APPENDIX I

Approved Sediment Sampling Plan

Armstrong Dam Removal Feasibility Study

GOMEZ AND SULLIVAN ENGINEERS

41 Liberty Hill Road • PO Box 2179 • Henniker, NH 03242 • Phone 603-428-4960 • Fax 603-428-3973

June 2, 2016

Mr. Ken Chin
Mass DEP Wetlands Program
1 Winter Street
Boston, MA 02108

Re: Armstrong Dam – Feasibility Study for Dam Removal, Revised Sediment Sampling Plan

Dear Mr. Chin:

Gomez and Sullivan Engineers, DPC (GSE) has been contracted by the Massachusetts Division of Marine Fisheries (*MarineFisheries*) to conduct tasks associated with a feasibility study for the removal of the Armstrong Dam (aka Hollingsworth Dam) located on the Monatiquot River in Braintree, MA. *MarineFisheries* is working collaboratively with the United States Fish and Wildlife Service (USFWS), F.X. Messina Enterprises, the Fore River Watershed Association and the town of Braintree (collectively Project Partners) on the Armstrong Dam Removal Feasibility Study. F.X Messina Enterprises owns Armstrong Dam.

One of the feasibility study tasks calls for collecting sediment samples from within the impoundment and in the project area to help inform sediment management measures should the dam be removed. F.X. Messina Enterprises has conducted some sediment testing in 2012 and compared the findings to MCP Method 1 Standards. Missing from the list of constituents tested were PCBs and pesticides. The attached document summarizes the following a) further background on the project, b) summary of the previous sampling and c) our proposed sediment sampling plan. We are seeking MADEP's input on the sediment sampling plan prior to conducting the work.

If you have any questions, please do not hesitate to contact me at (603) 428-4960.

Sincerely,

Aaron Rubin
Water Resource Engineer

Sediment Sampling Plan for
Armstrong Dam Pond
Monatiquot River, Braintree, MA

Prepared for:

Massachusetts Department of Environmental Protection

Prepared by:

Gomez and Sullivan Engineers

June 2, 2016

I. Background

Gomez and Sullivan Engineers, DPC (GSE) has been contracted by the Massachusetts Division of Marine Fisheries (*MarineFisheries*) to conduct tasks associated with a feasibility study for the removal of the Armstrong[1] Dam, located on the Monatiquot River in Braintree, MA (Figure 1). *MarineFisheries* is working collaboratively with the United States Fish and Wildlife Service (USFWS), F.X. Messina Enterprises, the Fore River Watershed Association and the town of Braintree (collectively Project Partners) on the Armstrong Dam Removal Feasibility Study. F.X Messina Enterprises owns Armstrong Dam and the building sitting atop the dam.

The Farm and Cochato Rivers unite to form the Monatiquot River near the Braintree Municipal Golf Course just upstream of Armstrong Dam (Figure 2). The Monatiquot River continues downstream over the Armstrong Dam and Ames Pond Dam before eventually emptying into the Fore River and then Hingham Bay. In 2009, a collaborative study done by the Project Partners was conducted to determine the feasibility of restoring river herring to the upper portion of the watershed, specifically the Great Pond water supply reservoir. With proper fish passage and flow management it was deemed feasible to restore river herring (GSE, 2009).

The Armstrong Dam is approximately 100 feet long consisting of nine equally sized 8-foot-wide bays as shown in the photograph. Vertical concrete columns between the bays extend from the spillway crest up to the base of the building. The dam is classified by MA Dam Safety as a high hazard structure.

To further investigate the option of dam removal, the quality and quantity of sediment will be evaluated to inform sediment management alternatives should the Armstrong Dam be removed. The quality/quantity of sediment and potential for sediment mobilization above the dam, should it be removed, will inform sediment management alternatives including a) allowing the sediment to naturally migrate downstream upon dam removal, b) partial or full dredging of impounded sediments or c) partial dredging of sediments and stabilizing the remaining material in place.

The purpose of this document is to summarize previous sediment sampling data collected in the Armstrong Dam Impoundment and to obtain input on a new Sediment Sampling Plan.

II. Past Sediment Sampling

Background

[1] Note that Armstrong Dam is also known as the Hollingsworth Dam.

In November 2012, FX Messina Enterprises contracted with Loureiro Engineering Associates, Inc. (Loureiro) to collect sediment cores in the Armstrong Dam Impoundment for chemical analysis. Loureiro's full report is included in Appendix A, and is summarized herein.

On November 2, 2012, Loureiro collected shallow sediment samples from four locations in the Armstrong Dam impoundment as shown in Figure 3 (Figure 1 of the Loureiro report). Samples were collected using a 2-inch polyvinyl chloride (PVC) tube with an open end and a capped end with an air vent. The device was manually driven into the sediment until refusal upon which the air vent was closed and the tube retrieved. At the surface, the air vent was opened releasing the sediment from the tube.

Samples were analyzed for the following parameters:

- Volatile Organic Compounds (VOCs) by EPA Method 8260;
- Polycyclic Aromatic Hydrocarbons (PAHs) by EPA Method 8270;
- Extractable Petroleum Hydrocarbons (EPHs) with target PAHs;
- 14 Metals.

Loureiro collected three aliquots of sediment to assure enough material to fill the sample containers. The VOC portion was obtained exclusively from the third aliquot. The aliquots were collected within a 3-foot diameter area of the selected sampling location. The fourth sample (LEA-SS-004) was not analyzed for VOCs.

The samples were distributed spatially to capture areas within the impoundment with sediments that would be exposed or mobilized if the dam was removed and to gather representative information regarding the sediment conditions. The sample locations are summarized below and shown in Figure 3.

- LEA-SS-001 was located along the eastern portion of the pond adjacent to the parking lot and its stormwater outfall.
- LEA-SS-002 was located along a shallow "sand" bar in the southern portion of the Pond mid-channel with the incoming river; upstream of the main portion of the Pond.
- LEA-SS-003 was located in the northwestern portion of the Pond adjacent to the junction of the channel spanning portion of the building and the portion of the building that occupies the western area of the Site.
- LEA-SS-004 was collected in the western portion of the Pond adjacent to a narrow vegetated buffer between the Pond and the commuter rail tracks.

The samples were collected in water depths of 1.25 to 3 feet and ranged from 2 inches to 3.83 feet below ground surface. Predominantly the sediment observed was dark brown/black silty-fine to medium sand with trace gravel. Sample location LEA-SS0003 had a notable petroleum odor at collection and a sheen was observed in the area.

Brief Overview of Findings

Shown in Table 1 of the Loureiro Report (included below) are the sediment constituent concentrations. Loureiro compared the results to the MCP Reportable Concentrations (RCS1, RCS2) and MCP Method 1 Standards (S1GW1, S1GW2, S1GW3 and UCLs). The analytes detected above the reporting limit were shown in bold while the analytes detected above the RC and/or Method 1 clean up standard were

highlighted and shown in bold. As Table 1 (Loureiro Engineering Associates, 2012) shows there are several exceedances of VOCs, PAHs, PAHs and metals. Further details on the results is included in Appendix A.

III. 21E File Review

The mill site just downstream of Hollingsworth pond was initially a saw and grist mill in the 1700s. The mill was then bought and operated by the Boston and Braintree Copper and Brass Manufactory in 1823 before being sold to Hollingsworth Interests in 1832 for paper manufacturing. Old ropes were used to make (and initially invent) manila paper, starting in 1841. The site was sold to Monatiquot Rubber Works in 1901, later becoming the Stedman Rubber Flooring Company. The Armstrong Cork Company took the site over in 1936, later to be known as the Armstrong World Industries (AWI) in the 1950s. AWI used the river water solely for industrial cooling but manufactured linoleum flooring at the mill until shutting down in the 1990s (Frazier 1985).

Baird and McGuire is a 20 acre Superfund site less than 2 miles upstream of Hollingsworth Pond and 500 feet from the Cochato River. The Cochato River feeds into the Monatiquot River, eventually leading to Hollingsworth Pond. Baird and McGuire operated as a chemical mixing and batching company from 1912 to 1983. Products they manufactured include pesticides, disinfectants, soaps, floor waxes and solvents. Hazardous wastes were historically disposed of on-site in a lagoon or cesspool, or into the soil, a nearby brook, surrounding wetlands or former gravel pit. A plume of hazardous waste affected the groundwater, causing a nearby drinking water aquifer to be put out of use. A groundwater monitoring facility is currently in place. Hazardous substances historically disposed of on-site include heavy metals such as lead and arsenic, Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAHs), other organic compounds, pesticides such as DDT and Chlordane, as well as dioxin (EPA, 2016). Figure 4 shows Baird and McGuire Superfund in relation to the Armstrong Dam drainage area, as well as Armstrong Dam.

Several facilities within the drainage area are regulated via Activity and Site Use Limitations (AULs). AULs specify the allowable and prohibited use of a property by establishing limits and conditions for the future use of contaminated property, thereby allowing cleanups to be tailored to these uses. These limitations were implemented as part of the Massachusetts Waste Site Cleanup Program established by MGL c. 21E and the Massachusetts Contingency Plan (310 CMR 40.0000). More details of the AUL locations within the drainage area are included in Table 1. A map of the 21E locations can be found in Figure 4. Locations within the watershed include a light manufacturing facility, a floor laminate facility, Speedy Lube (an automotive service and maintenance facility), a Veteran of Foreign Wars (VFW) hall and two residences. The majority of AULs deal with gasoline or oil contamination. The Mass DEP AUL website did not state what the regulated chemicals were for the Chase & Sons Laminating facility, however supporting documents listed several chemical contaminants historically significant to the site, as stated in Table 1. It is important to note that the land Chase & Sons exists on has housed industrial operation facilities since the 1800s. There was once a shoe factory, a railroad company and a coal company before Chase & Sons took it over in the 1950s (MA DEP, 2015).

Several 21E locations also exist within the drainage area. Contaminants include but are not limited to: aromatic hydrocarbons, petroleum products, Volatile Organic Compounds (VOCs), pesticides, lead and other metals. Petroleum products, especially #2 fuel oil, comprise the largest recorded volume of contamination within the watershed. Table 2 provides additional information about the 21E contamination locations within the drainage area of the Armstrong Dam. A map of the 21E locations can be found in Figure 5.

Massachusetts companies that use large quantities of certain toxic chemicals are required to evaluate and plan for pollution prevention, implement the plan if practical and measure/report the results annually as required under the Toxics Use Reduction Act (TURA) of 1989. The Toxic Release Inventory (TRI) keeps

track of industrial use (i.e., recycling, combustion, destruction, disposal etc.) of certain chemicals that pose a threat to human health and the environment. The TRI also helps track the reduction of chemical waste generation by industry regulations. TRI locations within the Armstrong Dam drainage area are included in Table 3. Figure 6 provides a map of these TRI locations.

IV. Proposed Sediment Sampling Plan

Overview

Gomez and Sullivan proposes to supplement the existing sampling and conduct sediment sampling at eleven locations in the Project Area as described below. Once the samples are collected, they will be delivered to a certified laboratory for analysis. The lab analysis will test nine of these samples for constituents identified in 314 CMR 9.07 of the 401 Water Quality Certification criteria and specifically for constituents shown in the list below. The testing results will be compared to screening criteria including MacDonald's Threshold Effects Concentration (TEC) and Probable Effects Concentration (PEC) (MacDonald, et. al., 2000[2]). Two additional samples will be collected and frozen at the laboratory in case additional testing is required, as recommended by MassDEP.

