US Army Corps
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Buffalo District

Scope of Work

Eighteenmile Creek Sediment Investigation, Upstream of Area of Concern (AOC)

September 2006

SCOPE OF WORK (SOW)

EIGHTEENMILE CREEK SEDIMENT INVESTIGATION UPSTREAM OF AREA OF CONCERN (AOC)

1. INTRODUCTION

a. Location and Setting.

(1) *Area of Concern (AOC)*—The Eighteenmile Creek AOC is located in the lower reach of Eighteenmile Creek near its mouth on Lake Ontario, in the hamlet of Olcott, Niagara County, New York (Figure 1). The creek flows from the south into the lake through Olcott Harbor, about 18 miles east of the Niagara River mouth at Lake Ontario. The AOC was identified by the International Joint Commission (IJC) in 1985, and includes that portion of the creek between Olcott Harbor, upstream to the farthest point at which backwater conditions exist during Lake Ontario's highest monthly average lake level (generally, about 2 miles upstream, just downstream of Burt Dam in Burt, New York) (U.S. Environmental Protection Agency [USEPA] 2001). Just downstream of the dam, an active railroad bridge crosses the creek and two old fruit storage buildings are situated adjacent to the creek on its east bank. Land immediately adjacent to the AOC is comprised of mostly of residential, orchard/grove/vineyard/nursery/ORN, cropland/pasture and commercial uses (County of Niagara 2006). Depending on flows, the creek's width within the AOC varies widely, with maximum depth of about 35 feet in the Burt Dam impoundment. Bottom substrate varies and can be comprised of clay/silt, sand, gravel or shale. Riverine/palustrine wetlands are located in various areas of the creek channel within the AOC. The AOC provides high quality aquatic habitat for both cold and warmwater fish species, and the State-threatened Blanding's turtle (*Emydoidea blandingii*). The AOC attracts over 15,000 anglers annually mainly through fall salmonid runs (Niagara County Soil & Water Conservation District [NCSWCD] 2006).

(2) *Upstream Reach of Eighteenmile Creek*—The upstream reach of Eighteenmile Creek starts at Burt Dam and ends at the Erie Canal (Figure 2). Burt Dam is an unreinforced concrete gravity structure operated by Burt Dam Power Company for the generation of hydroelectric power. The dam is approximately 328 feet long and has a maximum height of 54.5 feet. Normally, the dam holds an impoundment that is up to about 35 feet deep, between about 325 to 400 feet wide, and 8000 feet long (Burt Dam Power Company 1987). It has three operational intakes/reservoir outlets and an ogee spillway. A riverine/palustrine wetlands complex is located just upstream of the dam's impoundment near Ide Road. The abandoned, essentially submerged Newfane Dam is situated about 3 miles upstream of Burt Dam near ____ Road. This dam results in no discernable impoundment. The East Branch and The Gulf confluences are about 4 and 7 miles upstream of the Newfane Dam, respectively. The Erie Canal traverses Eighteenmile Creek in Lockport about 1.5 miles upstream of The Gulf; however, the canal drains into the creek via an outlet. The Flintkote Plant Site (or Williams Street Site), a site currently being investigated by the New York State Department of

Environmental Conservation (NYSDEC) and Niagara County Department of Health (NCDOH), is located within this segment of the creek (NCSWCD 2006). Land adjacent to the creek is comprised of a mixture of residential, orchard/grove/vineyard/nursery /**ORN**, cropland/pasture, deciduous forest, mixed forest, and other urban/built up and industrial uses (County of Niagara 2006). Depending on flows, the creek's width within this reach varies widely and with a maximum depth of about [redacted] feet. Similar to the AOC, bottom substrate varies and can be comprised of clay/silt, sand, gravel or shale.

b. AOC Use Impairments. Three use impairments, and their causes and sources, have been identified for the AOC in a combined Stage 1/2 Remedial Action Plan (RAP) report (NYSDEC 1997):

- *Restrictions on fish and wildlife consumption due to polychlorinated biphenyl (PCB) and dioxin/dibenzofuran (PCDD/F) contamination* - Sources include upstream industrial discharges, inactive hazardous waste sites, contaminated sediments, air deposition and Lake Ontario. In 2005, the New York State Department of Health (NYSDOH) issued a fish consumption advisory for Eighteenmile Creek, recommending that the public eat no fish of any species that is collected from the creek, due to high PCB levels (NYSDOH 2005).
- *Degradation of benthos due to sediment contamination (see sources listed above)* - Sediment contamination (particularly metals) appears to be higher in surface sediments, which results in slight to moderate toxicity and degradation of the benthic community. In addition, benthos bioaccumulate PCBs and PCDD/Fs from the bottom sediments, and serve as vectors for trophic transfer in aquatic food webs.
- *Restrictions on dredging activities due to sediment contamination (see sources listed above)* – The concentration of pollutants such as the following metals: chromium, copper, lead, manganese, nickel, zinc, cyanide and mercury, and the polycyclic aromatic hydrocarbon (PAH) benzo(a)anthracene, preclude the open-lake placement of any sediments dredged just upstream of Olcott Harbor's Entrance Channel.

