Hog Island Inlet Study 2011
Wisconsin Department of Natural Resources

Project CAP_1_2011

February 2012

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EXECUTIVE SUMMARY

Hog Island is located within the St. Louis River Area of Concern, Douglas County, Wisconsin. Hog Island Inlet/Newton Creek Segment L was the first Great Lakes Legacy Act project remediated, completed in 2005. Post-remediation sampling in 2006 indicated benthic populations in these areas were much diminished due to the removal of organic material during remediation the year before.

The objective of this study was to observe the current status of macroinvertebrate populations in the Inlet. Core samples were taken at or near the same sites and in the same manner as sampled in previous site investigations. Kurt Schmude, Lake Superior Research Institute, identified macroinvertebrates in the cores and prepared a report comparing 2011 sampling results to previous samplings.

A second objective was to sample Hog Island isthmus sediments for more information that would inform future habitat restoration efforts, as well as site safety and health concerns about petroleum product contamination. The isthmus was not in the remediation area in 2005. Sheens and petroleum odors in places along the isthmus have been noted by habitat restoration workers. The remediation goal of 2.6 mg/Kg total polynuclear aromatic hydrocarbons (TPAH) was the benchmark for PAH analyses at the isthmus. Laboratory analyses of diesel range organics (DRO) and PAHs were utilized with air screening readings to approximate sediment contaminant levels on the isthmus.

The results of this study suggest that the benthic macroinvertebrate community in the Hog Island Inlet is recovering as a natural sediment base is re-built since the remediation stripped the area to clay. There is no way of knowing how long this natural process will take.

Some areas on the northwestern side of the isthmus do appear to be impacted by petroleum hydrocarbons. The results of this study show that the sediment concentrations of TPAHs in the isthmus (which was not within the area remediated) are within the range of the 2005 remedial goals. Care should be taken while working in these areas to avoid direct skin contact with petroleum contaminated sediments or inhalation of vapors.

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INTRODUCTION

The Hog Island Inlet is part of the St. Louis River Area of Concern and is identified as one of the known contaminated sites in the Remedial Action Plan, Stage One (1992). Hog Island itself was created by deposition of navigation channel dredge materials in the 1920s and 1930s, the isthmus was most likely created at a later date. The tributary to the Hog Island Inlet, Newton Creek, was determined to be contaminated with petroleum products in the early 1990's. Newton Creek (WDNR, 1995) was subcategorized into 12 segments (A-L), with Segment A being the most upstream segment of the creek (downstream from the Murphy Oil impoundment area). Cleanup of Newton Creek focused on the impoundment area and Segments A through K, beginning in 1997.

An Ecological Risk Assessment and a Human Health Risk Assessment were completed in September 2003, prior to remediation of Hog Island Inlet/Newton Creek Segment L. The Ecological Risk Assessment concluded that the ecological risk associated with contaminated sediments was high. Dry weight concentrations of total polynuclear aromatic hydrocarbons (TPAH) showed good correlation to toxicity test results. The concentration threshold for TPAHs associated with no- or lowest-observed effects was in the 2,000 to 3,000 ug/kg range. The Human Health Risk Assessment concluded that non-carcinogenic hazards at Hog Island Inlet were within acceptable ranges for both adults and adolescents engaging in recreational activities. The carcinogenic risk associated with swimming was slightly elevated for both adults and adolescents, but within acceptable limits for wading, shore use and fish consumption.

Dredging removed 60,520 tons of contaminated sediment from Newton Creek Segment L and approximately 15 acres of the Inlet in 2005 to meet a site remediation goal of 2,600 ug/KG (2.6 mg/Kg) TPAH. Lead above 50 mg/Kg was considered a secondary contaminant as it was co-located in a smaller area than the TPAH. Confirmation sampling of inlet sediments and Newton Creek for PAH analyses was carried out in 2005 after remediation was completed. The results showed that the target TPAH concentration goal of 2,600 ug/Kg was met (SEH, 2006).

The post-remediation monitoring, in June, 2006, included sediment traps and Hess stream bottom sampling in Newton Creek (Segments A, B, D, F, G, and L) and sediment core samples at three previously sampled locations within Hog Island Inlet and the previous background location. Sediment contaminant analyses indicated that the remediation goals had been met. The Inlet and Segment L toxicity studies indicated no significant reduction of survival to organisms exposed to post-remediation sediments. Benthic populations along upper reaches of Newton Creek showed potentially increased diversity, indicating a positive step toward improved environmental quality (it was noted that one year may not have been enough time post-remediation to re-establish an adequate organic sediment bed habitat in the inlet). Benthic populations in Hog Island Inlet and Newton Creek Segment L were much diminished due to the removal of organic material during remediation the year before.

Douglas County received a habitat restoration grant from the Great Lakes Commission for Hog Island/Newton Creek, in 2009. The grant project work plan includes invasive species control, establishment and maintenance of a buffer zone, aquatic habitat structures and restoration of submerged aquatic vegetation among other activities.

The objective of this study was to observe the current status of macroinvertebrate populations in the Inlet. Core samples were taken at or near the same sites and in the same manner as sampled previously (SEH, 2006). Taxa richess and total densities were compared to the 2006 post-remediation sampling. The ideal situation would be that the benthic macroinvertebrate population is recovering post-remediation, while habitat restoration is occurring.

A second objective was to sample Hog Island isthmus sediments for more information that would inform future habitat restoration efforts as well as site safety and health concerns. Sheens and petroleum odors have been noted by along the northwestern side of the isthmus by habitat restoration workers. The remediation goal of 2,600 ug/Kg (2.6 mg/Kg) TPAH was the benchmark for PAH analyses at the isthmus. Laboratory analyses of diesel range organics (DRO) and PAHs were utilized with air screening readings to approximate contaminant levels on the isthmus. This information will be utilized by the WDNR, Douglas County and other site workers for safety and health considerations. The DRO chromatograms will allow a qualitative estimate of the relative concentrations of DRO and natural biodegradation products that may be measured during the DRO analyses.