Nine samples, eight individually composited samples and one comprised of three aliquots spaced evenly in front of the dam, will be tested for the following parameters using the standard methods noted:

- 6010/7471 Metals
- 8270 PAH
- 8082 NOAA PCB Congeners – Total
- MADEP Extractable Petroleum Hydrocarbons (EPH)
- 8260 Volatile Organic Compounds (VOC)
- Walkley Black TOC
- ASTM 2216 % Moisture
- ASTM D422 Grain Size –Sieve

Preparation

Sediment sampling equipment will be prepared and thoroughly cleaned prior to sampling. Equipment will be soaked (fully immersed) for three days in a 0.5 % solution of Alconox™ detergent and water. Equipment will then be scrubbed and rinsed three times with deionized water and let dry in a clean place. Equipment that is pre-cleaned includes the hand corer, coring tubes, eggshell core catchers, sample scoops, compositing bucket and wash bottles. Equipment will be double-checked prior to mobilization.

Sample Procedures

Sediment samples will be collected with a stainless steel hand corer outfitted with a Cellulose Acetate Butyrate (CAB) liner, which can obtain sediment samples to a depth of 5 feet, or as a surficial grab sample. The samples will be placed in a compositing bucket, homogenized (stirred) and placed into the appropriate

[2] MacDonald DD, Ingersoll CG, Berger T. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems.

sample containers for analysis. The sediment samples will be transported on ice under chain of custody to a certified laboratory.

The sample containers will either be supplied by the laboratory, or will be manufacturer-supplied, pre-cleaned containers. In order to obtain the appropriate volume needed for each sample, subsamples may be collected from each site. The subsamples will be placed into a compositing bucket, homogenized (stirred) and scooped into the appropriate sample containers for analysis of chemistry, total organic carbon (TOC), and grain size. The samples will be held on ice in a cooler for transportation. The water depth, amount of sediment in each sub sample, flow and weather conditions will be noted on the field data collection sheet. Note that a sample can be taken from exposed sediments, if properly documented.

Prior to collecting the next sample, the equipment will be scrubbed with a solution of Alconox™ detergent and then rinsed with deionized water.

Sample Locations

Sampling locations will include: one sample upstream of the influence of the impoundment, two core samples within the impoundment, and one sample downstream of the impoundment as shown in Table 4 and Figure 7 – Figure 9. Note that the exact location of the sediment samples may require refinement in the field, and is contingent on the sediment depth as found in the field. However, it is important that the sediment cores in the impoundment be obtained in a location that is likely to become mobile following dam removal (i.e., relatively close to the thread of the river). For example, obtaining a deep sediment core near the shoreline will not be obtained as it is not representative of the potentially mobile sediments following dam removal. Also, if advancing the corer in a given location has minimal penetration, another site in relatively close proximity will be selected in an attempt to collect a deep core.

V. References

EPA (2016). EPA Superfund Program: BAIRD & MCGUIRE, HOLBROOK, MA. Retrieved on June 1, 2016 from: https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0100392

Frazier, Ronald F. (1985). “Business and Industry.” In Braintree Massachusetts, Its History, ed. Hobart Holly, (pp.152 – 183). Braintree, MA: Braintree Historical Society.

Gomez and Sullivan, P.E. 2009. Feasibility Analysis for Restoring River Herring to the Fore River. Prepared for Mass. Division of Marine Fisheries, by Gomez and Sullivan, DPC. http://www.mass.gov/eea/docs/dfg/dmf/publications/fore-river-feasibility.pdf

MA DEP. (2015). Searchable Sites. Retrieved on June 1, 2016 from: http://public.dep.state.ma.us/SearchableSites2/.

MA, DEP. (2016). Toxics Use Reduction Act. Retrieved on May 31, 2016 from: http://www.mass.gov/eea/agencies/massdep/toxics/tur/

Loureiro Engineering Associates, Inc. 2012. Results of Environmental Investigation of Hollingsworth Pond, Braintree, Massachusetts. Prepared for Messina Enterprises, by Loureiro Engineering Assoc., Inc, Rockland, MA.

Table 1. Response Action Outcome AUL Locations within the Armstrong Dam drainage

Map ID	NAME	ADDRESS	TOWN	STATUS	RAO CLASS	AUL_DATE	Chemicals	Amount	Units	Notes
AUL-1	**PACELLA INDUSTRIAL PARK**	21 PACELLA PARK DR	RANDOLPH	RAO	A3	2/10/1998	2-METHYLNAPHTHALENE	3400	PPM	Closed site with use limitation. Office, warehouse and light manufacturing facility
							9H-FLUORENE	2600	PPM	
							CHRYSENE	500	PPM	
							FLUORANTHENE	2100	PPM	
							LEAD	370000	PPM	
							NAPTHALENE, BETA-CHLORO	2100	PPM	
							PHENANTHRENE	6600	PPM	
							PYRENE	2700	PPM	
AUL-4	**CHASE & SONS LAMINATING**	19 HIGHLAND AVE	RANDOLPH	RAO	B2	8/7/1998	Unknown	Unknown		This site has been industrial since 1800s until 1950s when Chase & Sons took over. It has been a shoe factory, railroad company and coal company. From a 1993 report (Woodard and Curran): "Results of soil analyses indicated the presence of base/neutral extractable organic compounds, metals, low levels of volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH) on site. Results of groundwater analyses indicated the presence of VOCs. Concentrations of 1,1,1-Trichloroethane (1,1,1-TCA) of 440 ug/l in one sample exceeded the Massachusetts drinking water and groundwater standards of 200 ug/l. VOCs and TPH were also detected in a surface water sample. The direction of groundwater flow was predicted by GHR to be from south to north. The nearest sensitive receptor was identified to be Glovers Brook along the west property boundary; however, Glovers Brook does not flow to Great Pond Reservoir, the nearest drinking water supply identified by the Randolph Water Department, located approximately 1 mile to the northeast of the site" (Woodard & Curran, February 1993) Other historical contaminants may include CVOCs, methyl-ethyl-ketone, trichloroethylene and/or toluene (DiPersio, T., April 29, 1993)
AUL-3	**SPEEDY LUBE**	633 MAIN ST	RANDOLPH	RAO	A3	8/25/2011	GASOLINE	105	PPMV	closed site with use limitation
AUL-5	**RANDOLPH VFW**	10 HIGHLAND AVE	RANDOLPH	RAO	B2	12/20/1999	FUEL OIL	11000	PPM	closed site with use limitation
							FUEL OIL #2	634	PPMV	
AUL-6	**RESIDENCE**	11 ARNOLD ST	HOLBROOK	RAO	A3	4/3/1995	#2 FUEL OIL	40	GAL	close site with use limitation, a #2 fuel oil leak incident involving a 275 gal above ground storage tank (1994)
							#2 FUEL OIL	28000	PPM	
AUL-2	**RESIDENCE**	1243 LIBERTY ST	BRAINTREE	RAO	A3	7/14/2000	#2 FUEL OIL	100	PPMV	underground storage tank leak of #2 fuel oil (2008)
							FUEL OIL #2	571	PPMV	

Sources:

GIS source: Retrieved on May 30, 2016 from: http://www.mass.gov/eea/agencies/massdep/cleanup/sites/site-activity-and-use-limitations.html

Woodard & Curran (February 1993). Phase I Site Investigation. Retrieved on June 1, 2016 from: http://public.dep.state.ma.us/fileviewer/DefaultScanned.aspx?documentid=105491

DiPersio, T. (April 29, 1993). Memorandum. Woburn, MA: Woodard & Curran. Retrieved on June 1, 2016 from: http://public.dep.state.ma.us/fileviewer/DefaultScanned.aspx?documentid=105491

Table 2. 21E Locations within the Armstrong Dam drainage

Map ID	Release Tracking No.	Site Name	Address	Town	Status	Official Notification Date	Category	Phase	Location Type	Source	Chemicals	Amount	Units	Open/Closed[1]
21E-2	4-0024253	Ramp	Rt. 138N From Rt. 93S	Canton	TIER1D	10/18/2012	Two HR		Roadway, State	Vehicle	Diesel Fuel	20	gal	ND
21E-6	4-0020834	Former Nike Misile Site	Middle St	Randolph	TIERII	10/11/2007	120 day	II		Unknown/UST	Beryllium	0.714	mg/Kg	Open
											Thallium	22.8	mg/Kg	
21E-5	4-0024867	Pad-Mounted Transformer Modf Release	15 Pacella Park Drive	Randolph	TIERII	11/4/2013	120 day	II		Unknown	Aromatic hydrocarbons	27,400	mg/Kg	Open
											Aliphatic hydrocarbons	32,200	mg/Kg	
											Aliphatic hydrocarbons	33,700	mg/Kg	
21E-10	4-0024938	Priority Freight Systems	99 York Avenue	Randolph	TIER1D	12/30/2013	Two HR		Industrial	Vehicle	Diesel Fuel Engine Mix Oil	40	gal	Open
21E-9	4-0025333	Us Gas	945 N. Main Street	Randolph	TIER1D	9/26/2014	72 HR		Commercial	UST/UST OTHER	Gasoline			Open
	4-0025464	Lot 42	Pacella Park Dr	Randolph	TIERII	1/30/2015	120 day	II		Unknown	Aromatic hydrocarbons	48,000	mg/Kg	Open
											Aliphatic hydrocarbons	110,000	mg/Kg	ND
											Napthalene	18,000	mg/Kg	ND
21E-8	4-3000167	J G Grant & Sons Inc	60 Garden Park	Braintree	TIERII	8/21/1986	None	IV	Junkyard	Uncontained	Waste Oil			Open
21E-1	4-3000679	Townsend\Textron	530 West St	Braintree	TIERII	10/15/1988	120 day				Oil			Open
21E-7	4-0025095	Residential Property	4 Tilton St	Randolph	TIER1D	4/24/2014	Two hr		Residential	AST, LINE	#2 Fuel Oil	250	gal	ND
21E-3	4-3023897	Lot 37	Pacella Park Dr	Randolph	TIERII	5/21/2004	120 day	II	Residential		Aromatic hydrocarbons	1,660	mg/Kg	Open
											Lead	2,200	mg/Kg	
											Phenanthrene	350	mg/Kg	
21E-16	4-0019885	Woodlawn Cleaners	334 North Main St	Randolph	TIERII	6/30/2006	Two hour	IV	Commercial	Chlorinated, solven	Vinyl Chloride	19	ug/L	Open
21E-16	4-0020288			Randolph	TIERII	1/24/2007	Two hour	II	Commercial	Unknown	Organic vapors	30	mg/L	Open
21E-16	4-0020294			Randolph	TIERII	1/25/2007	120 day	II	Commercial		Aromatic hydrocarbons	542	mg/Kg	ND
21E-15	4-0022303	Lucky Cleaners	348 North Main Street	Randolph	TIERII	7/18/2011	120 day	II	Commercial	Unknown	Cis-1,3-Dichloropropene	90	ug/L	Open
											PCE	72	ug/L	
											TCE	30	ug/L	
21E-13	4-0020999	Extrusion Technology, Llc	80 Trim Way	Randolph	TIERI	1/11/2008	Two hour	V	Industrial	Unknown	PCE	71	ug/L	Open
											PCE	483	ug/m^3	
21E-12	4-0021012	Rear	115 Braemore Rd	Braintree	TIER1D	2/11/2008	120 day				Cadmium	3.43	mg/Kg	ND
											Lead	2,280	mg/Kg	
											Nickel	67.3	mg/Kg	
											PCB	5.02	mg/Kg	
											Zinc	1.07	ug/L	
											Zinc	7,360	mg/Kg	
21E-14	4-0024264	Commercial Building	296-298 North Street	Randolph	TIERII	10/26/2013	Two hour	II	Commercial	Unknown	Tetrachloroethylene	450	ug/m^3	Open
21E-17	4-3019406	Olympic Plaza	424 North Franklin St	Holbrook	TIERII	3/24/2001	120 Day	II			PCE	3,600	ug/L	Open
											Tetrachloroethylene	7.6	mg/Kg	
21E-11	4-3020592	Residence	54 Althea Rd	Randolph	TIER1D	4/11/2001	120 day				#2 Fuel Oil	12,000	mg/Kg	ND
21E-18	4-0025431	Residential Dwelling	3 Chapin Circle	Randolph	TIER1D	12/10/2014	Two hour		Residential	AST, fuel tank, line	#2 Fuel Oil	150	gal	Open
21E-20	4-3001021	Texaco Station	400 South Franklin St	Holbrook	TIERII	8/25/1985		V	Gas station	UST	Unknown	-	-	Open
21E-19	4-3024519	No Location Aid	3 Philipps Rd	Holbrook	TIERII	12/24/2204	120 day	IV			Beryllium	1.2	mg/Kg	Open
											Bis(2-Ethylhexyl)Phthalate	14,000	mg/Kg	
											Aromatic hydrocarbons	5,830	mg/Kg	
											Lead	450	mg/Kg	
21E-21	4-0024510	Residence	46 Boundary Street	Brockton	TIER1D	4/9/2013	Two hour		Residential		#2 Fuel Oil	50	gal	ND