All of these use impairments are linked to bottom sediment contamination.

c. Contaminants of Concern (COCs) and Sources. The COCs associated with the above use impairments, and their respective perceived sources, are summarized in the following table:

PARAMETER GROUP	COC	POTENTIAL SOURCE(S) LOCATIONS
Organic compounds	PCBs	Flintkote Site; upstream of Burt Dam; Erie Canal; Lockport Sewage Collection System
	Chlorinated pesticides (∑DDT)	Non-point source watershed agriculture; old fruit storage buildings just downstream of Burt Dam
	PCDD/Fs	Erie Canal; possibly Flintkote Site
Heavy metals	Chromium	Upstream of Burt and Newfane Dams; Burt Dam
	Copper	Flintkote Site; between Newfane and Burt Dams; Burt Dam
	Lead	Flintkote Site; The Gulf; Newfane and Burt Dams
	Manganese	
	Mercury	Upstream of Burt and Newfane Dams
	Nickel	Upstream of Burt and Newfane Dams
	Zinc	Erie Canal; The Gulf; Flintkote Site; Burt and Newfane Dams
	Cyanide	

d. Purpose and Need for this Scope of Work (SOW). Existing data on Eighteenmile Creek sediments indicate that most of the sources of contamination are located upstream of the AOC, between Burt Dam and the Erie Canal. Sediment quality data on this reach of the creek are limited. The major sources of sediment contamination are believed to be the Erie Canal, Flintkote Plant Site and City of Lockport Sewage Collection System (USEPA 2002). The Burt and Newfane Dams serve to accumulate contaminated sediments in the creek. Since NYSDEC and NCDOH are currently investigating the segment of creek near the Flintkote Plant Site, this SOW outlines a preliminary plan and cost estimate to sample and analyze sediments relative to all other suspected sources in the upstream reach.

2. SEDIMENT SAMPLING AND ANALYSES

a. Sampling Methodologies. The sediment sampling for this SOW will be accomplished by U.S. Army Corps of Engineers (USACE) personnel due to the uncertainties associated with the planned sediment sampling.

(1) *Sampling Vessel Launching, Mooring and Staging Area*—Facilities for boat launching and mooring will be required for two vessels. Mooring facilities need not exceed 50 feet in total length. A staging area in close proximity to the project site will be required to provide adequate parking area for sediment sampling personnel (and other government agencies) and visitor parking, and the necessary work area and utilities. The staging area will provide parking for a minimum of three passenger vehicles, two pickup trucks with boat trailers, and one 20x20 foot work area. Required utilities will consist of at least one 110V, 30A grounded electrical outlet.

(2) *Sample Collection and Processing*—A combination of core and surface grab sediment samples will be collected for analyses. This sampling protocol is described as follows:

(a) **Core.** Core samples will be collected in order to characterize the chemical contamination of the creek sediments with respect to depth. These samples will be collected using a vessel-mounted vibracore or hand-operated core sampler, depending on the conditions in the creek (primarily water depth, width of the channel and substrate) and available access. A global positioning system (GPS) will be used to locate the sampling locations. The core sampler will be penetrated to known virgin material or refusal, and dissected into two-foot sections from the bottom to top of the sample. The depth elevation, relative to Low Water Datum (LWD), will be recorded for each core sample interval. Material from each of core segment will be homogenized in a stainless steel pan. The following samples will be obtained from this homogenate: (1) a full one quart glass jar of sediment for bulk chemistry; and (2) a full one quart glass jar of sediment for particle size analyses, if required. The GPS coordinates, along with a physical description of the sampling site and sediment samples will be recorded in field notes. A minimum of three photographs will be taken of the sampling site.

It is important to note that it is anticipated that core sample recovery will vary tremendously throughout the reach of Eighteenmile Creek addressed in this SOW. For example, upstream of the old Newfane Dam impoundment and downstream of Burt Dam, core samples may often be less than two to three feet. In contrast, downstream of this dam, particularly within the Burt Dam impoundment, core samples may potentially be up to eight feet or greater. A preliminary linear estimate of total core sample recovery is 116 feet. When assuming that sediment samples will be analyzed from these cores every one to two feet, an average of 2.97 samples will be required to be analyzed per recovered core sample. Therefore, this SOW uses an average of three samples requiring analyses per core sample.

(a) **Surface Grab.** Surface grab samples will be collected for the bioaccumulation testing in order to determine the uptake and bioavailability of select organic contaminants at the benthic level. A Petite Ponar will be used to collect the surface grab samples. A GPS will be used to locate the sampling locations. At each of the sediment sampling sites, at least two surface grab samples will be collected within 10 feet of each other. A minimum of 1.75 gallons of sediment will be collected for the bioaccumulation testing at each site. The material will be placed in a stainless steel bowl and homogenized as a single sample. The following samples will be obtained from this homogenate: (1) a full one gallon polypropylene bucket of sediment for bioaccumulation testing; (2) a full one quart glass jar of sediment for select bulk organic chemistry; (3) a full quart glass jar of sediment for particle size analyses, and; (4) eight ounces of sediment in a 12 ounce glass jar for Quality Assurance testing (QA), if required (see below). The GPS coordinates, along with a physical description of the sampling site and sediment samples, will be recorded in field notes. A minimum of three photographs will be taken of the sampling site.

All samples will be labeled with the location, sample type, required analyses and date, and immediately placed on ice in a 48-quart cooler at 4±2°C for shipment to the analytical laboratory. The samples will be maintained under such conditions until they are processed for analyses.