STUDY AREA

The project site is Hog Island Inlet, within the St. Louis River, northeast of Superior, Wisconsin, immediately west of the Superior inlet on Lake Superior. Douglas County is the land owner. Hog Island Inlet is bordered by Ogdensburg Pier, Hog Island, the Hog Island isthmus wetland, and the mainland shore. Hog Island is undeveloped. The Ogdensburg Pier was previously developed as a coal storage area and petroleum depot but is currently vacant. Railroad tracks lie along the southwest side of the Inlet. State Highway 2 runs parallel to the railroad tracks and mainland shore at higher elevations. Figure 1 shows the location of the Hog Island Inlet.

The Inlet is a sheltered bay wetland connected to Superior Bay by a 50-foot wide channel. The post-remediation depths range from one to seven feet. It receives water from Newton Creek and all floodplain, overflow areas and wetlands associated with the Creek. Newton Creek enters the Inlet from the west, winding 1.5 miles from the Murphy Oil refinery through forested wetlands and residential areas before entering the Inlet. The Creek and inlet also receive storm water through overland flow and storm water outfalls. The inlet is approximately 17-acres, and is separated from the adjacent Loon's Foot Landing, on the east, by a narrow isthmus, which is covered by wetlands. Hog Island, rising approximately 15 feet above the water on the east side of the inlet, was created by the disposal of navigation channel dredged sediment in the 1920s and 1930s. The isthmus

appears in historical aerial photos in the 1960s, but the origin of the isthmus sediments is unknown at this time.

Surficial soils in the vicinity of the area consist of Ontonagon silty clay loam and Rudyard-Bergland clay soils. These are moderately well drained to poorly drained soils formed in clayey lacustrine deposits. Surficial soils in the vicinity of the site are underlain by a thick sequence of glacial till and offshore lacustrine soils belonging to the Miller Creek Formation.

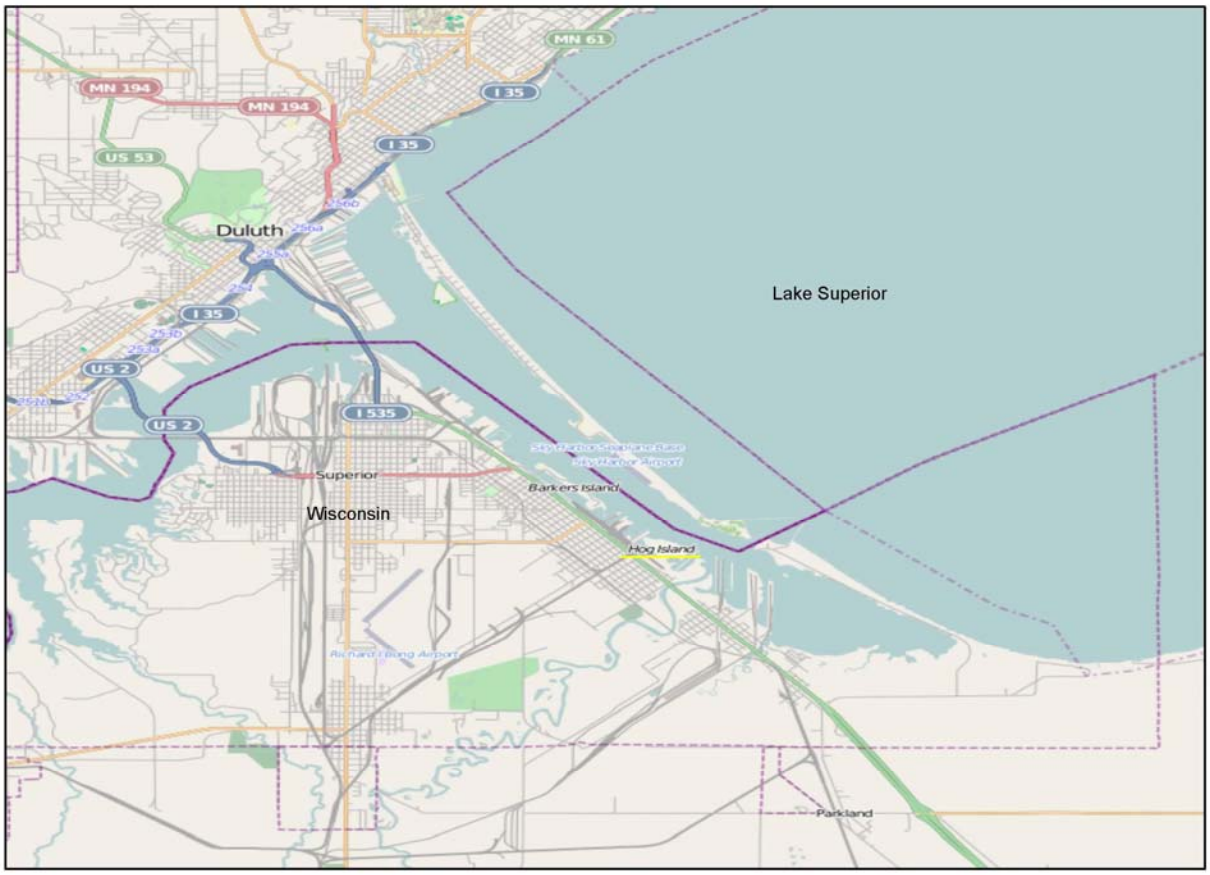

Figure 1 Site Location

METHODS

Macroinvertebrate samples were taken by Lake Superior Research Institute with WDNR staff. Sediment samples on the isthmus were taken by WDNR staff. For more details on the study design see the Quality Assurance Project Plan (QAPP, Benthic Macroinvertebrate Monitoring, May, 2011).