ND = No data reported

Source: Retrieved on June, 2, 2016 from: http://public.dep.state.ma.us/SearchableSites2/Search.aspx

Table 3. TRI Locations within the Armstrong Dam drainage

Map ID	TRI Facility ID No.	Facility Name	Address	Industry	Chemicals Reported to TRI*
TRI-5	02368MDSTT92YOR	M. D. Stetson Co.	92 York Ave, Randolph, MA	chemicals	Certain glycol ethers[1]
TRI-1	02184HMNTC400WO	Haemontics Corp.	400 Wood Rd, Braintree, MA	plastics and rubber	Di(2-Ethylhexyl) pthalate[1]
TRI-6	02368XTRVS80TRI	Extrusion Technology, Inc. ("CBT technology" starting 2011)	80 Trim Way, Randolph, MA	electrical/electronic manufacturing	Tetrachloroethylene[2]
TRI-3	02184FRMLW141CA	Formal Wear Management, Inc.	141 Campanelli Dr., Braintree, MA	drycleaning and laundry services	Tetrachloroethylene[2]
TRI-2	02184TWNSN530WE	Townsend Automation	530 W. St, Braintree, MA	automotive	No data
TRI-4	02184RMSTR10PLA	Armstrong World Industries	10 Plain St, Braintree, MA	rubber and cork	Antimony compounds[1]
					Di(2-ethyhexyl)phthalate[1]
TRI-8	02368CPCNCONECI	CPC Inc	1 Circuit Dr, Randolph, MA	no data	No data
TRI-10	02322TLDWR100WA	TL Edwards Inc.	100 Wales Ave, Avon, MA	Petroleum	Polycyclic aromatic compounds[1]
					Benzo (g,h,i) perylene[1]
TRI-7	02368CHSND19HIG	Chase & Sons	19 Highland Ave, Randolph, MA	floor laminating	Trichloroethylene[2]
					1,1,1-Trichloroethane[2]
TRI-9	02368CCRTM414SO	Accurate Metal Finishing	414 South St. Randolph, MA	aluminum finishing	No data
TRI-11	02343THBRC620SO	Barcolene Co.	620 S. St, Holbrook, MA	no information	Methanol[2]
					Certain glycol ethers[1]
TRI-12	02343FSTRS46SPR	Foster Southeastern	46 Spring St, Holbrook, MA	stone, clay and glass products	Lead[2]

Sources:

[1] Retrieved on June, 1, 2016 from: https://iaspub.epa.gov/triexplorer/tri_factsheet_search.searchfactsheet

[2] Retrieved on June, 1, 2016 from: http://www.yourmapper.com/map/180/toxic-release-chemicals/epa-tracked-emissions-and-clean-air-act-chemicals.htm?

Table 4: Proposed Sediment Sampling Locations in the Armstrong Dam Project Area and Rationale

Sample No.	Location	Rationale
01	Below Dam	The intent of this sample is to provide information on the sediment constituents downstream of the dam/impoundment to understand the quality of sediments which could be affected by an upstream release of sediments associated with dam removal. The sample would be obtained in a depositional area.
02	Within Impoundment Further Upstream	The intent of this sample is to provide information on sediment constituents in the impoundment, immediately upstream of the dam. These sediments are the most likely to become mobilized following dam removal unless dredging is conducted. Note that the exact location of sample site 02 may require adjustment in the field, based on sediment depth.
03	Further upstream in Impoundment	Similar to Sample No. 02, the intent of this sample is to provide information on sediment constituents in the impoundment. This sediment sampling location would be obtained near the thread of the river, the area where sediment is most likely to become mobile following dam removal. Note that the exact location of sample site 03 may require adjustment in the field, based on sediment depth.
04	Upstream of the Impoundment	The purpose of this sample is to compare sediment quality in the impoundment to sediment found in other upstream depositional areas, and to assess "background" sediment quality within the watershed. The sample location would be within free-flowing river reach upstream of the impoundment.
05	Upstream of the Impoundment	The purpose of this sample is to compare sediment quality in the impoundment to sediment found in other upstream depositional areas, and to assess "background" sediment quality within the watershed. The sample location would be within free-flowing river reach upstream of the impoundment. Added after consultation with MassDEP.
06	Upstream Extent of the Impoundment	Similar to Sample No. 02 and No. 03, the intent of this sample is to provide information on sediment constituents in the impoundment. This sediment sampling location would be obtained near the thread of the river, the area where sediment is most likely to become mobile following dam removal. Note that the exact location of sample site 06 may require adjustment in the field, based on sediment depth. Added after consultation with MassDEP.
07	Further Below Dam	The intent of this sample is to provide information on the sediment constituents downstream of the dam/impoundment to understand the quality of sediments which could be affected by an upstream release of

Sample No.	Location	Rationale
		sediments associated with dam removal. The sample would be obtained in a depositional area. Added after consultation with MassDEP.
08	Further Below Dam	The intent of this sample is to provide information on the sediment constituents downstream of the dam/impoundment to understand the quality of sediments which could be affected by an upstream release of sediments associated with dam removal. The sample would be obtained in a depositional area. Added after consultation with MassDEP.
09	Within Impoundment, Immediately Above Dam	The intent of this sample is to provide information on sediment constituents in the impoundment, immediately upstream of the dam. This sample will be made up of three aliquots equally spaced in front of the dam. Note that the exact location of sample site 09 may require adjustment in the field based on sediment depth. Added after consultation with MassDEP.
10	Within Impoundment, Above Dam, Located Close to LEA-SS-003	The intent of this sample is to provide information on sediment constituents in the impoundment, immediately upstream of the dam and close to sample LEA-SS-003 from the 2012 sediment sampling. It will be frozen at the laboratory in case further chemical analysis is needed. Added after consultation with MassDEP.
11	Within Impoundment, Above Dam, Located Close to LEA-SS-003	The intent of this sample is to provide information on sediment constituents in the impoundment, immediately upstream of the dam and close to sample LEA-SS-003 from the 2012 sediment sampling. It will be frozen at the laboratory in case further chemical analysis is needed. Added after consultation with MassDEP.

