kg. The average concentration of copper detected in the seven sediment samples was 28,486 µg/kg.

The average concentration of all Michigan-ten metals results, including cadmium and copper were below their respective Eco-SSL/TEC. It is likely that the levels of metals detected are representative of naturally occurring metals located throughout the river system, as concluded by the MDEQ in March 1995 and March 2000 based on then available results. Based on this comparison, the concentrations do not appear to present additional risk to the river system ecology as a result of the proposed dewatering in the raceway nor to human health due to exposure to sediment after dam removal as demonstrated in the analytical data from the five Backwater Areas. The sediment in the raceway is not intended to be removed; the concentration of metals detected do not exceed the MDEQ's Direct Contact Criteria.

CLOSING

If you have any questions regarding the information provided in this letter report, please do not hesitate to contact Ms. Sandra Sroonian of Amec Foster Wheeler at (231) 922-9050 or via email at sandra.sroonian@amec.com.

Sincerely,

Amec Foster Wheeler Environment & Infrastructure, Inc.

Sandra L. Sroonian
Principal Project Manager

Scott Rought, CHMM
Senior Project Manager

Enclosures:

Table 1	Summary of Sediment Analytical Results
Figure 1	Sediment Sampling Location Map
Appendix A	Sediment Sampling and Analysis Plan
Appendix B	Photograph Log
Appendix C	Laboratory Analytical Reports

cc: Mr. Rick Westerhof, USFWS (via email)

TABLES

Table 1: Summary of Sediment Analytical Results
Lyons Dam Removal and Grand River Restoration Project

Sample ID	Date Sampled	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Selenium	Silver	Zinc	Percent Solids
Method		6020A	6020A	6020A	6020A	6020A	6020A	7471A	6020A	6020A	6020A	ASTM D2216
State Default Background[1]		5,800	75,000	1,200	18,000	32,000	21,000	130	410	1,000	47,000	NA
Region V Eco-SSL[2] / TEC[3]		9,790	NA	990	43,400	31,600	35,800	180	1,000	500	121,000	NA
Consensus-Based PEC[3]		33,000	NA	4,980	111,000	149,000	128,000	1,060	NA	NA	459,000	NA
Direct Contact Criteria[1]		7,600	3.70E+07	5.50E+05	7.90E+08	2.00E+07	4.00E+05	1.60E+05	2.60E+06	2.50E+06	1.70E+08	NA
RW-01-Composite	03/22/16	7,200	76,000	990	23,000	**91,000**	32,000	<50	440	300	98,000	67
BW-01-Composite	03/22/16	6,800	100,000	**1,400**	26,000	29,000	28,000	73	610	370	96,000	48
Dup-1 (BW-01-Composite)	03/22/16	6,100	84,000	790	17,000	20,000	21,000	78	490	220	72,000	49
BW-02-Composite	03/22/16	5,600	98,000	640	15,000	17,000	15,000	<50	420	180	58,000	52
BW-03-Composite	03/22/16	4,600	72,000	660	14,000	17,000	15,000	<50	380	170	54,000	63
BW-04-Composite	03/22/16	5,200	93,000	860	20,000	22,000	23,000	76	480	260	80,000	46
BW-05-Composite	03/22/16	1,600	22,000	120	6,900	3,400	3,800	<50	<200	<100	21,000	76
Calculated Mean (detections only)		5,300	77,857	780	17,414	28,486	19,686	76	470	250	68,429	NA

Notes:

[1] Michigan Department of Environmental Quality (MDEQ) Part 201 Generic Soil Criteria and Screening Levels dated December 30, 2013.

[2] United States Environmental Protection Agency, Region V, Resource Conservation and Reclamation Act (RCRA) Ecological Screening Levels for Sediment (Eco-SSLs), Freshwater Ecosystems dated August 22, 2003.

[3] United States Environmental Protection Agency, *A Guide to Support the Assessment of Contaminated Sediments in Freshwater Ecosystems, Volumes III,* December, 2002.

TEC = Theshold effect concentration (equivalent to Eco - SSL). Note no TEC nor Eco-SSL for Selenium is published; the Apparent Effects Threshold (AET) is used.

PEC = Probable effect concentration

All results in micrograms per kilogram (µg/kg), unless noted otherwise.

Composite samples at each location were analyzed for polychlorinated biphenyls (PCBs)/Pesticides (Methods 8081B/8082A), semi-volatile organic compounds (VOCs) (Method 8270D), and Herbicides (Method 8151A). All results were below the applicable laboratory method detection limits (MDLs).

A grab sediment sample was collected from each of the six areas for analysis of volatile organic compounds (VOCs) (Method 8260C, wet weight basis). All results were below the applicable laboratory MDLs.

Bold = Concentration exceeds both the State Default Background and the Consensus-Based TEC criteria.