(3) *QA Samples*—At least eight ounces of additional sediment from four sites (see below) will be contained in separately labeled (with the location, sample type, date, and designated "QA Sample for [analyte]") glass jars for QA testing purposes.

b. Sample Sites and Analyses.

(1) *Sampling Limits*—This SOW is limited to the reach of Eighteenmile Creek situated upstream of the AOC, between Burt Dam and the Erie Canal (see Figure 2). This SOW focuses on this reach of the creek based on the following information and factors:

(a) **Eighteenmile Creek Sediment Quality Data**. In 1994, NYSDEC (2006) showed levels of chromium, copper and lead that exceed 10x the severe effect levels (SELs) (see NYSDEC 1999), and cadmium, nickel and zinc concentrations that exceed the SEL at the sites upstream of both Burt and Newfane Dams. In addition, PCDD/F TEQs and ∑4,4'-dichlorodiphenyldichloroethane (DDT) concentrations at these two sites exceeded the wildlife bioaccumulation criteria (NYSDEC 1999), and PCB levels exceeded the SEL and PEL at the sites upstream of the Burt and Newfane Dams, respectively. Further evaluation of this reach by NYSDEC in 1999 (NYSDEC 2006) suggested that the Flintkote Site, The Gulf (a tributary that feeds into Eighteenmile Creek near Lockport) and Erie Canal were significant upstream sources of contamination (the East Branch and areas upstream of the Erie Canal suggested that they were not major sources). The SELs (and at times 10xSELs) for cadmium, chromium, copper, lead, mercury, nickel, silver and zinc were exceeded at sites upstream of both the Newfane and Burt Dams. The SELs for copper, lead, silver and mercury were also exceeded at the Flintkote site. Lead and zinc concentrations at The Gulf and Erie Canal sites exceeded

the SELs. Radiometric dating indicates that the highest metal concentrations upstream of both dams date from the 1950s and 1960s (NYSDEC 2006). With respect to organics, PCDD/F TEQs at the sites upstream of the Newfane and Burt Dams, and Flintkote and Erie Canal all exceeded the wildlife bioaccumulation criteria. In addition, high levels of PCBs (i.e., about 25 mg/kg) were found upstream of Burt Dam and downstream of the Flintkote Site, and ∑DDT exceeded the lowest effect level (LEL) upstream of Burt Dam (NYSDEC 2006). Total PAHs levels upstream of Burt Dam, near the Burt Dam and Flintkote Site and The Gulf ranged from 13.3 to 24.1. However, total PAH levels in the Erie Canal and upstream of the Erie Canal were higher, ranging from 25.6 to 29.8 mg/kg (NYSDEC 2006).

(b) **AOC Sediment Quality Data.** Preliminary findings of USACE (2006) show high levels of lead, zinc (both exceeding the Severe Effect Level [SEL] threshold [NYSDEC 1999]) and chromium (exceeding the Probable Effect Level [PEL]), at the base of Burt Dam, suggesting upstream sources. This investigation also indicated upstream sources of PCBs, 4,4'-dichlorodiphenyldichloroethylene (DDE]) (a metabolite of DDT) (and ∑DDT) and PCDD/Fs. Both PCBs and DDE were very bioavailable in sediments at the base of the dam, and the PCB concentration was almost two times the equilibrium partitioning (EqP)-based sediment criteria for wildlife bioaccumulation (NYSDEC 1999). Regarding PCDD/Fs, sediments at this site yielded the highest toxic equivalent (TEQ) in the investigation (16 pg/g), which was 1.7 fold the wildlife bioaccumulation criteria.

(c) **Burt and Newfane Dams.** These dams upstream of the AOC in Eighteenmile Creek serve to detain or accrue contaminated sediments on their upstream side, and also eventually release some of these contaminated sediments downstream toward the AOC. In this way, they have incidentally become "subsidiary sources" of sediment contamination.

Based on the above information, the weight-of-the-evidence indicates that there are significant sources of contamination upstream of Burt Dam, including the Flintkote Site, The Gulf, Erie Canal at Lockport and agricultural runoff. All are suspected of contributing to sediment contamination within the AOC, therefore adversely influencing the designated use impairments. The downstream migration of contaminated sediments associated with these sources has been affected by the two dams, since they have developed into secondary sources of sediment contamination to the AOC and Lake Ontario.

(2) *Sample Locations and Analyses*

(a) **Sampling Sites.** The sampling sites for this SOW were located based on the following criteria:

- Historic sediment quality surveys (mainly NYSDEC 2006 [two surveys] and USACE 2006);

- Data gaps;
- Perceived primary and subsidiary sources of COCs;
- Sediment depositional or amassing areas in the creek; and
- Assessed need for bioaccumulation data.

The sediment sampling sites under this SOW are shown in Figures 2 and 3. Table 2 includes the latitude and longitude of each site location.

(b) **Analyses.** Table 2 specifies the type of sample to be collected at each location and the required sediment testing with supporting rationale. All sediment testing will be completed by a USACE contractor. A brief summary of the sediment analyses is as follows:

- Bulk Chemistry—These analyses will be performed on both core and surface sediment samples to characterize the contamination in the sediments. Core sample chemistry will be used to assess contamination in the sediments with respect to depth, and surface grab chemistry will be used to determine the levels of contaminants to which the aquatic community is exposed. All sediment contaminant concentrations will be reported on a dry weight basis and will be required to conform to specified laboratory reporting limits (LRLs). The specific analytical parameters and methods are included in Table 3.