FIELD

Macroinvertebrate cores

Five replicate cores were taken in each of three Hog Island Inlet locations from a boat, and one background location, as sampled in 2006. Cores were taken to 20 cm with a piston corer. See Figure 2.

Sediment Samples on the Isthmus

Sediment samples from three locations on the isthmus, and the background location, were taken with a dedicated stainless steel scoop for laboratory analyses of PAH, total organic carbon (TOC) and lead. The vegetative matter was removed and the top six inches of sediment was homogenized in a dedicated stainless steel bowl and collected in enough volume for the required sample containers. See Figure 2.

A dedicated plastic syringe (30 mL) was used to collect sediment for DRO analyses from the homogenized sample. The syringe contents were immediately placed in a tared 60-mL VOC vial supplied by PACE, three vials per sample. The same syringe was used to fill a container for dry weight analysis.

The intent of the project was to utilize a photoionization detector (PID) for air readings and headspace readings of sediment samples in order to select locations for laboratory samples. The day that sampling occurred, however, the power plug for the PID was lost in the field, making it impossible to take PID readings that day.

The sample locations were, therefore, chosen based on visible sheens and petroleum-like odors. When the power plug replacement was received, the PID was deployed a second day. The PID was used to check air and headspace readings at the previously sampled locations on an 80F day. Ambient air readings were taken at the water surface upon disturbance of the sediment. Air readings were also taken at various surrounding locations, the Loons Foot Landing parking lot and the rail trail.

Photo-ionization Detector

A portable Thermo OVM 580B, which detects and quantitates most volatile organic vapors with a photoionization detector (PID), was used for readings in air and sediment head space. The unit, utilizing a 10.6 eV lamp, was calibrated to an isobutylene standard in the WDNR office. A PID does not identify the volatile component in the air being sampled, but rather responds to the overall amount of volatile organic components ionized by the lamp. Several different volatile components may be ionized at once and contribute differently to the overall reading based on their individual response factors.

Notes: HI and WL-2 = Macroinvertebrate samples
IM-SD and WL-2 = Sediment and sediment headspace samples
1-7 = Air samples

Figure 2 Hog Island Inlet Samples Locations, 2011

LABORATORY

Macroinvertebrate samples were preserved in the field and taken to the Lake Superior Research Institute. Sediment samples were shipped, on ice, by overnight commercial carrier to the appropriate laboratory.

LSRI – Macroinvertebrate

Each core was analyzed in entirety. Identification of specimens was taken to the lowest practical taxonomic level. A report, "Analysis of Macroinvertebrate Samples Collected From Hog Island Inlet Area, Superior, WI: June 24, 2011", was provided by Kurt Schmude. See Appendix A.

WSLOH – Total Organic Carbon, Lead, PAHs

Analytical - Total Organic Carbon (TOC) was analyzed by the Wisconsin State Lab of Hygiene according to ESS Org Method 1560. Lead was analyzed according to EHD Metal Method 400.2 (Sample preparation EHD Metals Method 100.1, and digestion by EHD Metals Method 750.1).

Polynuclear aromatic hydrocarbons (PAHs) were analyzed according to Wisconsin State Lab of Hygiene ESS Org Method 1580 for a list of 20 PAHs.

PACE – Diesel Range Organics

Samples were analyzed for DRO by PACE Analytical Services, Green Bay, WI, according to SOP S-GB-0-019-Rev.03. The method is a solvent extraction, gas chromatography procedure. Detection and quantitation is based on FID detection response compared to a diesel component standard. See SOP in Appendix C of the QAPP.

RESULTS

Macroinvertebrate

Macroinvertebrate core samples were taken at four locations within the isthmus and one location historically utilized as a reference location (WL-2). See Table 1. A report, "Analysis of Macroinvertebrate Samples Collected From Hog Island Inlet Area, Superior, WI: June 24, 2011", was provided by Kurt Schmude. See Appendix A.

Table 1: Macroinvertebrate Core Locations

Sample ID	Latitude	Longitude	Sediment type	Water Depth
WL-2	46.702198	-92.035736		6 inches
HI-1	46.70327	-92.03884	Fair amount clay	3 to 6 ft
HI-10	46.70513	-92.04089	Clay, silt, detritus	<6 ft
HI-13	46.71591	-92.0412	Hard clay	No sample
HI-30	46.704853	-92.041374	Clay and gravel	<6 ft

Table 2: Comparisons (t-test) of total numbers of organisms/m^2 and total taxa richness between 2006 and 2011 at each site. (From Schmude, 2011)

	Number of organisms/m^2				Total Taxa Richness			
Site	2006	2011	Pvalue	Power	2006	2011	Pvalue	Power
WL-2	50,516	31,694	0.175	0.157	18.4	16.6	0.421	n/a
HI-1	12,783	8,111	0.265	0.087	**6.2**	**9.6**	0.007	0.864
HI-10	5,113	14,635	0.170	0.162	6.8	12.2	0.143	0.195
HI-30	**3,262**	**15,913**	0.028	0.585	**3.4**	**14.4**	0.005	0.910

"Power" is the power of the performed test. Values in **bold** are significantly different. "n/a" means not applicable when using a Mann-Whitney Rank Sum test.

In the 2006 post-remediation monitoring, significant differences were found in density data ($p = <0.001$) between the control site (WL-2, Loon's Foot Landing) and all three sites within the Hog Island Inlet area. Densities of organisms were significantly less and values of total taxa richness were significantly lower at all three sites compared to the control site.

In 2011, no significant differences were detected in densities ($p=0.070$) and total taxa richness ($p=0.200$) between the Loon's Foot Landing sample and the sites in the Hog Island Inlet area. Data from 2006 for each sampling location are compared to data from 2011 in Table 2. The data suggest that organic debris is beginning to re-accumulate in the inlet and aquatic macroinvertebrates are beginning to re-colonize the substrate.