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

GOMEZ AND SULLIVAN ENGINEERS

N

Massachusetts Division of Marine Fisheries
Armstrong Dam Removal

0 150 300 600 900 1,200 Feet

Figure 1
Site Map

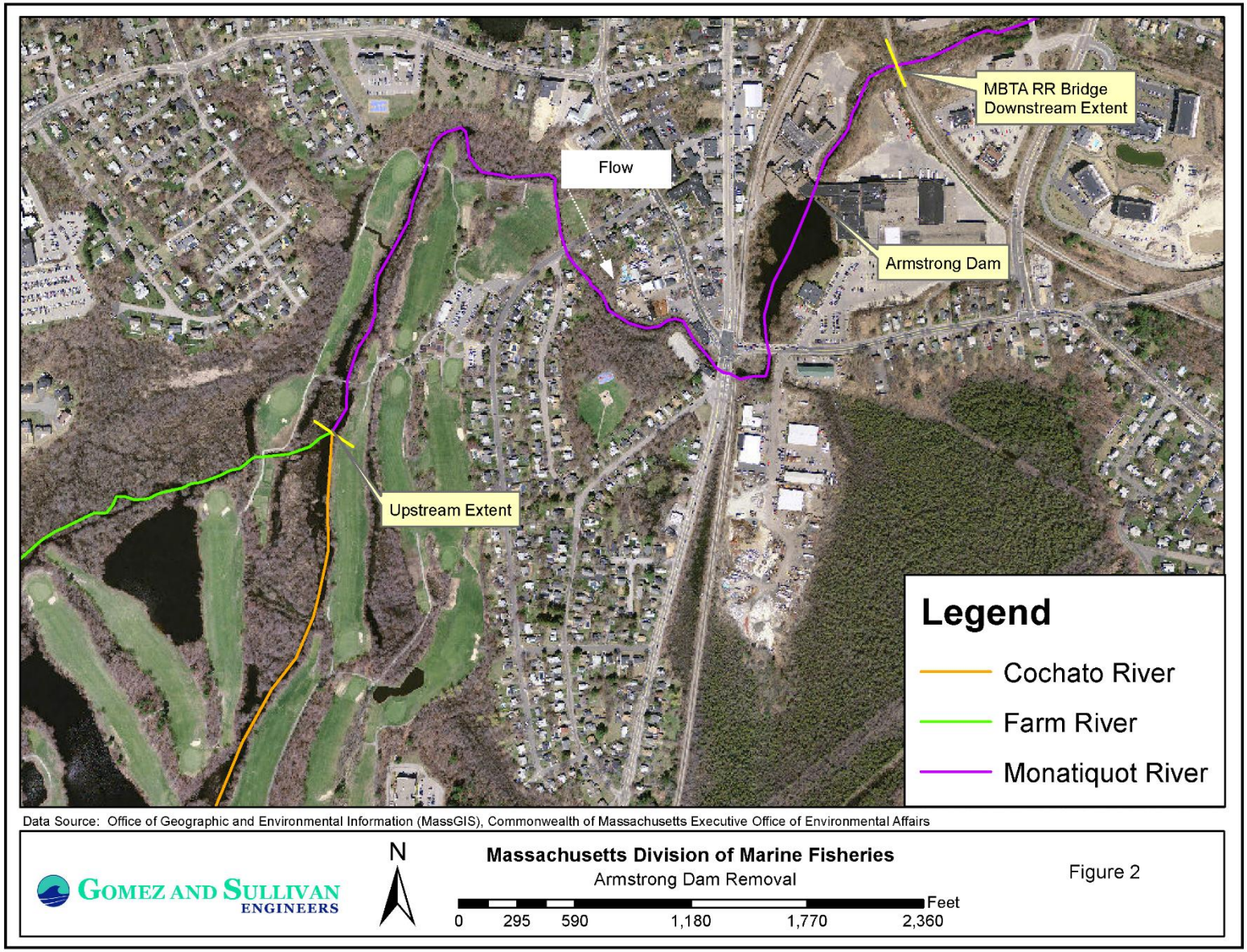
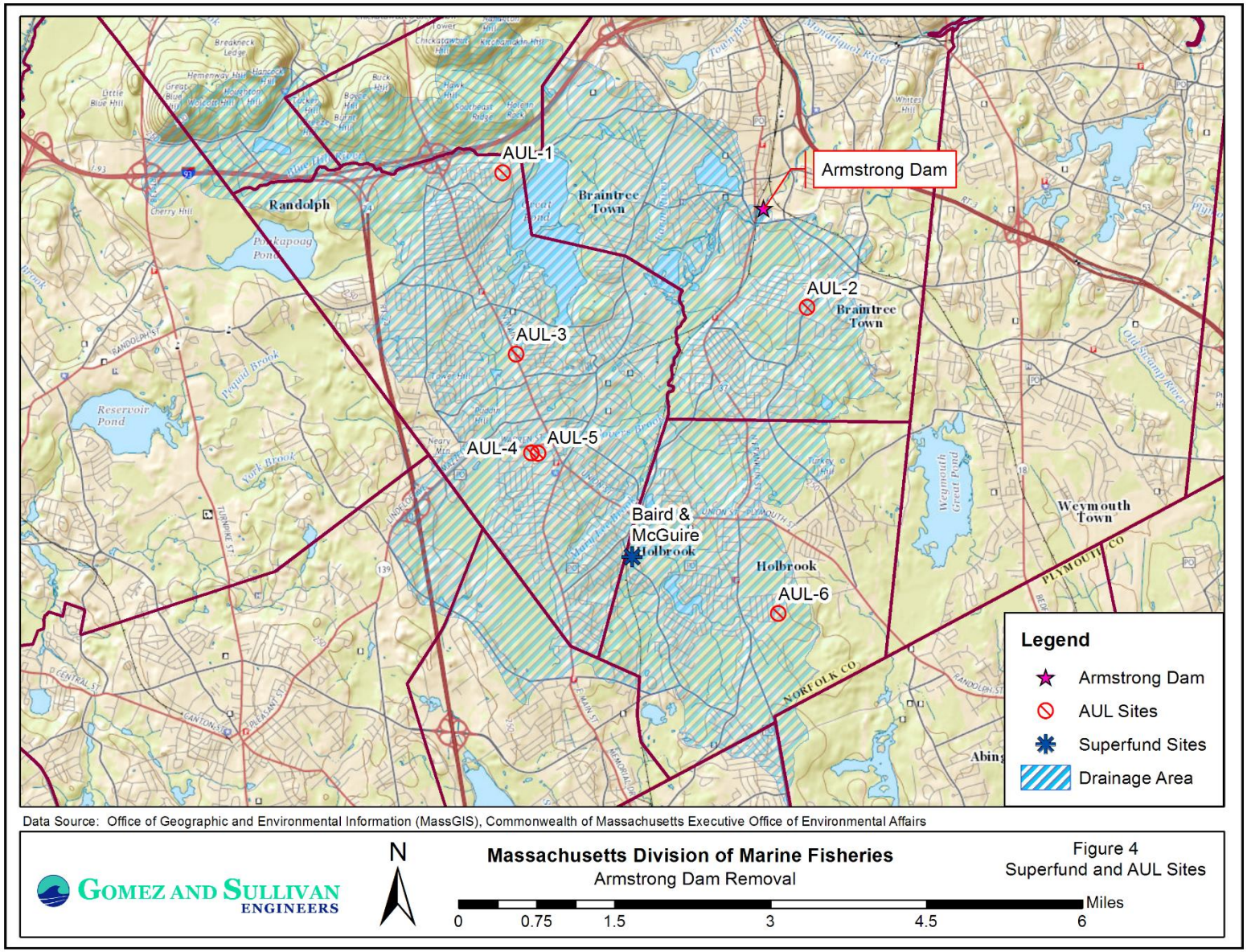
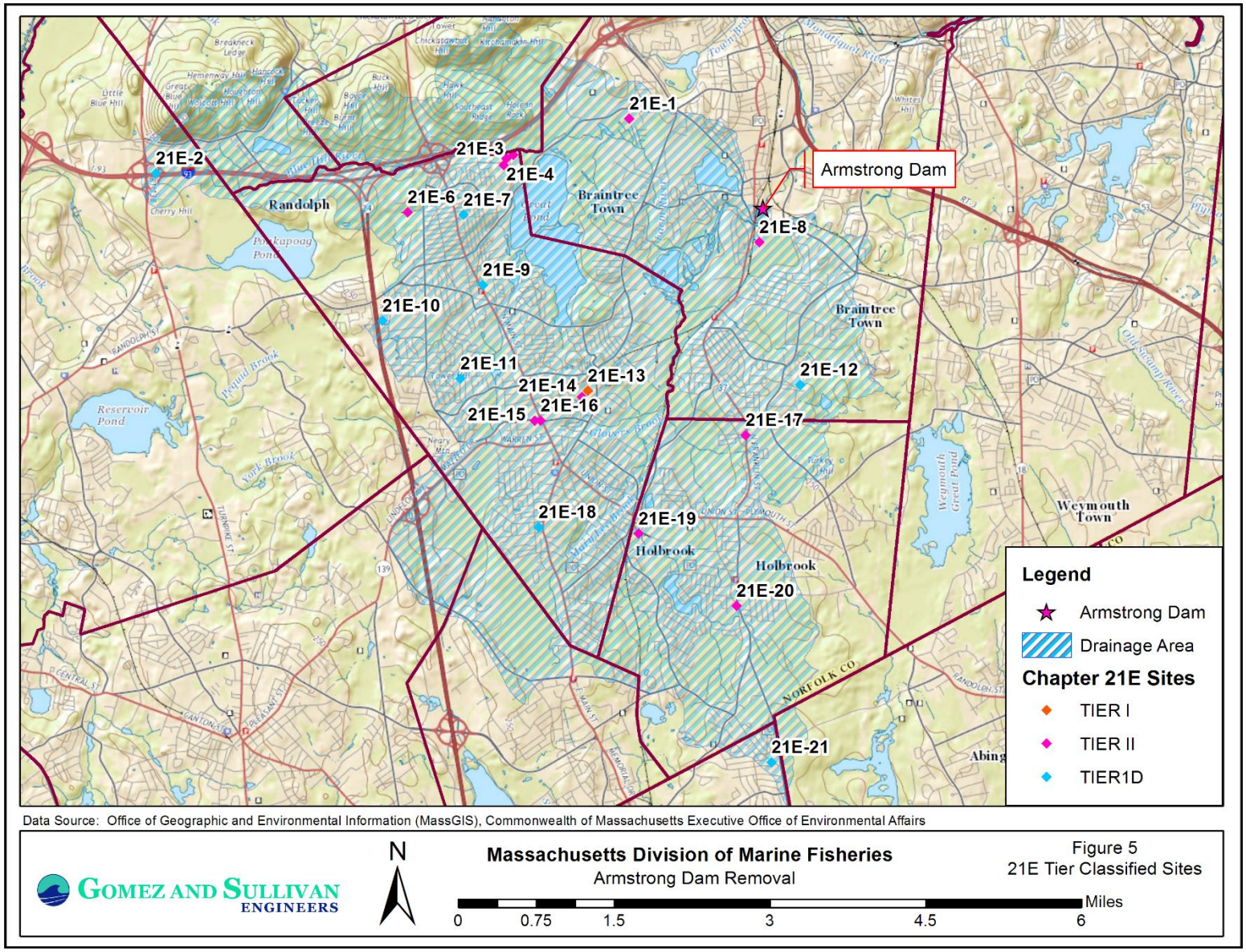
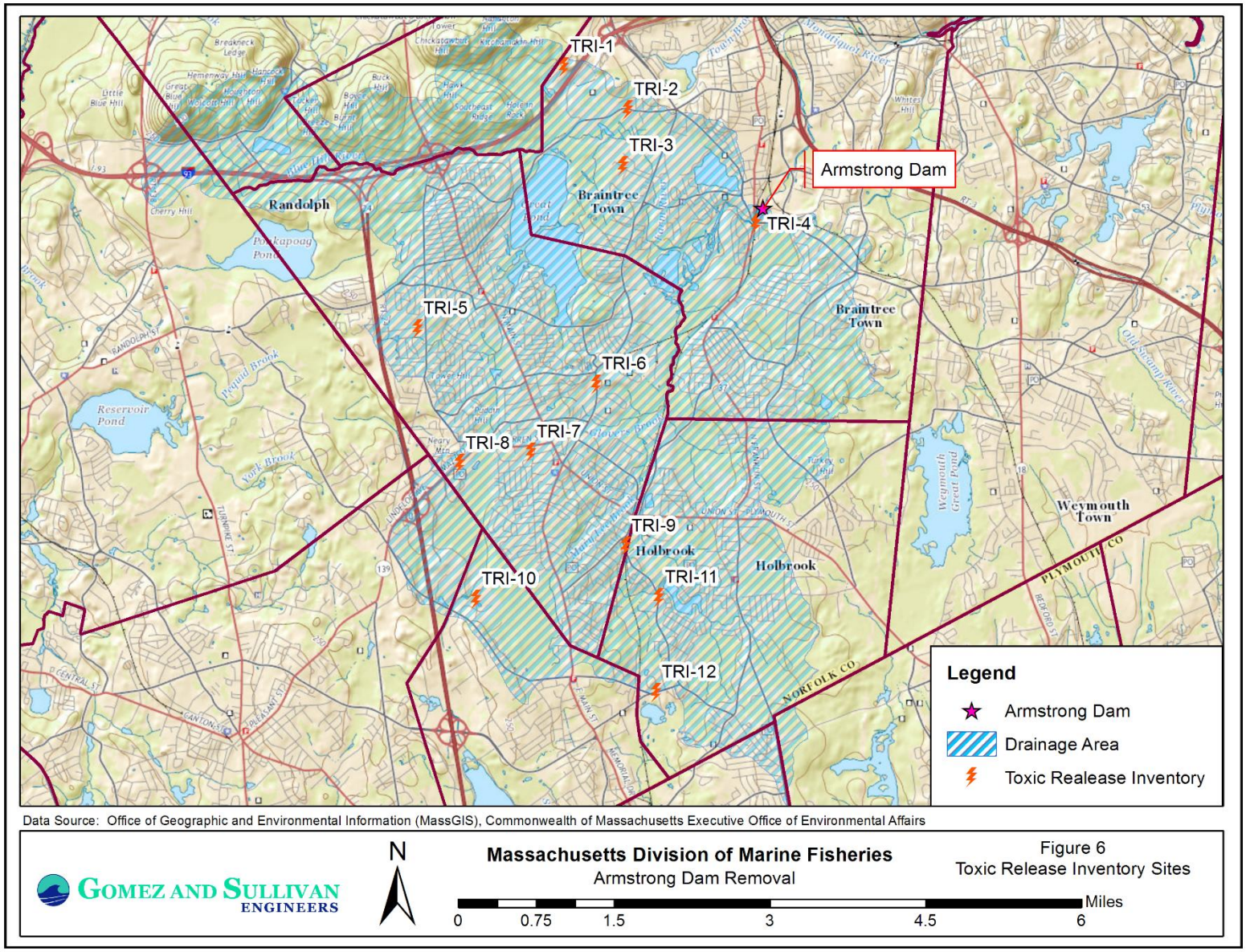
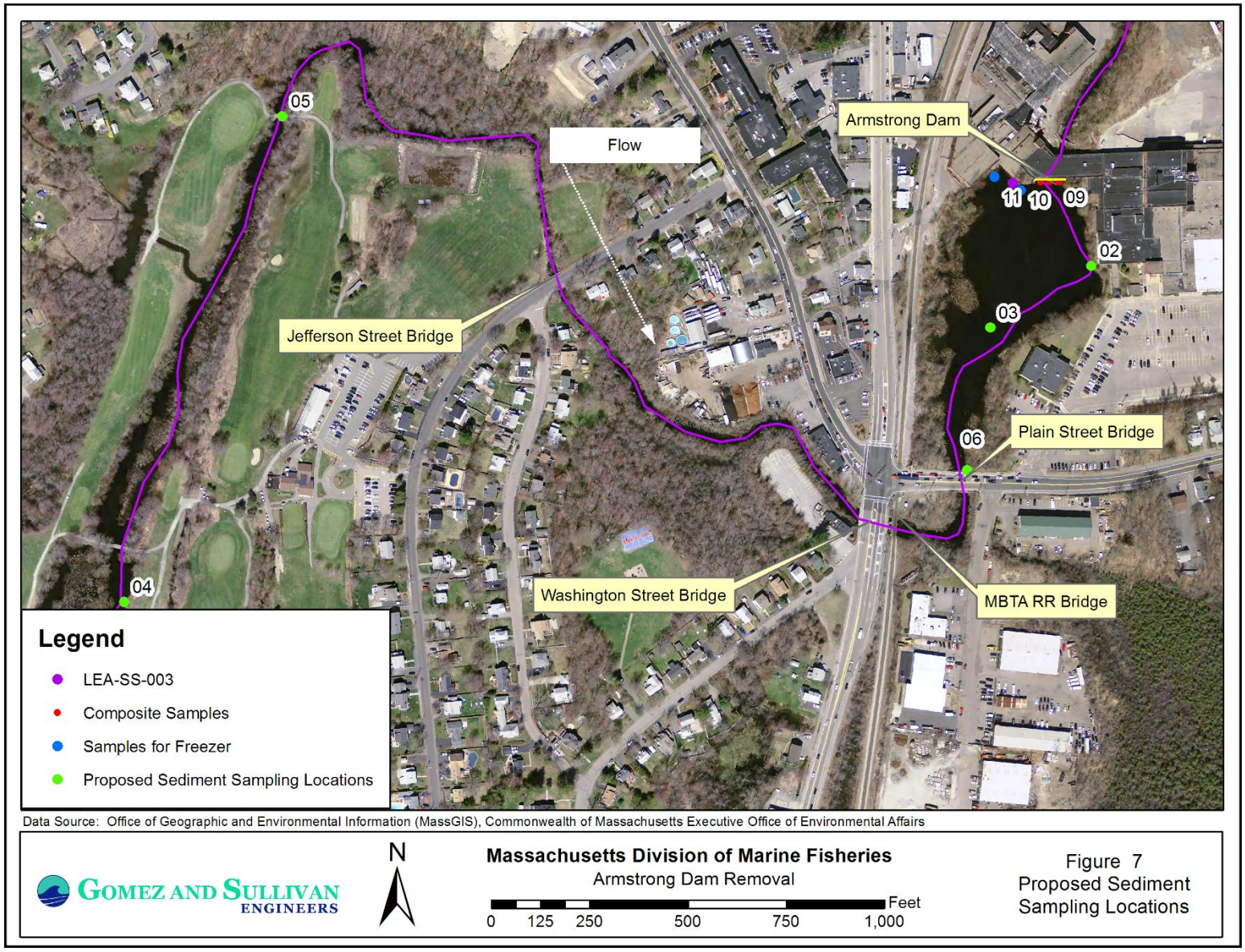