- Bioaccumulation of Organic Contaminants—The standard bioaccumulation test for select organic contaminants using the aquatic earthworm *Lumbriculus variegatus* will be applied to the surface sediment samples according to the protocol contained in the Great Lakes Dredged Material Testing and Evaluation Manual (USEPA/USACE 1998). Worm masses will be exposed to sediment samples contained in aquaria equipped with an intermittent flow system for overlying water renewal to maintain adequate exposure conditions. Five replicate exposures will be run per treatment (sediment sample) over a period of 28 days. Each tissue replicate will be analyzed for select organic contaminants and lipid. A sediment sample obtained from the composite will be analyzed for the same organic contaminant(s) measured in the tissues, and total organic carbon (TOC). All sediment and tissue parameter concentrations will be reported on a dry and wet weight basis, respectively, and will be required to conform to specified LRLs. The specified organic parameters and analytical methods are included in Table 3.

(3) *QA Testing*—Each sample specified below will be shipped to a separate analytical laboratory for bulk sediment testing.

(a) **Metals.** An eight-ounce sample of sediment from Site EMU-21 (core sample) will be contained in a 12-ounce glass jar and subjected to metals QA testing.

(b) **PCBs.** An eight-ounce sample of sediment from Site EMU-20 (core sample) will be contained in a 12-ounce glass jar and subjected to PCB QA testing.

(c) **DDT/DDE/DDD.** An eight-ounce sample of sediment from Site EMU-18 (core sample) will be contained in a 12-ounce glass jar and subjected to DDT/DDE/DDD QA testing.

(d) **PCDD/Fs.** An eight-ounce sample of sediment from Site EMU-10 (core sample) will be contained in a 12-ounce glass jar and subjected to PCDD/F QA testing.

(4) At each sampling site, a single "representative" sub-sample from each core sample will be contained in a separate 32-ounce glass jar for particle size analyses.

c. Issues/Contingency Plans. The notable uncertainties associated with the SOW are gaining access to the sampling sites and sediment core recoveries, such that the sediment obtained samples are representative. For example, some of the sediment sampling sites between the Newfane and Burt Dams may be accessible to a vessel-mounted vibracore sampler, while other sites in the more upstream reach of the creek may be obtainable only by a hand-driven core sampler. In order to address such contingencies, an additional 15 man/days of USACE labor is being included as a contingency to allow for additional field reconnaissance and work.

3. REPORTING

Data generated as a result of this SOW will be reported in two phases as follows:

a. Analytical Data. Draft and final versions of the analytical report (report) will be required from the sediment testing contractor. The report will contain project information and summary of the sampling effort, sampling figures and photographs, field notes, test methods, summary tables of the test results, and the actual laboratory reports. The draft report will be submitted to the USACE and other entities for technical review, and all comments will be resolved prior to the finalization of the report. After approval, five copies of the final report, and an electronic version in Adobe (PDF) format, will be furnished to the USACE. In addition, a copy of all generated data in summary tables will be required on a separate diskette.

b. Sediment Investigation. Following the receipt of the final report from the testing contractor, a sediment quality assessment in the form of a sediment investigation report will be completed by USACE personnel to interpret the data contained in the analytical report. This report will be presented in the general form of a scientific manuscript with the following Chapters: (1) Summary; (2) Materials and Methods; (3) Results and Discussion; (4) Conclusion; and (5) Literature Cited.

4. COST ESTIMATE

Table 3 summarizes a preliminary cost estimate for this SOW. The total cost is estimated at $507,585 ($519,585 when including a USACE labor contingency).

5. REFERENCES

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USEPA. 2001. *Great Lakes Eighteenmile Creek AOC.* http://www.epa.gov/glnpo/aoc/eighteenmile.html

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FIGURE 1. Eighteenmile Creek Great Lakes AOC.