Sediment

Sediment samples were taken on July 12, 2011 at four locations across the isthmus, including the historical background location on the east side of the isthmus (WL-2). See Table 3. The weight of syringe samples exceeded the weight required for the method, but analyses proceeded normally. Percent solids and percent moisture, reported by the two different labs, were in agreement.

Table 3: Sediment Samples in the Isthmus

Sample ID	Latitude	Longitude	Sediment type	Description
WL-2	46.70220	-92.035733	Detritus and silt	6" water, no sheen or odor
IM-SD-2	46.70232	-92.036317	Silty clay under 4" detritus	1" water, slight petroleum odor, no sheen
IM-SD-3	46.70300	-92.03795	Detritus	6" water, petroleum odor, some sheen
IM-SD-4	46.70290	-92.038483	Detritus	1" water, petroleum odor, no sheen

Summary results from the analytical laboratories are presented in Table 5 and 5a. Reports from PACE Analytical Services and the State Lab of Hygiene are included in Appendices B and C, respectively.

Table 5: Analytical results

Sample/Result	WL-2	IM-SD-2	IM-SD-3	IM-SD-4
TOC mg/Kg	25,600	45,100	44,800	109,000
%Solids	58	53	51	29
Lead mg/kg	13	20	20	43
DRO (mg/Kg)	11.3	4.8	12.1	14.8
$TPAH_{18}$ (ug/Kg)	1,656	1,908	2,787	4,856

Table 5a: Individual PAH results

PAHs ug/Kg	**WL-2**	**IM-SD-2**	**IM-SD-3**	**IM-SD-4**
1-Methylnapthalene	<17*	31	<20*	64
2-Methylnapthalene	27	47	44	95
** 3,6-Dimethylnapthalene	21	33	41	83
Acenaphthylene	<9*	<9*	<10*	<17*
Acenapthene	<17*	<19*	<20*	<34*
Anthracene	40	39	68	92
Benzo(a)anthracene	130	140	220	360
Benzo(a)pyrene	110	140	190	350
Benzo(b)fluoranthene	110	160	200	420
** Benzo(e)pyrene	96	120	180	350
Benzo(g,h,i)perylene	77	110	150	290
Benzo(k)fluoranthene	99	110	160	310
Chrysene	140	160	270	500
Dibenz(a,h)anthracene	<17*	30	<49*	160
Fluoranthene	280	290	460	680
Fluorene	33	49	55	85
Indeno(1,2,3-c,d)pyrene	93	140	180	370
Naphthalene	<17*	34	31	69
Phenanthrene	150	130	230	250
Pyrene	290	270	430	710
$TPAH_{18}$ (ug/Kg)	1,656	1,908	2,787	4,856

** not included in Total PAH calculation, only the 18 compounds from previous investigations are used for totals comparison.

* The lab reported Dry weight concentration as indeterminate due to wet weight concentrations below the LOD of 10 ug/Kg. The level of detection (LOD) was substituted for non-detects in totals calculations (WDNR, 2003).

Analytical results originally reported in ng/g which is equal to ug/Kg. The unit ug/Kg was utilized in this report to facilitate comparison to previous reports.

Air

Photoionization Detector (PID) readings were taken of air and headspace sediment samples on July 25, 2011. See Table 4. The air temperature that day was 80F, the sky was partly cloudy, wind approximately 10 – 15 mph SW. For headspace samples, sediment was placed in a clean one-gallon sealable bag. The sediment was broken up gently by hand pressure within the sealed bag, the bag was left intact for at least 10 minutes. The seal was then opened enough to insert the PID intake tube, and sealed around the tube while a reading was taken within the headspace above the sediment sample.

Table 4: PID Results

Sample ID	Latitude (N)	Longitude (W)	PID Reading	Description
			98.4	100 Isobutylene calibration check
			0.2	WDNR office
			0.2	Loon's Foot Landing parking air
			0.2	Loon's Foot wetland overlook air
1	46.70220	-92.035733	0.6	WL -2 Air near disturbed water surface
WL-2	46.70220	-92.035733	0.6	WL-2 Sediment headspace
IM-SD-2	46.70232	-92.036317	1.4	Sediment headspace
2	46.70267	-92.037417	1.4	Air at plant base
3	46.70267	-92.037417	1.0	Air at chest high
4	46.70270	-92.037600	1.0	Sediment headspace
5	46.70272	-92.037900	4.2	Air, plant base, while stepping
IM-SD-3	46.70300	-92.037950	1.4	Sediment headspace, cattail area
6	46.70290	-92.038483	1.0	Air, plant base
IM-SD-4	46.70290	-92.038483	1.4	Sediment headspace
7	46.70282	-92.038650	1.8	Air in cattails, sheen and odor
			0.6	Rail path, base of Hog Island, air
			1.4	Air above creosoted rail tie
			0.6	Loon's Foot Landing parking air
			0.2 – 0.6	WDNR office (fluctuating) air
			96.8	100 Isobutylene re-check

DISCUSSION

The 2011 macroinvertebrate data suggest that the benthic community is slowly improving. In 2011, no significant differences were detected in densities ($p=0.070$) and total taxa richness ($p=0.200$) between the Loon's Foot Landing sample and the sites in the Hog Island Inlet area. Data from 2006 for each sampling location are compared to data from 2011 in Table 2. The data suggest that organic debris is beginning to re-accumulate in the inlet and aquatic macroinvertebrates are beginning to re-colonize the substrate. "Particularly encouraging was the appearance of fingernail clams, snails, scuds (amphipods) and/or sowbugs (isopods), even if these macroinvertebrates were low in numbers. As a matter of fact, there was one nymph of an aeshnid dragonfly collected from Site HI-30, along with one larval specimen of riffle beetle (Stenelmis), which typically occurs in flowing water and likely originated from the nearby mouth of Newton Creek. All of these taxa are considered relatively intolerant to contamination" (Schmude, 2011).