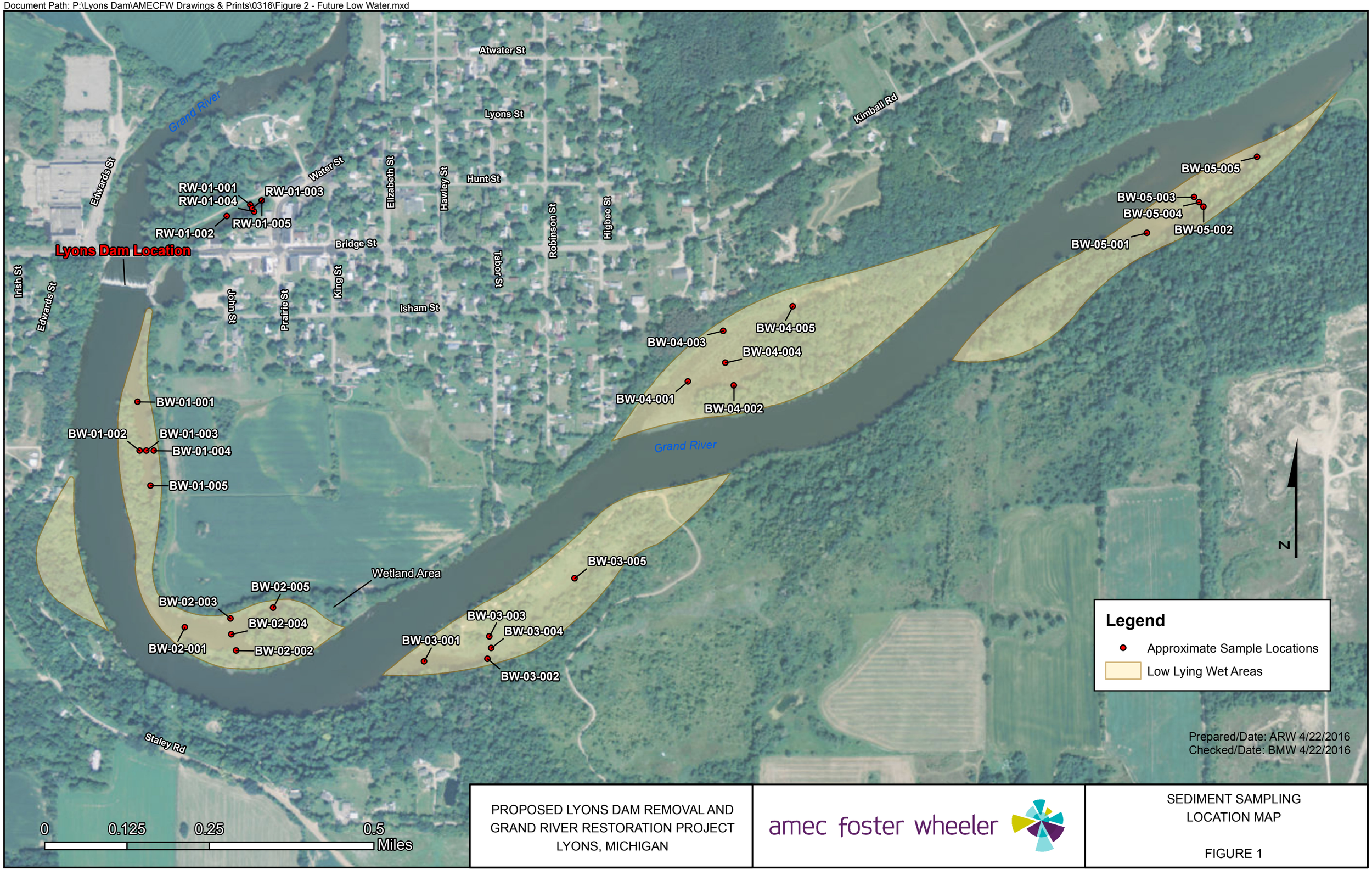
NA = Not available / Not applicable

Samples collected by Amec Foster Wheeler Environment & Infrastructure, Inc. on March 22, 2016.

Prepared by: BMW Date: 04/22/16
Checked by: LCM Date: 04/22/16

FIGURES

Document Path: P:\Lyons Dam\AMECFW Drawings & Prints\0316\Figure 2 - Future Low Water.mxd



PROPOSED LYONS DAM REMOVAL AND GRAND RIVER RESTORATION PROJECT
LYONS, MICHIGAN

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SEDIMENT SAMPLING LOCATION MAP

FIGURE 1

APPENDIX B

PHOTOGRAPH LOG

PHOTOGRAPH LOG
Lyons Dam — Lyons, MI
Sediment Sampling Field Photos
Taken by: Brent Wheat
Date: March 22, 2016

Photo 1: Backwater Area 1

Photo 2: Backwater Area 2

Photo 3: Backwater Area 3

PHOTOGRAPH LOG
Lyons Dam — Lyons, MI
Sediment Sampling Field Photos
Taken by: Brent Wheat
Date: March 22, 2016

Photo 4: Backwater Area 4

Photo 5: Backwater Area 5

Photo 6: Raceway

PHOTOGRAPH LOG

Lyons Dam — Lyons, MI
Sediment Sampling Field Photos
Taken by: Brent Wheat
Date: March 22, 2016

Photo 7: Lexan cores were used to determine the depth to the sediment. Markers were used on the Lexan cores to document depth of water and penetration depth.

Photo 8: Lexan cores were driven to depth using a dead blow hammer to help reduce compaction.

Photo 9: Typical removed sediment sample.

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PHOTOGRAPH LOG
Lyons Dam — Lyons, MI
Sediment Sampling Field Photos
Taken by: Brent Wheat
Date: March 22, 2016

Photo 10: Water was removed from the cores.

Photo 11: Soils from each location were drained into a stainless steel bowl for homogenizing

Photo 12: Soils from each location were classified using ASTM Standards

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PHOTOGRAPH LOG

Lyons Dam — Lyons, MI
Sediment Sampling Field Photos
Taken by: Brent Wheat
Date: March 22, 2016

Photo 13: Soils were homogenized then poured into a disposable sheet pan.

Photo 14: Soils were divided in quadrants and 2 of the corners were removed. Soil were re-homogenized and spread over the sheet pan in a circular motion. The first two steps were repeated until the remaining soil volume matched the volume required to fill bottles

Photo 15: Sediment samples for volatile organic analysis were collected directly from the bottom of the additional core.