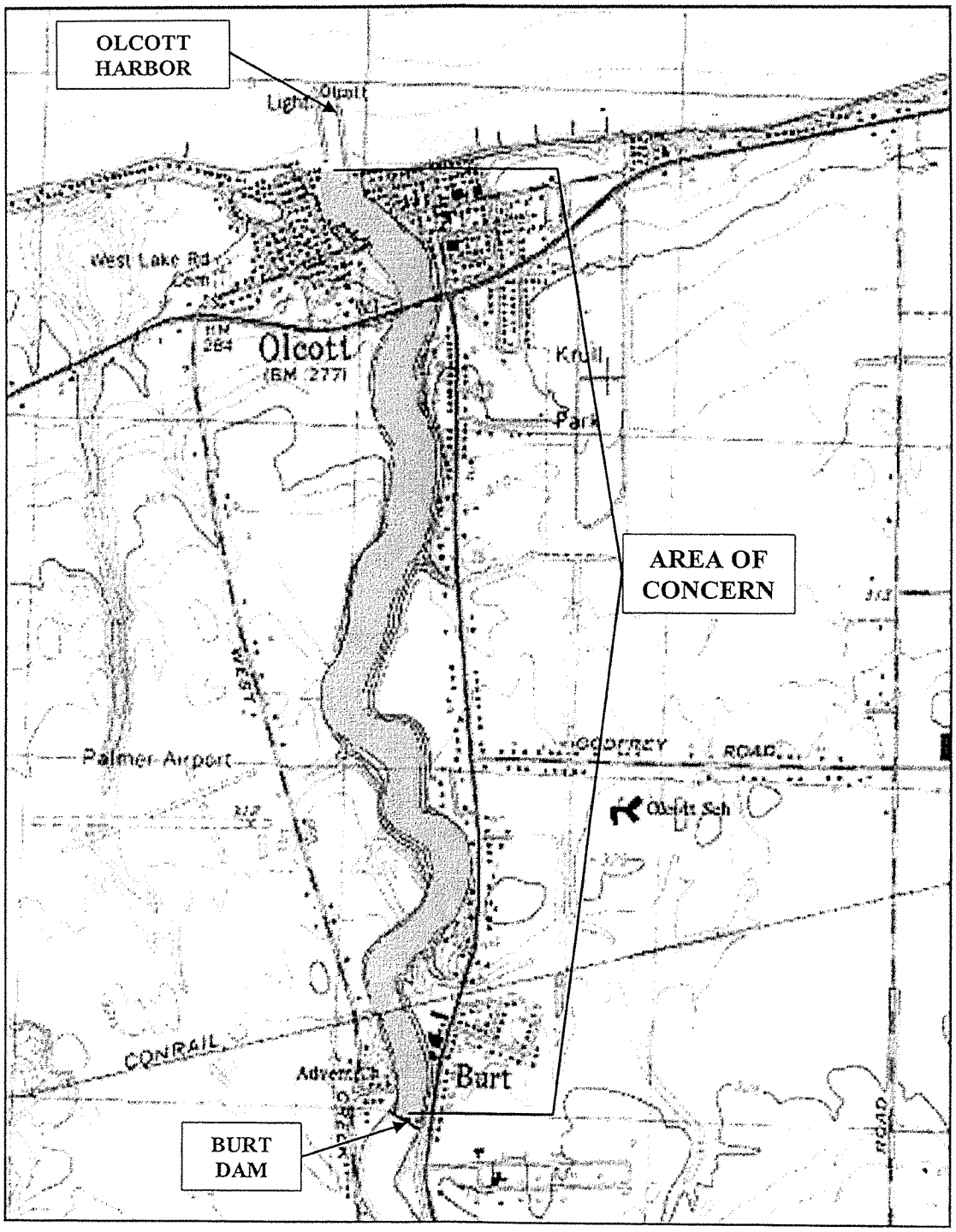

FIGURE 2. Sediment sampling sites in Eighteenmile Creek between Burt Dam in Burt and Jacques Road in Corwin, New York.