MBTA RR Bridge
Downstream Extent
Flow
Armstrong Dam
Upstream Extent
Legend
Cochato River
Farm River
Monatiquot River
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
GOMEZ AND SULLIVAN ENGINEERS
N
Massachusetts Division of Marine Fisheries
Armstrong Dam Removal
Feet
0 295 590 1,180 1,770 2,360
Figure 2

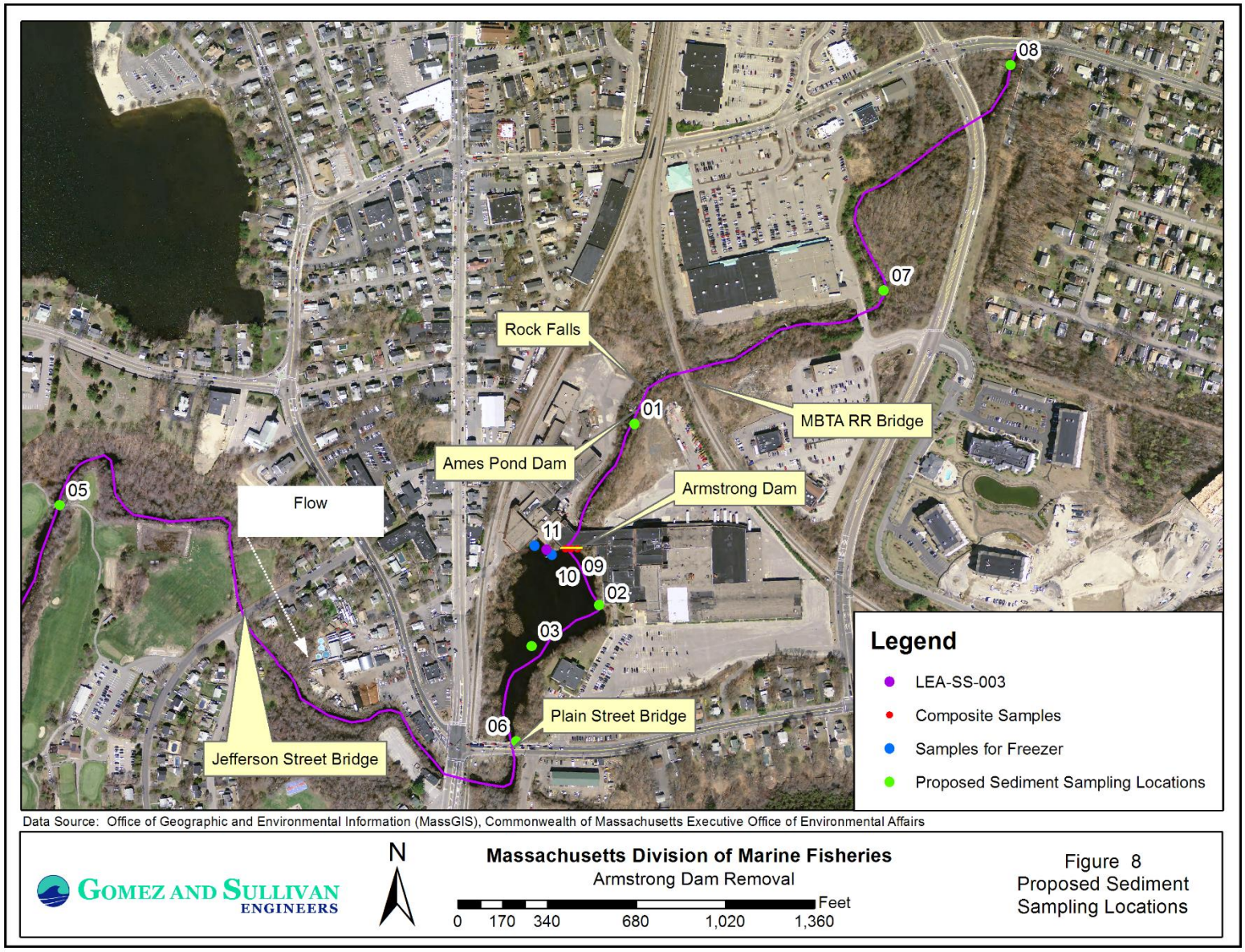
Figure 3. Loureiro Sediment Sampling Locations


AUL-1
Armstrong Dam
Randolph
Braintree Town
AUL-2
AUL-3
AUL-4
AUL-5
Baird & McGuire Holbrook
Holbrook
AUL-6
Weymouth Town
Legend
Armstrong Dam
AUL Sites
Superfund Sites
Drainage Area
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
GOMEZ AND SULLIVAN ENGINEERS
N
Massachusetts Division of Marine Fisheries
Armstrong Dam Removal
Figure 4
Superfund and AUL Sites
0 0.75 1.5 3 4.5 6
Miles


Armstrong Dam
21E-1
21E-2
21E-3
21E-4
21E-6
21E-7
21E-8
21E-9
21E-10
21E-11
21E-12
21E-13
21E-14
21E-15
21E-16
21E-17
21E-18
21E-19
21E-20
21E-21
Randolph
Braintree Town
Weymouth Town
Holbrook
Reservoir Pond
Legend
Armstrong Dam
Drainage Area
Chapter 21E Sites
TIER I
TIER II
TIER1D
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
GOMEZ AND SULLIVAN ENGINEERS
N
Massachusetts Division of Marine Fisheries
Armstrong Dam Removal
0 0.75 1.5 3 4.5 6 Miles
Figure 5
21E Tier Classified Sites


TRI-1
TRI-2
TRI-3
Armstrong Dam
TRI-4
TRI-5
TRI-6
TRI-7
TRI-8
TRI-9
TRI-10
TRI-11
TRI-12
Randolph
Braintree Town
Holbrook
Weymouth Town
Reservoir Pond
Pequid Brook
York Brook
Legend
Armstrong Dam
Drainage Area
Toxic Realease Inventory
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
GOMEZ AND SULLIVAN ENGINEERS
N
Massachusetts Division of Marine Fisheries
Armstrong Dam Removal
Figure 6
Toxic Release Inventory Sites
0 0.75 1.5 3 4.5 6
Miles


05
Flow
Armstrong Dam
11
10
09
02
03
Jefferson Street Bridge
06
Plain Street Bridge
04
Washington Street Bridge
MBTA RR Bridge
Legend
LEA-SS-003
Composite Samples
Samples for Freezer
Proposed Sediment Sampling Locations
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
GOMEZ AND SULLIVAN ENGINEERS
N
Massachusetts Division of Marine Fisheries
Armstrong Dam Removal
0 125 250 500 750 1,000 Feet
Figure 7
Proposed Sediment
Sampling Locations


08
07
Rock Falls
01
MBTA RR Bridge
Ames Pond Dam
Armstrong Dam
05
Flow
11
09
10
02
03
06
Plain Street Bridge
Jefferson Street Bridge
Legend
LEA-SS-003
Composite Samples
Samples for Freezer
Proposed Sediment Sampling Locations
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
GOMEZ AND SULLIVAN ENGINEERS
N
Massachusetts Division of Marine Fisheries
Armstrong Dam Removal
Feet
0 170 340 680 1,020 1,360
Figure 8
Proposed Sediment
Sampling Locations