There is some uncertainty in the interpretation of the macroinvertebrate samples in the LSRI reports. The benthic community at Site HI-1 decreased considerably from 2002 to 2006, and then it decreased slightly from 2006 to 2011 (Schumde, 2011). The reason for the large decrease in density of the macroinvertebrate community observed in 2006 was unclear (Schmude 2006). The difficulty may be in the assumption made that the HI-1 location was out of the zone of remedial work. However, aerial photos of the Hog Island Inlet during remediation show that the aqua barrier and likely heavy equipment work did occur in the HI-1 area. See Figure 3.

Murphy Oil constructed a new wastewater treatment plant in 1995, and added a constructed wetland to the treatment train in 2007. The first phase of the Newton Creek/Hog Island Inlet cleanup, conducted in 1997, included remediation of the impoundment area and Segment A of Newton Creek by Murphy Oil, USA, Inc. The WDNR completed the interim cleanup of creek segments B through K in 2003. Remediation of the inlet and Newton Creek Segment L occurred in 2005. The isthmus was not within the 2005 remediation area based on the extent of visible petroleum product and TPAH contamination as mapped by environmental investigations conducted from 1990 to 2005. It is possible that the isthmus was affected to some extent by the Newton Creek contamination or other urban sources. Sediments that make the isthmus are of undocumented origin and may be influenced by urban runoff.

NOTE: The inlet was dry dredged. The blue aqua barrier appears to have been placed across the location of the HI-1 sampling location.

Figure 3 Site Work
2005 Remedial Site

The 2005 Hog Island and Newton Creek Segment L remediation goal was based on a site- specific Human Health and Ecological Risk Assessment (SEH, 2003). Toxicity test results indicated that sublethal ecologically undesirable impacts to the benthic community begin at a threshold TPAH concentrations greater that 2,000 to 3,000 ug/Kg. Acute impacts appeared to occur at TPAH concentrations greater than 5,000 to 7,500 ug/Kg. The site-specific remediation target was 2,600 ug/Kg TPAH. During remediation, any area with an average concentration above the 5,000 ug/Kg TPAH action level, upon confirmation sampling, would be re-dredged.

The results of this study show that though there are likely to be spots impacted by petroleum hydrocarbons on the isthmus, the concentrations of TPAHs in isthmus sediments are within the range of the 2005 remedial goals. Sample location IM-SD-4, near the inlet, showed a TPAH concentration of 4,856 ug/Kg, above the remediation goal but below the action level (bulk sediment concentrations, dry weight basis).

2011 Analytical Results and the 2005 Remediation Goals

Bulk Sediment	WL-2	IM-SD-2	IM-SD-3	IM-SD-4
$TPAH_{18}$ ug/Kg DW	1656	1908	2787	4856

Site-Specific Remediation Target: 2,600 ug/Kg TPAH
Site-Specific Chronic Ecological Protection: 2,000 to 3,000 ug/Kg TPAH
Site-Specific Human Health & Acute Ecological Protection: 5,000 to 7,500 ug/Kg TPAH
Action level for additional excavation during remediation: 5,000 TPAH ug/Kg
(SEH, 2003)

The Consensus-Based Sediment Quality Guidelines (CBSQGs) utilized within the St. Louis River are based on a Threshold Effect Concentration (TEC) at which no toxic effect on benthic organisms is expected, and a Probable Effect Concentration (PEC) above which a toxic effect is expected. The SQGs for nonpolar organic compounds such as PAHs are expressed as an assumed dry weight normalized basis at 1% total organic carbon, as it has been established that the organic carbon content of sediment is an important factor influencing the movement and bioavailability of nonpolar organic compounds (WDNR, 2003).

Site Analytical Results Organic Carbon Normalized Compared to CBSQGs

Analyte	WL-2	IM-SD-2	IM-SD-3	IM-SD-4
$TPAH_{18}$ ug/Kg (as 1% TOC)	650	420	620	450
TOC %	2.56	4.51	4.48	10.9

Threshold Effects Concentration (TEC): 1,610 TPAH ug/Kg at 1% TOC
Probable Effect Concentration (PEC): 22,800 TPAH ug/KG at 1% TOC

When the analytical results for PAHs in this study are expressed as dry weight at 1% TOC and compared to the screening criteria, the concentrations of TPAHs encountered on the isthmus are well below the screening threshold effect concentration.

Studies of the Newton Creek system by WDNR in 1993 and 1994 concluded that the effect levels to benthic macroinvertebrates for the system sediment contaminants of DRO were the following (WDNR, 1995a);

	No Observed Effect (NOEL)	Lowest Observed Effect (LOEL)	Severe Effect (SEL)
DRO mg/Kg	81	150	1,280

*Important to note that revisions to the Wisconsin Modified DRO method in 1995 may result in lower results than would be reported using the previous method.

The results of this study, as summarized in Table 5, show DRO concentrations on the isthmus to be well below the site-specific no observed effect level (NOEL). Chromatograms of the DRO analyses show the likelihood of other natural constituents being included in the DRO analytical results for the samples (as compared to chromatograms for laboratory standards).

Studies of the Newton Creek system by WDNR in 1993 and 1994 concluded that the effect levels to benthic macroinvertebrates for the system sediment contaminants of lead were the following (WDNR, 1995a);

	No Observed Effect (NOEL)	Lowest Observed Effect (LOEL)	Severe Effect (SEL)
Lead mg/Kg	33	40	70

Threshold Effects Concentration (TEC) 36 mg/Kg
Probable Effects Concentration (PEC) 130 mg/Kg

Results of lead analyses for this study are well below the no observed effect level (NOEL) for three of the samples, and IM-SD-4 lead concentration (43 mg/Kg) was slightly above the lowest observed effect level (LOEL) of 40 mg/Kg.