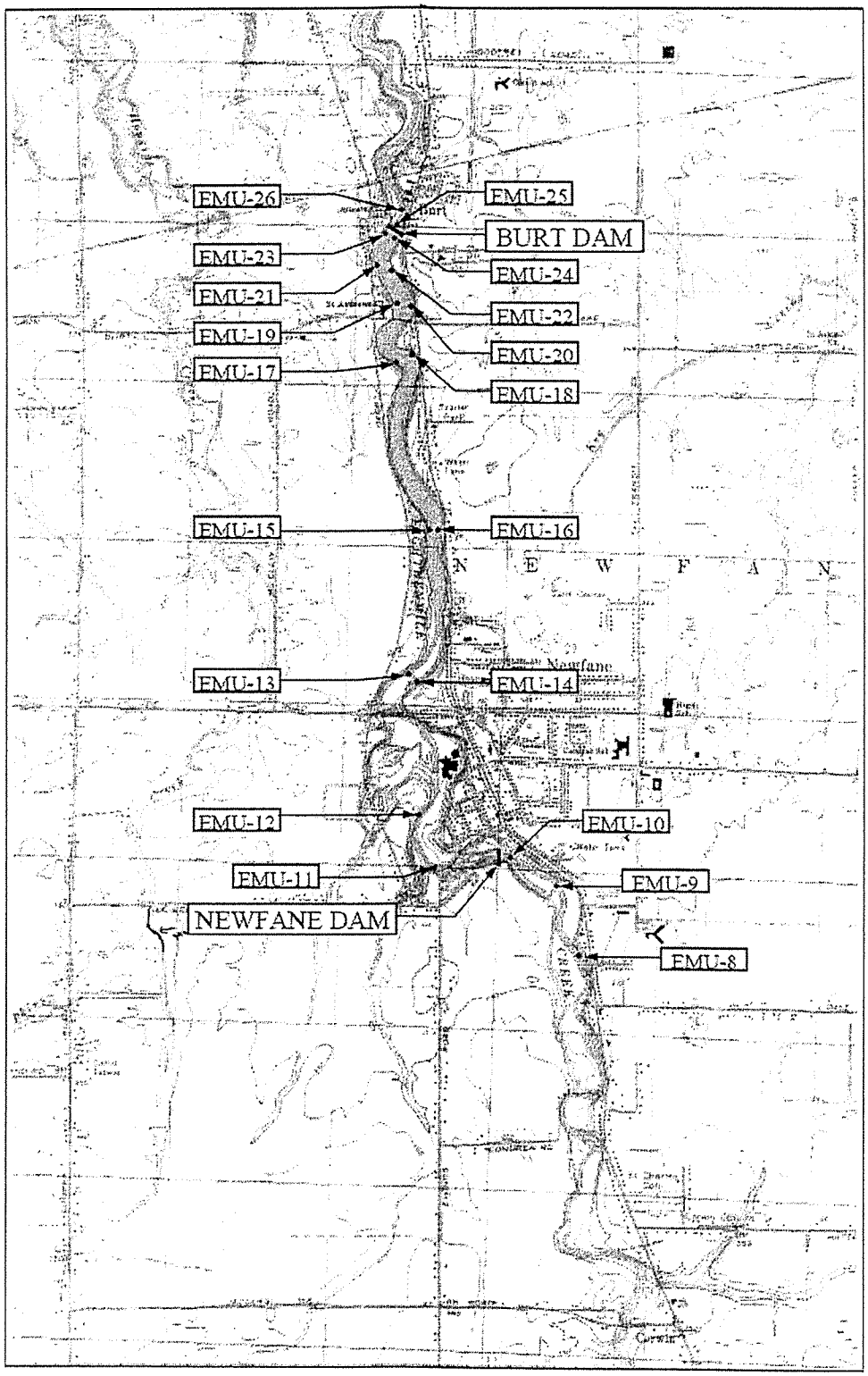

FIGURE 3. Sediment sampling sites is Eighteenmile Creek, between Jacques Road in Corwin to the Erie Canal at Lockport, New York.

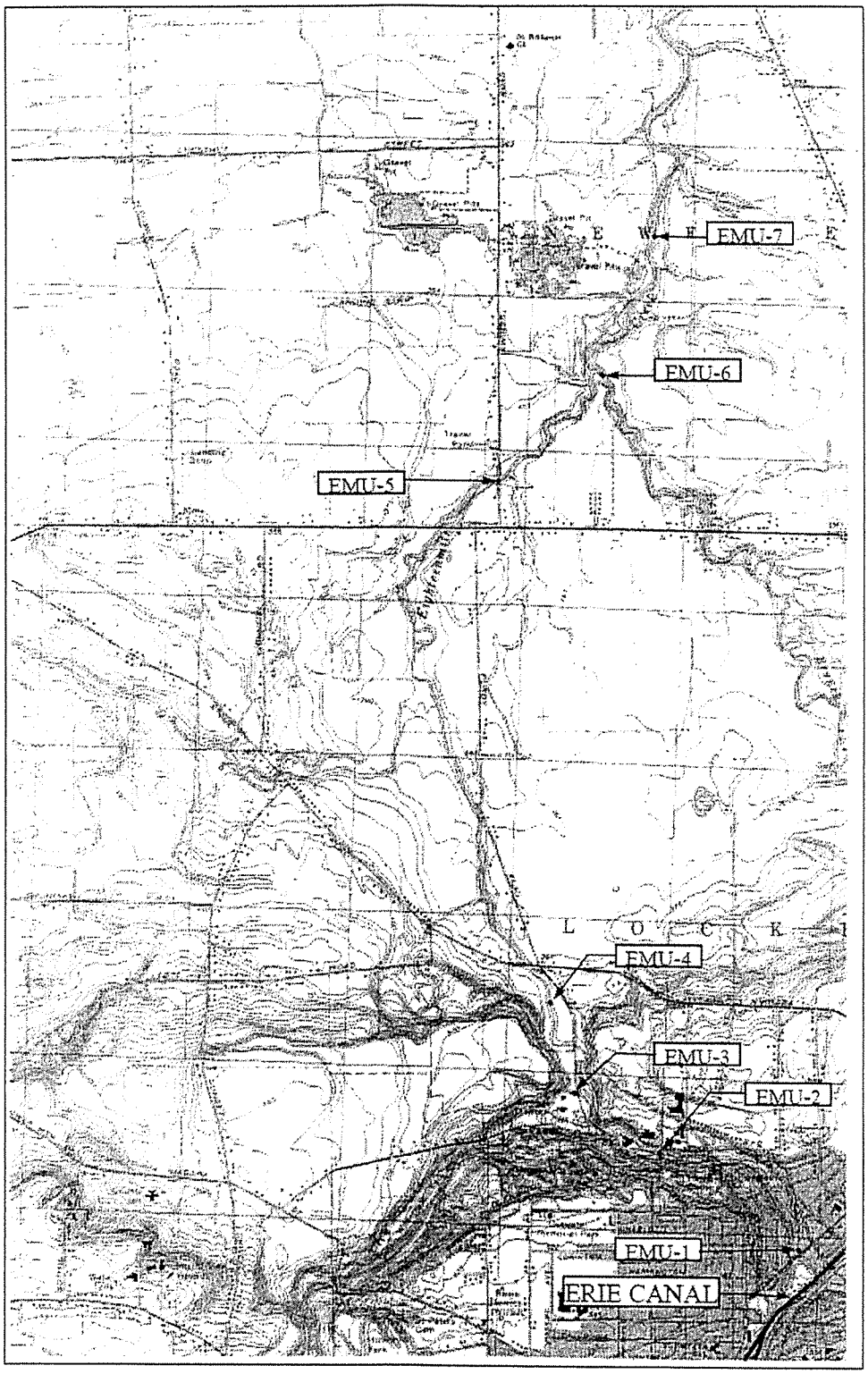

TABLE 1. Identification and description of site locations and analytes for sediment samples collected from Eighteenmile Creek, upstream of the AOC. Note that a single "representative" sub-sample from each core sample will be subjected to particle size analyses.