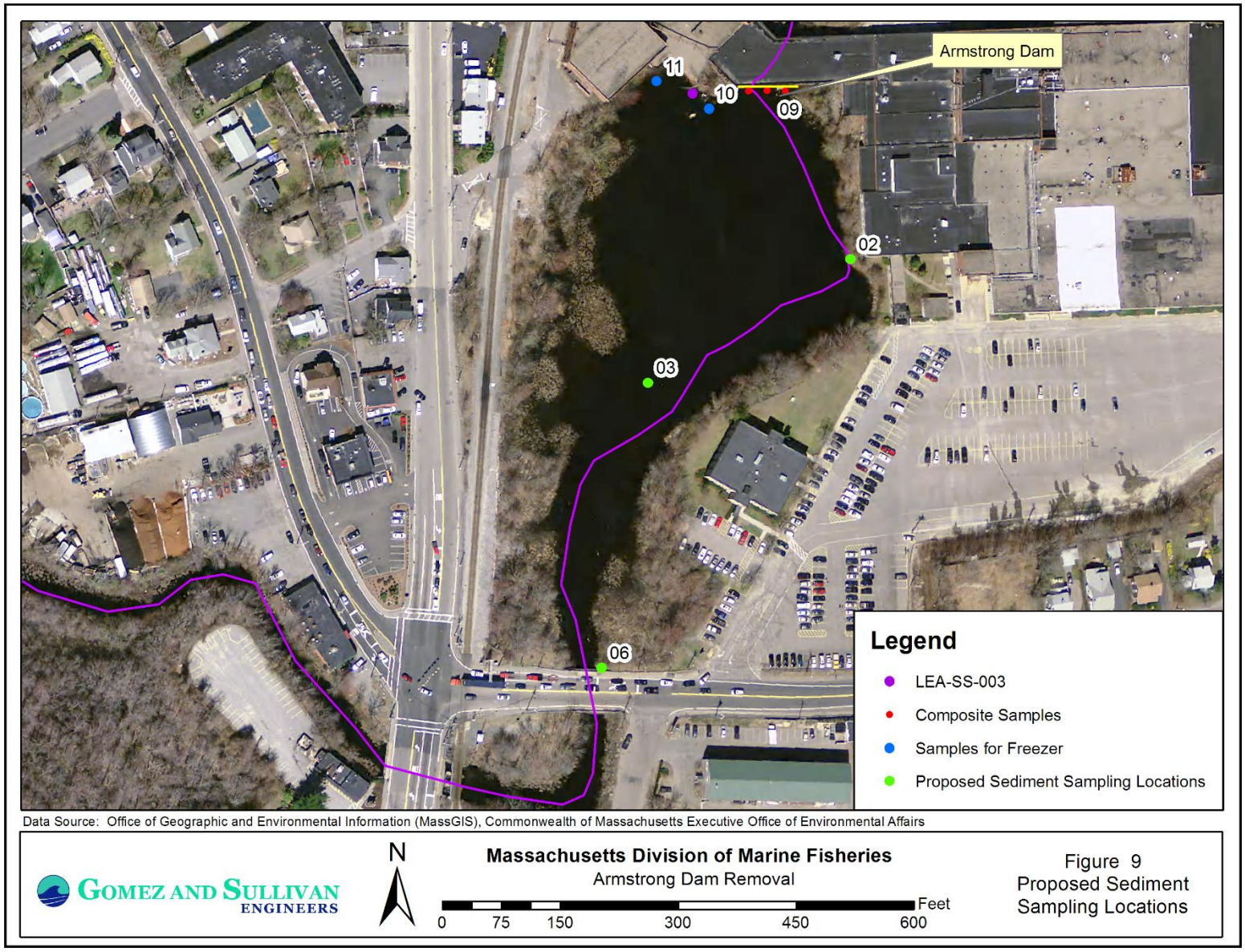

Armstrong Dam
11
10
09
02
03
06
Legend
LEA-SS-003
Composite Samples
Samples for Freezer
Proposed Sediment Sampling Locations
Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs
GOMEZ AND SULLIVAN ENGINEERS
N
Massachusetts Division of Marine Fisheries
Armstrong Dam Removal
0 75 150 300 450 600 Feet
Figure 9
Proposed Sediment
Sampling Locations

TABLE 1
SEDIMENT ANALYTICAL DATA SUMMARY OF DETECTS & EXCEEDANCES (November 2, 2012)
HOLLINGSWORTH POND, BRAINTREE, MA

Parameter	Units	LEA-SS-001	LEA-SS-002	LEA-SS-003	LEA-SS-004	MCP Reportable Conc.		MCP Method 1 Standards			
		1268055	1268056	1268057	1268058						
		11/2/2012	11/2/2012	11/2/2012	11/2/2012	RCS1	RCS2	S1GW1	S1GW2	S1GW3	UCLs
Percent Moisture	%	28	36	47	43	NA	NA	NA	NA	NA	NA
VOCs (8260C)											
1,1,2,2-Tetrachloroethane	mg/Kg	< 0.0031	< 0.0043	<0.0058	NA	0.005	0.02	0.005	0.02	0.8	400
1,2,4-Trimethylbenzene	mg/Kg	< 0.0031	< 0.0043	**0.006**	NA	1,000	10,000	NA	NA	NA	NA
1,4-Dioxane	mg/Kg	< 0.310	< 0.430	< 0.5580	NA	0.2	6	0.2	6	70	5,000
2-Butanone (MEK)	mg/Kg	**0.055**	**0.150**	**0.190**	NA	4	50	4	50	400	10,000
Acetone	mg/Kg	< 0.310	**0.510**	**0.620**	NA	6	50	6	50	400	10,000
Chlorobenzene	mg/Kg	< 0.0031	< 0.0043	**0.016**	NA	1	3	1	3	100	10,000
Chlorodibromomethane	mg/Kg	< 0.0031	< 0.0043	< 0.0058	NA	0.005	0.03	0.005	0.03	20	5,000
PAHs (8270D)											
2-Methylnaphthalene	mg/Kg	< 1.3	< 1.4	< 1.8	< 1.7	0.7	80	0.7	80	300	5,000
Acenaphthene	mg/Kg	**1.6**	< 1.4	**2.7**	< 1.7	4	3000	4	1000	1000	10,000
Acenaphthylene	mg/Kg	< 1.3	< 1.4	< 1.8	< 1.7	1	10	1	600	10	10,000
Anthracene	mg/Kg	**5.6**	< 1.4	< 1.8	< 1.7	1000	3000	1000	1000	1000	10,000
Benzo[a]anthracene	mg/Kg	**16**	**1.6**	**2.4**	< 1.7	7	40	7	7	7	3,000
Benzo[a]pyrene	mg/Kg	**15**	< 2.8	< 3.6	< 3.3	2	4	2	2	2	300
Benzo[b]fluoranthene	mg/Kg	**21**	**1.8**	**3.5**	< 1.7	7	40	7	7	7	3,000
Benzo[g,h,i]perylene	mg/Kg	**5**	< 1.4	< 1.8	< 1.7	1000	3000	1000	1000	1000	10,000
Benzo[k]fluoranthene	mg/Kg	**9.7**	< 1.5	< 1.9	< 1.8	70	400	70	70	70	10,000
Chrysene	mg/Kg	**16**	**1.6**	**2.4**	< 1.7	70	400	70	70	70	10,000
Dibenz(a,h)anthracene	mg/Kg	**1.9**	< 1.4	< 1.8	< 1.7	0.7	4	0.7	0.7	0.7	300
Fluoranthene	mg/Kg	**40**	**3.5**	**6.5**	< 1.7	1000	3000	1000	1000	1000	10,000
Fluorene	mg/Kg	**3.6**	< 1.4	**2.2**	< 1.7	1000	3000	1000	1000	1000	10,000
Indeno[1,2,3-cd]pyrene	mg/Kg	**5.7**	< 2.8	< 3.6	< 3.3	7	40	7	7	7	3,000
Phenanthrene	mg/Kg	**31**	**3.2**	**8.2**	< 1.7	10	1000	10	500	500	10,000
Pyrene	mg/Kg	**32**	**2.9**	**5.7**	< 1.7	1000	3000	1000	1000	1000	10,000
EPH (MA-EPH)											
Carbon Fractions											
C11-C22 Aromatics	mg/Kg	**370**	**180**	**1200**	**310**	NA	NA	NA	NA	NA	NA
C11-C22 Aromatics (Adjusted)	mg/Kg	< 4.6	< 5.1	< 6.2	< 5.8	1,000	3,000	1,000	1,000	1,000	10,000
C19-C36 Aliphatics	mg/Kg	**22**	**23**	< 180	**100**	3,000	5,000	3,000	3,000	3,000	20,000
C9-C18 Aliphatics	mg/Kg	< 13	< 14	< 180	< 17	1,000	3,000	1,000	1,000	1,000	20,000
Target PAHs											
2-Methylnaphthalene	mg/Kg	< 1.3	< 1.4	< 18	< 1.7	0.7	80	0.7	80	300	5,000
Acenaphthene	mg/Kg	1.5	< 1.4	< 18	< 1.7	4	3,000	4	1,000	1,000	10,000
Acenaphthylene	mg/Kg	< 1.3	< 1.4	< 18	< 1.7	1	10	1	600	10	10,000
Anthracene	mg/Kg	4.7	< 1.4	< 18	< 1.7	1,000	3,000	1,000	1,000	1,000	10,000
Benzo[a]anthracene	mg/Kg	**13**	**1.9**	< 18	**1.9**	7	40	7	7	7	3,000
Benzo[a]pyrene	mg/Kg	**13**	**2.7**	< 18	**3.1**	2	4	2	2	2	300
Benzo[b]fluoranthene	mg/Kg	**7.1**	**1.9**	< 18	**2.5**	7	40	7	7	7	3,000
Benzo[g,h,i]perylene	mg/Kg	**6.9**	< 1.4	< 18	< 1.7	1,000	3,000	1,000	1,000	1,000	10,000
Benzo[k]fluoranthene	mg/Kg	**19**	**3.1**	< 18	**3.4**	70	400	70	70	70	10,000
Chrysene	mg/Kg	**18**	**3.7**	**19**	**4.4**	70	400	70	70	70	10,000
Dibenz(a,h)anthracene	mg/Kg	**2.1**	< 1.4	< 18	< 1.7	0.7	4	0.7	0.7	0.7	300
Fluoranthene	mg/Kg	**39**	**3.8**	< 18	**2.8**	1,000	3,000	1,000	1,000	1,000	10,000
Fluorene	mg/Kg	3.1	< 1.4	< 18	< 1.7	1,000	3,000	1,000	1,000	1,000	10,000
Indeno[1,2,3-cd]pyrene	mg/Kg	**8.5**	< 1.4	< 18	< 1.7	7	40	7	7	7	3,000
Naphthalene	mg/Kg	< 1.3	< 1.4	< 18	< 1.7	4	40	4	40	500	10,000
Phenanthrene	mg/Kg	**28**	**3.2**	< 18	< 1.7	10	1,000	10	500	500	10,000
Pyrene	mg/Kg	**33**	**3.9**	**18**	**4.9**	1,000	3,000	1,000	1,000	1,000	10,000
METALS(6010/7471A)											
Antimony	mg/Kg	**0.72**	< 0.78	**68**	**2.2**	20	30	20	20	20	300
Arsenic	mg/Kg	**3.7**	**5.3**	**17**	**15**	20	20	20	20	20	200
Barium	mg/Kg	**20**	**48**	**1200**	**56**	1,000	3,000	1,000	1,000	1,000	10,000
Beryllium	mg/Kg	**0.34**	**0.45**	**0.59**	**0.71**	100	200	100	100	100	2,000
Cadmium	mg/Kg	< 0.26	**0.51**	**4.3**	**1.6**	2	30	2	2	2	300
Chromium	mg/Kg	**20**	**6.9**	**35**	**150**	30	200	30	30	30	2,000
Lead	mg/Kg	**110**	**46**	**1400**	**160**	300	300	300	300	300	3,000
Mercury	mg/Kg	< 0.14	< 0.16	**5.6**	**1.4**	20	30	20	20	20	300
Nickel	mg/Kg	**5.2**	**6.5**	**38**	**11**	20	700	20	20	20	7,000
Selenium	mg/Kg	< 0.64	**0.97**	**0.99**	< 0.86	400	800	400	400	400	8,000
Silver	mg/Kg	< 0.64 ^	< 0.78 ^	< 0.89 ^	0.88 ^	100	200	100	100	100	2,000
Thallium	mg/Kg	< 1.3	< 1.6	< 1.8	< 1.7	8	60	8	8	8	800
Vanadium	mg/Kg	**14**	**15**	**24**	**38**	600	1,000	600	600	600	10,000
Zinc	mg/Kg	**79**	**100**	**13000**	**360**	2,500	3,000	2,500	2,500	2,500	10,000

Note G:\Projects\31BF201 FX Messina Armstrong Cork Dam Removal\[2012.11.27.TBL.1.Sediment Results Data Summary.xls]Sediment Data

% - percent

mg/Kg - milligrams per kilogram

BOLD analyte detected above reporting limit

BOLD/SHADE analyte detected above reporting limit and RC and/or Method 1 cleanup standard.