The benefit of utilizing the PID in this situation is that the PID does not respond to methane. Methane is a natural volatile biodegradation product in wetland areas and can be detected by the human nose. Photoionization detector readings showed an increase in sediment headspace and air readings in the cattail area near IM-SD-4 over those in the reference area and other areas of the isthmus. The PID read 0.6 ppm, as isobutylene, at the Loons Foot Landing parking area and the rail trail, and 0.2 to 0.6 ppm inside the WDNR office. Readings at the WL-2 site were 0.6, other head space and ambient air readings across the isthmus ranged from 0.6 to 1.4 ppm as isobutylene. The highest reading was near IM-SD-3 in a location in which a sheen was noticed when the sediment was disturbed by walking. The sediment in this location was additionally disturbed by foot while a reading was taken at water level (4.2 ppm as isobutylene). Other areas where sheen was noticed were treated similarly and resulted in a PID reading of 1.4 ppm

as isobutlylene at water level. At one location treated in this manner, an air reading was also taken at chest height and that reading was slightly lower than the reading at water level (1.4 ppm at water level and 1.0 ppm at chest height).

The PID readings show that there is some detection of volatile organic carbons in the areas where petroleum odors are noted. (Note that there is often a background petroleum odor due to the refineries in the vicinity). The general site PID readings and the maximum reading are below available guidelines for perimeter air quality at manufactured gas remediation sites. Manufactured gas sites are also dominated by PAHs. As a comparison, using the most stringent guideline for perimeter air manufactured gas sites, a benzene concentration of 10 ppm (24-hour acceptable average, DHFS, 2004), PID response factor of 0.7, would result in a reading of 14.3 ppm as isobutylene. The Hog Island isthmus maximum reading, in a location with sheen and odor, while disturbing the sediments, was 4.2 ppm as isobutylene, or 3.6 ppm as isobutylene above background. However, it is highly unlikely that the PID response on the isthmus is all due to benzene, as benzene is highly volatile and would have volatilized in the time those sediments have been in place. Therefore this comparison could be considered a worst case scenario comparison, and the PID readings on the Hog Island Inlet are not as high as the guideline.

CONCLUSION

The results of this study suggest that the macroinvertebrate community in the Hog Island Inlet is recovering as a natural sediment base is re-built since the remediation stripped the area to clay. There is no way of knowing how long this natural process will take.

The study also shows that low levels of PAH do exist in some areas on the isthmus. Air screenings indicated that the odors detectable do not exceed ambient air health guidelines for coal gasification contaminant remediation sites. The area is covered with water and wetland vegetation, and is not expected to be utilized for recreation. However, habitat restoration projects may continue in this area.

There is evidence in literature that short-term direct contact with high concentrations or product of petroleum-related compounds or coal tars can result in dermal irritation and increased photosensitivity to ultraviolet light. Such exposures can pose a human health hazard. Headaches and other reversible symptoms (burning eyes, coughing, sore throat) have been reported by people who noted petroleum odors at petroleum-contaminated sites.

It is recommended that people who enter these areas be advised to use personal protection measures that prevent direct contact with the skin. Those who need to enter and wade in this area should don appropriate boots, waders, splash protection overalls, and gloves. Those who notice a slick or petroleum odors should leave the vicinity to avoid direct contact and inhalation of vapors that have the potential for causing adverse health responses. Volatilization of lighter fractions of these substances could pose a greater exposure concern on hot, windless days. Entering this area during lower ambient air temperatures and windy days could reduce this risk (electronic communication, H. Nehls-Lowe, Division of Public Health, Appendix D).

REFERENCES

Benthic Macroinvertebrate Monitoring Hog Island Quality Assurance Project Plan 2011

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Appendix A

Schumude, K., 2011. Analysis of Macroinvertebrate Samples Collected from Hog Island Inlet Area, Superior, WI: June 24, 2011.

ANALYSIS OF MACROINVERTEBRATE SAMPLES COLLECTED FROM HOG ISLAND INLET AREA, SUPERIOR, WI: JUNE 24, 2011

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October 4, 2011

INTRODUCTION

Contaminated bottom sediments from a large area within the Hog Island Inlet Area of the Superior Harbor of Lake Superior were removed in 2005. Information on the removal project can be found at the two websites listed below, and information on the site before remediation occurred can be found in SEH (2003) and WI DNR (1995). In 2006, the benthic macroinvertebrate community was sampled at three sites to determine to what extent the fauna had immediately recovered; another site at Loon's Foot Landing was sampled as a reference (control) site. Information on the community was presented by Schmude (2006). In 2011, the benthic macroinvertebrate community was sampled again at the same four sites to document the extent to which the fauna had recovered six years after the removal of the sediment and contaminants. This report presents the benthic macroinvertebrate data obtained in 2011, along with a comparison of the data collected from the same sites in 2006, and comparisons to previously collected data when applicable. The current report is similar in format to Schmude (2002, 2006).

1. www.epa.gov/glla/**hogisland**/index.html
2. www.glslcities.org/documents/**HogIsland**Inlet.pdf

METHODS

Collection of Samples

Five replicate core samples were collected on June 24, 2011 from four sites in the Hog Island Inlet Aea following the same procedures used in WI DNR (1995) and Schmude (2002, 2006). The sites included HI-1, HI-10, HI-30, and WL-2 (Loon's Foot Landing). These were the same sites that were sampled in 2006; a portable GPS unit was used to locate the sites. Kurt Schmude (UW-Superior), Adam Frankiewicz (UW-Superior), and Joseph Graham (WI DNR) together collected the replicates at these four sites. **Note**: six replicate samples were collected from site HI-10 because the first replicate was determined to be inadequate after subsequent samples at this site were collected; it was not analyzed.