Site	Latitude/Longitude	Type	Testing	Rationale
EMU-1 (Creek near Canal confluence)		Core and surface	•Sediment - Metals, TOC, PCDD/Fs and PCBs •Bioaccumulation - PCDD/Fs and PCBs	Characterize sediment contamination to further evaluate source input; assess bioaccumulation of PCDD/Fs (high levels) and PCBs (low to moderate levels); no core sample has been collected at this site to date
EMU-2 (upstream Flintkote)		Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize upstream site sediment contamination
EMU-3 (The Gulf near Creek confluence)		Core	•Sediment - Metals and TOC	Characterize source input; compare to Flintkote sediment metals data to evaluate source input; no core sample has been collected in this tributary to date
EMU-4 (Creek one-half mile downstream of The Gulf confluence)		Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize downstream site sediment contamination to evaluate source input and decipher between The Gulf, Flintkote Site and Erie Canal sources; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT; no core sample has been collected at this site to date
EMU-5 (Creek three-quarter mile upstream of East Branch confluence)		Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from The Gulf, Flintkote Site and Erie Canal sources; no core sample has been collected at this site to date
EMU-6 (East Branch near mouth at Creek)		Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess historic sediment quality near mouth of East Branch; no core sample has been collected at this site to date

EMU-7 (Creek three-quarter mile downstream of East Branch confluence)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from The Gulf, Flintkote Site and Erie Canal sources; substantiate that East Branch is not a significant source of contaminated sediments; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT, and compare to bioaccumulation data on Site EMU-4; no core sample has been collected at this site to date
EMU-8 (Creek just upstream of old Newfane Dam reservoir, one-half mile upstream of the dam)	Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from The Gulf, Flintkote Site and Erie Canal sources; determine contamination intercepted by the dam and assess as a subsidiary source to the AOC; confirm relatively low total PCB levels and high mercury levels
EMU-9 (Creek in old Newfane Dam reservoir, one-quarter mile upstream of the dam)	Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from The Gulf, Flintkote Site and Erie Canal sources; determine contamination intercepted by the dam and assess as a subsidiary source to the AOC; confirm relatively low total PCB levels and high mercury levels
EMU-10 (Creek in old Newfane Dam reservoir, just upstream of the dam)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs	Characterize site sediment contamination to assess downstream migration of contaminated sediments from The Gulf, Flintkote Site and Erie Canal sources; determine contamination intercepted and closest to the dam and assess as a subsidiary source to the AOC; assess bioaccumulation of PCDD/Fs (high levels); confirm relatively low total PCB levels and high mercury levels

EMU-11 (Creek one-quarter mile downstream of old Newfane Dam)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs	Characterize site sediment contamination to assess downstream migration of contaminated sediments from The Gulf, Flintkote Site and Erie Canal sources past the old Newfane Dam; assess downstream migration of mercury contamination; assess bioaccumulation of PCDD/Fs and compare to Site EMU-10; no core sample has been collected at this site to date
EMU-12 (Creek one-half mile downstream of old Newfane Dam)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from The Gulf, Flintkote Site and Erie Canal sources past the old Newfane Dam; assess downstream migration of mercury contamination; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT; no core sample has been collected at this site to date
EMU-13 (Creek in wetlands just upstream of Burt Dam reservoir, west side)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from The Gulf, Flintkote Site and Erie Canal sources past the old Newfane Dam; assess downstream migration of mercury contamination into wetlands; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT in wetlands; no core sample has been collected at this site to date
EMU-14 (Creek in wetlands just upstream of Burt Dam reservoir, east side)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from The Gulf, Flintkote Site and Erie Canal sources past the old Newfane Dam; assess downstream migration of mercury contamination into wetlands; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT in wetlands; no core sample has been collected at this site to date

EMU-15 (Creek in Burt Dam reservoir one and one-quarter mile upstream of the dam, west side)	Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from old Newfane Dam and trapped by Burt Dam; assess as a subsidiary source to the AOC; no core sample has been collected at this site to date
EMU-16 (Creek in Burt Dam reservoir one and one-quarter mile upstream of the dam, east side)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from old Newfane Dam and trapped by Burt Dam; assess as a subsidiary source to the AOC; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT from reservoir sediments; no core sample has been collected at this site to date
EMU-17 (Creek in Burt Dam reservoir one-half mile upstream of the dam, west side)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments trapped by Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT, and assess as a subsidiary source to the AOC; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT from reservoir sediments; no core sample has been collected at this site to date
EMU-18 (Creek in Burt Dam reservoir one-half mile upstream of the dam, east side)	Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments trapped by Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT, and assess as a subsidiary source to the AOC; no core sample has been collected at this site to date
EMU-19 (Creek in Burt Dam reservoir one-quarter mile upstream of the dam, west side)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments trapped by Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT, and assess as a subsidiary source to the AOC; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT from reservoir sediments; no core sample has been collected at this site to date