* - LCS or LCSD exceeds the control limits

^ - ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC exceeds the control limits.

APPENDIX A

Loureiro Report of November 30, 2012

Loureiro
Engineering • Construction • EH&S • Energy • Waste

VIA E-Mail

November 30, 2012

F.X. Messina Enterprises
400 Granite Street
Braintree, MA 02184

Attn: Robert St. John

RE: Results of Environmental Investigation
Hollingsworth Pond
Braintree, Massachusetts

Dear Mr. St. John:

Loureiro Engineering Associates, Inc. (Loureiro) prepared this letter report in support of an environmental investigation requested by F.X. Messina Enterprises (Messina Enterprises) regarding the composition of shallow-water sediment from Hollingsworth Pond (the Pond). The Pond is located on the Monatiquot River and is formed by the dam located at the property of 10 Plain Street, Braintree, Massachusetts (the Site), owned by Messina Enterprises. This report has been prepared to provide an understanding of the environmental conditions of the sediment within the pond. This investigation is being completed to evaluate the feasibility of removing the dam at the Site and the potential liabilities associated with the exposure and mobilization of sediment with regard to the Massachusetts Contingency Plan (310 CMR 40.0000) (MCP).

Field Investigation

On November 2, 2012, Loureiro collected shallow sediment samples from four locations in the Pond. Samples were collected using a 2-inch polyvinyl chloride (PVC) tube with an open end (driven end) and a capped end with an air vent. The device was manually driven into the sediment until refusal. Upon which time the air vent was closed and the tube was retrieved. At the surface the air vent was opened and the sample was then released from the tube. This sampling procedure allowed for the collection of sediment samples below the organic mat and into the loosely consolidated pond sediment.

Samples collected were analyzed for Volatile Organic Compounds (VOCs) by EPA Method 8260, Polycyclic Aromatic Hydrocarbons by EPA Method 8270, Extractable Petroleum Hydrocarbons (EPH – carbon chains only) with target PAHs, and Massachusetts's 14 Metals (Total). LEA collected three aliquots of sediment to assure enough material to fill the necessary sample containers. The VOC portion was obtained exclusively from the third aliquot. The aliquots were collected within a three-foot diameter area of the selected sampling location. The fourth sample (LEA-SS-004) was not analyzed for VOCs.

The samples were distributed spatially to capture areas within the pond with sediments that would be exposed or mobilized if the dam was removed and to gather representative information regarding the sediment conditions:

- LEA-SS-001 was located along the eastern portion of the pond adjacent to the parking lot and its stormwater outfall.
- LEA-SS-002 was located along a shallow "sand" bar in the southern portion of the Pond mid-channel with the incoming river; upstream of the main portion of the Pond.
- LEA-SS-003 was located in the northwestern portion of the Pond adjacent to the junction of the channel spanning portion of the building and the portion of the building that occupies the western area of the Site.
- LEA-SS-004 was collected in the western portion of the Pond adjacent to a narrow vegetated buffer between the Pond and the commuter rail tracks.

The samples were collected in water depths of 1.25 feet to 3 feet, and ranged from 2 inches to 3.83 feet below ground surface. Predominantly the sediment observed was dark brown/black silty-fine to medium sand with trace gravel. Sample location LEA-SS-003 had a notable petroleum odor at collection and a sheen was observed in the area.

Results

Table 1 presents the sediment constituent concentrations. The accompanying analytical data can be found in Appendix A.

Four VOCs (1,2,4,-trimethylbenzene, 2-butanone (MEK), acetone, and chlorobenzene) were detected across the three locations sampled. 1,2,4-trimethylbenzene and chlorobenzene were detected at one location only (LEA-SS-003) with concentrations of 0.006 milligrams per kilogram (mg/kg) and 0.016 mg/kg, respectively. Acetone was detected at two locations, LEA-SS-002 and LEA-SS-003, with concentrations of 0.510 mg/kg and 0.62 mg/kg, respectively. 2-Butanone was detected at all three VOC sample locations, LEA-SS-001 to LEA-SS-003, with a range of 0.055 mg/kg to 0.19 mg/kg.

14 PAHs compounds were detected by EPA Method 8270. The concentrations ranged from 1.6 mg/kg to 40 mg/kg. Only three locations: LEA-SS-001, LEA-SS-002, and LEA-SS-003 had detected PAHs. Six (benzo[a]anthracene, benzo[b]fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene) of the 14 compounds detected were present at the three sampling locations. Acenaphthene and flourene were detected at two of the four sampling locations with concentrations of 1.6 mg/Kg and 2.7 mg/kg; and 2.2 mg/kg and 3.6 mg/kg, respectively. The remaining six compounds were detected at LEA-SS-001 only.

EPH fractions for the C_{11}-C_{22} Aromatics (Adjusted) and C_9-C_{18} Aliphatics ranges were not detected at any location. The C_{19}-C_{36} Aliphatics fraction was detected at three of the four sample locations, the exception being LEA-SS-003, with a range from 22 mg/kg to 100 mg/kg. 14 target

PAH compounds were detected by the MA-EPH method. Target PAH concentrations ranged from 1.5 mg/kg to 33 mg/kg. Of the 14 PAH compounds detected two compounds, chrysene and pyrene, were detected at all four sample locations, with ranges of 4.4 mg/kg to 19 mg/kg and 3.9 mg/kg to 33 mg/kg, respectively. Five of the 14 compounds (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, and fluoranthene) were detected at three of the four sample locations. Phenanthrene was detected at two sample locations, LEA-SS-001 and LEA-SS-002, with concentrations of 28 mg/kg and 3.2 mg/kg, respectively. LEA-SS-003 had elevated reporting limits compared to the other sample locations. Given the associated elevated reporting limits for sample location LEA-SS-003 only two constituents were detected above their reporting limit.

Twelve of the 14 Massachusetts metals were detected. Eight of the 12 metals (arsenic, barium, beryllium, chromium, lead, nickel, vanadium, and zinc) were detected at all four sampling locations. Antimony and cadmium were only detected at three of the four sampling locations, with ranges of 0.72 mg/kg to 2.2 mg/kg and 0.51 to mg/kg to 4.3 mg/kg, respectively. Mercury and selenium were detected at two of the four sample locations. Mercury was detected at LEA-SS-003 and LEA-SS-004 with concentrations of 5.6 mg/kg and 1.4 mg/kg, respectively. Selenium was detected at sampling locations LEA-SS-002 and LEA-SS-003 with concentrations of 0.97 mg/kg and 0.99 mg/kg, respectively. Silver and thallium were not detected at any of the sampling locations. The single highest metal concentration was Zinc with 13,000 mg/kg at sample location LEA-SS-003.

Summary of Constituent Exceedances

LEA compared the sediment constituent concentrations, presented in Table 1, to the MCP Reportable Concentration Standards Reporting Category RCS-1 and RCS-2. For reference, though not immediately relevant, the MCP Method 1 Soil Category S-1 Standards, *310 CMR 40.0975(6)(a): Table 2*; and the MCP Method 3 Upper Concentrations Limits in Soil, *310 CMR 40.0996(7): Table 6* are also provided. In cases were a constituent was not detected but the associated reporting limit was above its respective Reportable Concentration standard or Standard concentration, a conservative approach was applied and the constituent was considered to have exceeded the applicable Reportable Concentration standard or Standard concentration. Note: An elevated method detection limit is often the result of the laboratory needing to dilute a sample due to the presence of one or more compounds at an elevated concentration.

No detected VOC exceed Reportable Concentrations. However, reporting limits above their respective RCS-1 Reportable Concentration standard and Method 1 S-1 GW-1 Standard concentration resulted in three additional VOCs (1,1,2,2-Tetrachloroethane, 1,4-Dioxane, and Chlorodibromomethane) exceeding the MCP standards. Sample location LEA-SS-003 had the most detections and exceedances; while sample location LEA-SS-001 had the least detections and exceedances.

Of the 14 PAHs detected by EPA Method 8270 five (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenzo(a,h)anthracene, and phenanthrene) were detected above the RCS-1 Reportable Concentration in LEA-SS-001. 2-Methlnaphthalene was not detected but due to the higher laboratory reporting limit in sample location LEA-SS-003 it exceeded its RCS-1 Reportable Concentration standard and Method 1 S-1 GW-1 Standard. Additionally, acenaphthylene was not detected in any sample location, but the reporting limit exceeded its RCS-1 Reportable Concentration standard.

Six target PAH compounds (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenzo(a,h)anthracene, indeno[1,2,3-cd]pyrene and phenanthrene) exceeded their respective RCS-1 Reportable Concentration standard and Method 1 S-1 GW-1 Standard concentration. Benzo[a]pyrene also exceeded its RCS-2 Reportable Concentration standard in LEA-SS-001. Four other compounds (2-methylnapthalene, acenaphthene, acenaphthylene, naphthalene) where below their respective reporting limits but exceeded their respective RCS-1 Reportable Concentration standard in one or more locations. Due to the elevated reporting limits associated with LEA-SS-003 this sample location had the largest number of constituents above their respective RCS-1 Reportable Concentration.

Seven of the metals (antimony, barium, cadmium, chromium, lead, nickel, and zinc) were detected above their respective RCS-1 Reportable Concentration. With the exception of chromium at sample location LEA-SS-004, all other exceedances were at sample location LEA-SS-003.

Conclusion

Result of laboratory analysis of sediment samples do not, in LEA's opinion, show evidence of a significant release of oil or hazardous materials to the pond. Instead, the results appear to indicate general degradation of sediment conditions associated with the long history of industry associated with the Armstrong Cork facility and degradation associated with stormwater discharge from upstream.

Based on our inspection of the pond and review of the laboratory analysis, the concentration of PAHs and metals associated with LEA-SS-001 are likely attributable to stormwater runoff from the nearby parking area and incidental spillage / leakage associated with parked cars and emissions. Similar PAHs and metals are present in LEA-SS-002, collected generally from the center of the pond, upstream of LEA-SS-001, and from LEA-SS-004 collected on the west side of the pond and on the interior side of the apparent stream channel. LEA concludes that the concentrations of PAHs and metals at these other locations is likely the result of contribution from upstream stormwater.