In 1993, 1994, and 2002, the core samples were collected by the late Tom Janisch (WI DNR). Kurt Schmude was present during the collection of the samples in 2002. Thus, the level of effort to collect the samples was very similar, if not identical, for all five years in which samples were collected from these sites.

Laboratory Processing

Core samples were sieved in the field and processed in the lab using a 250-µm mesh sieve. All samples were processed in the lab in their entirety; no splitting of the samples, or subsampling, was performed. All macroinvertebrates were picked from the sediment samples. Individuals of Nematoda were picked from the samples, but this group was not included in the analysis or Quality Control checks because this group was not processed for some of the previous studies. It is difficult to accurately quantify populations of Nematoda, even though a relatively fine mesh size was used for processing the samples.

Analysis

Identification of specimens was taken to the lowest taxonomic level practical based on current literature and the expertise of the author. The taxonomic levels for each major taxon were identical to the levels obtained in previous studies (Schmude 2002, 2006). Raw data for numbers of organisms were multiplied by a correction factor of 220.4 to obtain numbers/m^2. The coring device captured an area of 0.00453 m^2; an approximate volume of 453 cm^3 was captured in each core (see Schmude 2006).

Statistical tests were conducted on the raw data for total number of organisms in a sample, and on total taxa richness. These tests were run on the data from 1994, 2002, 2006, and 2011. The statistical package SigmaStat® 3.5 was used.

Total Number of Organisms

A One Way ANOVA was used to test for significant differences between the reference (control) site (Loon's Foot Landing, WL-2) and the three sites within Hog Island Inlet Area (treatments, HI-1, HI-10, HI-30); these comparisons were run separately on the raw data from 2006 and 2011. The Holm-Sidak method was used to make multiple comparisons of the treatments versus the control group. A square root transformation was used when the data failed the normality test.

Also, a One Way ANOVA was conducted to test for significant differences between the raw data collected in 1994, 2002, 2006, and 2011 for each site separately, when applicable (not all sites were sampled in each year). Data were compared for all four years at Sites HI-1 and WL-2; data were compared for 1994, 2006, and 2011 for Site HI-30. No samples were collected at Site HI-10 in 1994 and 2002. The Holm-Sidak method was used to make multiple comparisons of the treatments versus the control group. A square root transformation or natural log transformation was used when the data failed the normality and/or equal variance tests.

Since no data were collected at Site HI-10 before remediation occurred, a t-tests was run to test for significant differences between the raw data collected in 2006 and 2011 at this site. For comparative purposes, t-tests were also run for the other three sites for these two, post-remediation years. No transformation of the data was required.

Total Taxa Richness

A One Way ANOVA was used to test for significant differences between the reference (control) site (WL-2) and the three sites within Hog Island Inlet Area (treatments, HI-1, HI-10, HI-30); these comparisons were run separately on the data from 2006 and 2011. The Holm-Sidak method was used to make multiple comparisons of the treatments versus the control group.

Also, a One Way ANOVA was conducted to test for significant differences between the raw data collected in 1994, 2002, 2006, and 2011 for each site separately, when applicable (not all sites were sampled in each year). Data were compared for all four years at Sites HI-1 and WL-2; data were compared for 1994, 2006, and 2011 for Site HI-30. No samples were collected at Site HI-10 in 1994 and 2002. The Holm-Sidak method was used to make multiple comparisons of the treatments versus the control group.

Since no data were collected at Site HI-10 before remediation occurred, a t-test was run to test for significant differences between the raw data collected in 2006 and 2011 at this site. For comparative purposes, t-tests were also run for the other three sites for these two, post-remediation years. The t-test was run on the data for Sites HI-1, HI-10, and HI-30, all of which passed the normality test. A Mann-Whitney Rank Sum test was run on the data from WL-2 because the data failed the normality test.

Quality Control

Ten percent of the samples (2 out of 20) were randomly chosen to be examined for internal Quality Control with regard to processing accuracy (picking all organisms from a sample). Both replicates passed the 10% error level. There was an overall processing error of 9.8%.

		Number of Organisms			
Sample		1st Pick	2nd Pick	Total	%Error
WL-2, rep. 2		251	28	279	10.0
HI-10, rep. 6		32	3	35	8.6
	Total	383	31	314	9.8

RESULTS and DISCUSSION

A summary of the current data and the data obtained from all previous and comparable studies on the four sites that were sampled in the Hog Island Inlet Area is presented in Table 1. Detailed data from 2011 are presented in Table 3 (raw data) and Table 4 (organisms/m^2). Detailed data from 2006 are also presented in this report (Tables 5 and 6, raw data and organisms/m^2).

Important note. During the analysis of the data for the current project, an error was discovered in the report for the data collected from 2006 (Schmude 2006). The raw data was multiplied by an incorrect correction factor to obtain density data. This error occurred for the data from Sites HI-1 and HI-10. Consequently, the data presented for these two sites in Tables 2 and 6 from Schmude (2006) were incorrect. The corrected data are presented in Tables 1 and 6 in the current report.

Loon's Footing Landing (WL-2)

This site is considered the control site by which the sites within Hog Island Inlet Area (HI-1, HI-10, and HI-30) will be compared. The data collected at this site in 2006 vs. 2011 showed no significant differences in the total numbers of organisms (mean 50,516 organsims/m^2 vs. mean 31,694 organisms/m^2, respectively) and the total taxa richness (mean 18.4 vs. mean 16.6 respectively) (Table 1). Thus, the macroinvertebrate fauna at this site in 2011 has remained comparable to the fauna collected in 2006. The decrease in the fauna observed in 2011 was due to the decreased numbers of naidine worms and the lack of fingernail clams compared to 2006.