EMU-20 (Creek in Burt Dam reservoir one-quarter mile upstream of the dam, east side)	Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments trapped by Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT, and assess as a subsidiary source to the AOC; no core sample has been collected at this site to date
EMU-21 (Creek in Burt Dam reservoir one-eighth mile upstream of the dam, west side)	Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments trapped by Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT, and assess as a subsidiary source to the AOC; no core sample has been collected at this site to date
EMU-22 (Creek in Burt Dam reservoir one-eighth mile upstream of the dam, east side)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments trapped by Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT, and assess as a subsidiary source to the AOC; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT from reservoir sediments; no core sample has been collected at this site to date
EMU-23 (Creek in Burt Dam reservoir just upstream of the dam, west side)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments trapped by Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT, and assess as a subsidiary source to the AOC; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT from reservoir sediments; no core sample has been collected at this site to date
EMU-24 (Creek in Burt Dam reservoir just upstream of the dam, east side)	Core	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments trapped by Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT, and assess as a subsidiary source to the AOC; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT from reservoir sediments; no core sample has been collected at this site to date

EMU-25 (Creek in Burt Dam reservoir just downstream of the dam)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT, and assess as a tertiary source to the AOC; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT just downstream of the dam; no core sample has been collected at this site to date
EMU-26 (Creek in Burt Dam reservoir one eight mile downstream of the dam)	Core and surface	•Sediment - Metals, TOC, PCDD/Fs, PCBs and ∑DDT •Bioaccumulation - PCDD/Fs, PCBs and ∑DDT	Characterize site sediment contamination to assess downstream migration of contaminated sediments from Burt Dam; assess high levels of various metals, PCDD/Fs, PCBs and ∑DDT and assess as a tertiary source to the AOC; assess bioaccumulation of PCDD/Fs, PCBs and ∑DDT just downstream of the dam; no core sample has been collected at this site to date

TABLE 2 (Continued).

Item Description/ Method	Unit	Cost/unit ($)	Required Laboratory Reporting Limit (dry weight)	Number of Units	Cost ($)
L. variegatus tissue/sediment pesticides analyses – Method 8180A	Each	125	Tissue – 2 to 5 µg/kg Sediment – See above	5x13 1x13	9,750
L. variegatus tissue lipid analyses	Each	66		5x16	5,280
TOC – Method 9060	Each	65	250 (%)	3x26 1x16	10,400
QA Sediment samples					
Metals (TAL)	Each	210	0.050	1x210	210
PCBs (209 congeners, A-DRBC List)	Each	990	0.005	1x990	990
PCDD/Fs	Each	890	2 pg/g	1x890	890
Pesticides	Each	125	0.005 mg/kg	1x125	125
PROJECT MANAGEMENT, SUPERVISION/ADMINISTRATION, CONTRACTING AND REPORTING					
Labor ("Level 1")	Hour	70	-	24	1,680
Labor ("Level 2")	Hour	55	-	56	3,080
Labor (Technician)	Hour	40	-	48	1,920
Reproduction	Page	0.15	-	4000	600
Contracting (in-house labor)	Hour	100	-	10	1,000
Contract execution/oversight (in-house labor)	Hour	100	-	160	16,000
Data interpretation and sediment quality assessment report (in-house labor)	Hour	100	-	240	24,000
Project Management	Hour	80	-	240	19,200
Supervision/administration	Hour	120	-	80	9,600
TOTAL COST ESTIMATE ($)					507,585 (519,585 with labor contingency]

TABLE 2. Preliminary cost estimate for the sediment sampling and analyses outlined in this SOW. This estimate assumes: (1) a total of 26 core samples with three discrete sub-samples per core sample, regardless of length (3 to 9 feet); (2) bioaccumulation testing on composite surface sediment samples collected from 16 of the 26 sites; (3) particle size analyses will be performed on a single, representative sample from each of the 26 sampling sites, as well as each of the 16 samples to be subjected to bioaccumulation testing.

Item Description/ Method	Unit	Cost/unit ($)	Required Laboratory Reporting Limit (dry weight)	Number of Units	Cost ($)
SEDIMENT SAMPLING					
Labor (USACE)	Day	800	-	3x10	24,600
Labor contingency	Day	800	-	3x5	12,000
Vibracore sampler (USEPA Mudpuppy)	Week	No cost	-	-	0
Lexan core tubes	Foot	8	-	10x20	1,600
Overnight shipment of coolers	Each	100	-	12	1,200
Supplies/equipment (ice, jars, buckets, tools, camera, etc.)	Lump sum	-	-	-	1,500
SEDIMENT ANALYSES					
Particle size/hydrometer – ASTM Procedure D422	Each	120	-	26 14	4,800
Metals (TAL) – Method 6010B (7000 Series 7471 for mercury)	Each	210	0.050 mg/kg Mercury – 0.025	3x26	16,380
PCBs (209 congeners, A-DRBC List)	Each	990	0.005 mg/kg	3x25	74,250
Pesticides – Method 8081A (for ∑DDT)	Each	125	0.005 mg/kg	3x24	8,250
PCDD/Fs – Method 8290	Each	890	0.000002 (2 pg/g)	3x23	64,080
28-Day *L. variegatus* bioaccumulation test	Each	2,350	-	16	37,600
L. variegatus tissue/sediment PCDD/Fs analyses – Method 8290	Each	890	Tissue – 2 pg/g Sediment – See above	5x16 1x16	85,440
L. variegatus tissue/sediment PCB analyses - 209 Congeners, A-DRBC List	Each	990	Tissue – 1 to 2 µg/kg Sediment – See above	5x14 1x14	83,160