LEA concludes that the PAHs and metals detected in LEA-SS-003 are likely the result of contribution of upstream but also contribution from activities conducted at Armstrong Cork. LEA noted a distinct petroleum odor associated with these sediments and given the proximity of

the sample location to the building, activities within the building should be investigated to determine if storage or use of petroleum in this area may have contributed to sediment conditions.

Based on our review and understanding of applicable regulations, LEA concludes that if the water level in the pond is lowered such that sediment is exposed, the sediment would be considered soil for the purpose of the MCP. Given the presence of metals and PAHs above the applicable RCS-1 standard, LEA concludes that a reporting condition associated with the newly exposed soil will exist. With the exception of sediment/soil proximal to LEA-SS-003, LEA does not believe that significant remediation of site soil will be necessary. Based on the limited data to date, LEA believes that any risk associated with the exposure of this soil can be managed through careful planning of use of the area.

We hope that the information contained herein is helpful to your understanding of sediment conditions. LEA appreciates the opportunity to provide our services. If you have any questions please do not hesitate to contact the undersigned. Samuel Butcher can be reached at 781-878-1272.

Sincerely,

LOUREIRO ENGINEERING ASSOCIATES, INC.

Samuel W. Butcher, LSP,
Vice President

William C. Meagher III, EIT
Engineer

Attachments:

Table 1: Sediment Analytical Data

Appendix A: Laboratory Report 480/27715-1

75 0 75 150 225

APPROXIMATE SCALE IN FEET

MAP NOTES:

MAP IMAGE OBTAINED FROM GOOGLE EARTH, NOVEMBER 5, 2011. DATE OF IMAGERY JUNE 10, 2012.

ALL LOCATIONS ARE APPROXIMATE

ENVIRONMENTAL INVESTIGATION

F.X. MESSINA ENTERPRISES, INC.

SEDIMENT SAMPLING LOCATIONS

Comm.No.		
31BF2.01	FIGURE 1	Loureiro Engineering • Construction • EH&S • Energy • Waste

G:\PROJECTS\31BF201 FX MESSINA ARMSTRONG CORK DAM REMOVAL\FIGURES\2012.11.30.FIG.1.SAMPLING LOCATIONS.DWG Tab:FIGURE 1 Saved: 11/30/2012 4:44 PM Plotted: 11/30/2012 4:47 PM

TABLE 1
SEDIMENT ANALYTICAL DATA SUMMARY OF DETECTS & EXCEEDANCES (November 2, 2012)
HOLLINGSWORTH POND, BRAINTREE, MA

Parameter	Units	LEA-SS-001	LEA-SS-002	LEA-SS-003	LEA-SS-004	MCP Reportable Conc.		MCP Method 1 Standards			
		1268055	1268056	1268057	1268058						
		11/2/2012	11/2/2012	11/2/2012	11/2/2012	RCS1	RCS2	S1GW1	S1GW2	S1GW3	UCLs
Percent Moisture	%	28	36	47	43	NA	NA	NA	NA	NA	NA
VOCs (8260C)											
1,1,2,2-Tetrachloroethane	mg/Kg	< 0.0031	< 0.0043	<0.0058	NA	0.005	0.02	0.005	0.02	0.8	400
1,2,4-Trimethylbenzene	mg/Kg	< 0.0031	< 0.0043	**0.006**	NA	1,000	10,000	NA	NA	NA	NA
1,4-Dioxane	mg/Kg	< 0.310	< 0.430	< 0.5580	NA	0.2	6	0.2	6	70	5,000
2-Butanone (MEK)	mg/Kg	**0.055**	**0.150**	**0.190**	NA	4	50	4	50	400	10,000
Acetone	mg/Kg	< 0.310	**0.510**	**0.620**	NA	6	50	6	50	400	10,000
Chlorobenzene	mg/Kg	< 0.0031	< 0.0043	**0.016**	NA	1	3	1	3	100	10,000
Chlorodibromomethane	mg/Kg	< 0.0031	< 0.0043	< 0.0058	NA	0.005	0.03	0.005	0.03	20	5,000
PAHs (8270D)											
2-Methylnaphthalene	mg/Kg	< 1.3	< 1.4	< 1.8	< 1.7	0.7	80	0.7	80	300	5,000
Acenaphthene	mg/Kg	**1.6**	< 1.4	**2.7**	< 1.7	4	3000	4	1000	1000	10,000
Acenaphthylene	mg/Kg	< 1.3	< 1.4	< 1.8	< 1.7	1	10	1	600	10	10,000
Anthracene	mg/Kg	**5.6**	< 1.4	< 1.8	< 1.7	1000	3000	1000	1000	1000	10,000
Benzo[a]anthracene	mg/Kg	**16**	**1.6**	**2.4**	< 1.7	7	40	7	7	7	3,000
Benzo[a]pyrene	mg/Kg	**15**	< 2.8	< 3.6	< 3.3	2	4	2	2	2	300
Benzo[b]fluoranthene	mg/Kg	**21**	**1.8**	**3.5**	< 1.7	7	40	7	7	7	3,000
Benzo[g,h,i]perylene	mg/Kg	**5**	< 1.4	< 1.8	< 1.7	1000	3000	1000	1000	1000	10,000
Benzo[k]fluoranthene	mg/Kg	**9.7**	< 1.5	< 1.9	< 1.8	70	400	70	70	70	10,000
Chrysene	mg/Kg	**16**	**1.6**	**2.4**	< 1.7	70	400	70	70	70	10,000
Dibenz(a,h)anthracene	mg/Kg	**1.9**	< 1.4	< 1.8	< 1.7	0.7	4	0.7	0.7	0.7	300
Fluoranthene	mg/Kg	**40**	**3.5**	**6.5**	< 1.7	1000	3000	1000	1000	1000	10,000
Fluorene	mg/Kg	**3.6**	< 1.4	**2.2**	< 1.7	1000	3000	1000	1000	1000	10,000
Indeno[1,2,3-cd]pyrene	mg/Kg	**5.7**	< 2.8	< 3.6	< 3.3	7	40	7	7	7	3,000
Phenanthrene	mg/Kg	**31**	**3.2**	**8.2**	< 1.7	10	1000	10	500	500	10,000
Pyrene	mg/Kg	**32**	**2.9**	**5.7**	< 1.7	1000	3000	1000	1000	1000	10,000
EPH (MA-EPH)											
Carbon Fractions											
C11-C22 Aromatics	mg/Kg	**370**	**180**	**1200**	**310**	NA	NA	NA	NA	NA	NA
C11-C22 Aromatics (Adjusted)	mg/Kg	< 4.6	< 5.1	< 6.2	< 5.8	1,000	3,000	1,000	1,000	1,000	10,000
C19-C36 Aliphatics	mg/Kg	**22**	**23**	< 180	**100**	3,000	5,000	3,000	3,000	3,000	20,000
C9-C18 Aliphatics	mg/Kg	< 13	< 14	< 180	< 17	1,000	3,000	1,000	1,000	1,000	20,000
Target PAHs											
2-Methylnaphthalene	mg/Kg	< 1.3	< 1.4	< 18	< 1.7	0.7	80	0.7	80	300	5,000
Acenaphthene	mg/Kg	1.5	< 1.4	< 18	< 1.7	4	3,000	4	1,000	1,000	10,000
Acenaphthylene	mg/Kg	< 1.3	< 1.4	< 18	< 1.7	1	10	1	600	10	10,000
Anthracene	mg/Kg	4.7	< 1.4	< 18	< 1.7	1,000	3,000	1,000	1,000	1,000	10,000
Benzo[a]anthracene	mg/Kg	**13**	**1.9**	< 18	**1.9**	7	40	7	7	7	3,000
Benzo[a]pyrene	mg/Kg	**13**	**2.7**	< 18	**3.1**	2	4	2	2	2	300
Benzo[b]fluoranthene	mg/Kg	**7.1**	**1.9**	< 18	**2.5**	7	40	7	7	7	3,000
Benzo[g,h,i]perylene	mg/Kg	**6.9**	< 1.4	< 18	< 1.7	1,000	3,000	1,000	1,000	1,000	10,000
Benzo[k]fluoranthene	mg/Kg	**19**	**3.1**	< 18	**3.4**	70	400	70	70	70	10,000
Chrysene	mg/Kg	**18**	**3.7**	**19**	**4.4**	70	400	70	70	70	10,000
Dibenz(a,h)anthracene	mg/Kg	**2.1**	< 1.4	< 18	< 1.7	0.7	4	0.7	0.7	0.7	300
Fluoranthene	mg/Kg	**39**	**3.8**	< 18	**2.8**	1,000	3,000	1,000	1,000	1,000	10,000
Fluorene	mg/Kg	3.1	< 1.4	< 18	< 1.7	1,000	3,000	1,000	1,000	1,000	10,000
Indeno[1,2,3-cd]pyrene	mg/Kg	**8.5**	< 1.4	< 18	< 1.7	7	40	7	7	7	3,000
Naphthalene	mg/Kg	< 1.3	< 1.4	< 18	< 1.7	4	40	4	40	500	10,000
Phenanthrene	mg/Kg	**28**	**3.2**	< 18	< 1.7	10	1,000	10	500	500	10,000
Pyrene	mg/Kg	**33**	**3.9**	**18**	**4.9**	1,000	3,000	1,000	1,000	1,000	10,000
METALS(6010/7471A)											
Antimony	mg/Kg	**0.72**	< 0.78	**68**	**2.2**	20	30	20	20	20	300
Arsenic	mg/Kg	**3.7**	**5.3**	**17**	**15**	20	20	20	20	20	200
Barium	mg/Kg	**20**	**48**	**1200**	**56**	1,000	3,000	1,000	1,000	1,000	10,000
Beryllium	mg/Kg	**0.34**	**0.45**	**0.59**	**0.71**	100	200	100	100	100	2,000
Cadmium	mg/Kg	< 0.26	**0.51**	**4.3**	**1.6**	2	30	2	2	2	300
Chromium	mg/Kg	**20**	**6.9**	**35**	**150**	30	200	30	30	30	2,000
Lead	mg/Kg	**110**	**46**	**1400**	**160**	300	300	300	300	300	3,000
Mercury	mg/Kg	< 0.14	< 0.16	**5.6**	**1.4**	20	30	20	20	20	300
Nickel	mg/Kg	**5.2**	**6.5**	**38**	**11**	20	700	20	20	20	7,000
Selenium	mg/Kg	< 0.64	**0.97**	**0.99**	< 0.86	400	800	400	400	400	8,000
Silver	mg/Kg	< 0.64 ^	< 0.78 ^	< 0.89 ^	0.88 ^	100	200	100	100	100	2,000
Thallium	mg/Kg	< 1.3	< 1.6	< 1.8	< 1.7	8	60	8	8	8	800
Vanadium	mg/Kg	**14**	**15**	**24**	**38**	600	1,000	600	600	600	10,000
Zinc	mg/Kg	**79**	**100**	**13000**	**360**	2,500	3,000	2,500	2,500	2,500	10,000

Note G:\Projects\31BF201 FX Messina Armstrong Cork Dam Removal\[2012.11.27.TBL.1.Sediment Results Data Summary.xls]Sediment Data

% - percent

mg/Kg - milligrams per kilogram

BOLD analyte detected above reporting limit

BOLD/SHADE analyte detected above reporting limit and RC and/or Method 1 cleanup standard.

* - LCS or LCSD exceeds the control limits

^ - ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC exceeds the control limits.

Loureiro
Engineering • Construction • EH&S • Energy • Waste