When the data from the post-remediation time frame (2006, 2011) was compared to the data from the pre-remediation time frame (1994, 2002), the only significant difference in density values was between 1994 and 2006. The only significant difference in the data for total taxa richness was between 1994 and 2002.

Site HI-1
The data collected at this site in 2006 vs. 2011 revealed no significant difference in total numbers of organisms (mean 12,783 organsims/m^2 vs. mean 8,111 organisms/m^2, respectively) (Table 1). The decrease in numbers of organisms from 2006 to 2011 was due to a decrease in the chironomid midge *Chironomus* sp. and tubificine worms.

On the other hand, a t-test revealed a significant difference in total taxa richness between 2006 and 2011 (mean 6.2 vs. mean 9.6, respectively) (Tables 1, 2). However, when the taxa richness data was run using One Way ANOVA for all four years, there was no significant difference observed between 2006 and 2011. Despite the fact that the mean number of organisms decreased (difference not significant), the number of taxa increased. This increase was due to more taxa of chironomid midges and naidine worms.

The density values for organisms/m^2 from the post-remediation time frame (2006, 2011) were both significantly less compared to the pre-remediation time frame (1994, 2002) (Table 1). Values for taxa richness from the post-remediation period were also significantly less than pre-remediation, except for values observed in 1994 (13.4) versus 2011 (9.6).

Site HI-10
Even though total numbers of organisms and total taxa richness increased (Table 1) at this site from 2006 to 2011, the differences were not statistically significant (Table 2). The lack of significant differences may have been due to high variability among the replicates collected in 2011. More taxa of chironomid midges and oligochaete worms were found in 2011. In addition, snails (n=1) and amphipods (n=2) were collected for the first time at this site, although they were found in very low numbers.

Site HI-30
This site showed significant increases in both total numbers of organisms and total taxa richness from 2006 to 2011 (Tables 1, 2). Numbers of organisms increased from 3,262/m^2 (2006) to 15,913/m^2 (2011), and taxa richness increased from 3.4 (2006) to 14.4 (2011). Chironomid midges and oligochaete worms increased in numbers of taxa. Fingernail clams, snails, and isopods were present. Amphipods were found for the first time at this site, along with zebra mussels (Tables 3, 4).

The data from post-remediation was mixed when compared to the data collected in 1994. The density value and total taxa richness were significantly lower in 2006 compared to 1994. However, there were no significant differences in the data for these two metrics for 1994 versus 2011.

Table 2. Comparisons (t-test) of total numbers of organisms/m² and total taxa richness between 2006 and 2011 at each site. "Power" is the power of the performed test. Values in bold are significantly different. "n/a" means not applicable when using a Mann-Whitney Rank Sum test.

	Number of organisms/m²				Total Taxa Richness			
Site	2006	2011	P value	Power	2006	2011	P value	Power
WL-2	50,516	31,694	0.175	0.157	18.4	16.6	0.421	n/a
HI-1	12,783	8,111	0.265	0.087	**6.2**	**9.6**	0.007	0.864
HI-10	5,113	14,635	0.170	0.162	6.8	12.2	0.143	0.195
HI-30	**3,262**	**15,913**	0.028	0.585	**3.4**	**14.4**	0.005	0.910

Control (WL-2) vs. Treatment (HI-1, HI-10, HI-30)

Data from 2006

Significant differences were found in density data ($p = <0.001$) between the control site (Loon's Foot Landing, WL-2) and all three sites within the Hog Island Inlet Area. Densities of organisms were significantly less at these three sites compared to Loon's Foot Landing (Table 1). In addition, values of total taxa richness were significantly lower ($p = <0.001$) at all three sites in Hog Island compared to Loon's Foot Landing.

Data from 2011

No significant differences were detected in densities ($p = 0.070$, power of the performed test = 0.385) and total taxa richness ($p = 0.200$, power of the performed test = 0.168) between Loon's Foot Landing and the sites in Hog Island Inlet Area.

The data show that soon after the removal of the contaminated sediments in 2005, densities of macroinvertebrates in the benthic community at the three sites within the Hog Island Inlet Area were significantly less than the density observed at the control site (Loon's Foot Landing). In addition, total taxa richness was significantly less at all three sites compared to the control site. Six years later in 2011, the aquatic macroinvertebrate communities showed no significant difference in densities and total taxa richness between treated and control sites. Values for these two metrics increased significantly at Site HI-30, and although both metrics increased at Site HI-10, the increase was not significant. Total taxa richness increased significantly at Site HI-1, but numbers of organisms/m² decreased (not significant). Concurrently, both metrics decreased slightly, but not significantly, at the control site (WL-2).

Schmude (2006) postulated that "once organic debris begins to re-accumulate in the bay, aquatic macroinvertebrates should recolonize the substrate, and taxa richness and densities should increase" at the reclamated sites (HI-10, HI-30). The data suggest that this event is occurring at these two sites. Particularly encouraging was the appearance of fingernail clams, snails, scuds (amphipods) and/or sowbugs (isopods), even if these macroinvertebrates were low in numbers.

As a matter of fact, there was one nymph of an aeshnid dragonfly collected from Site HI-30, along with one larval specimen of a riffle beetle (*Stenelmis*), which typically occurs in flowing water and likely originated from the nearby mouth of Newton Creek. All of these taxa are considered relatively intolerant to contamination.

The benthic community at Site HI-1 decreased considerably from 2002 to 2006, and then it decreased slightly from 2006 to 2011. This site was apparently outside the boundary of the reclamation project. The reason for the large decrease in density of the macroinvertebrate community observed in 2006 was unclear (Schmude 2006). The continued decrease in density in 2011 remains unclear. This site was dominated by a large number of oligochaete worms (Table 1) in 2002 (Schmude 2002), and worms and chironomid midges were equally abundant in 1993 and 1994 (WI DNR 1995). Molluscs and amphipods were present in previous years, but both taxa have been absent in 2006 and 2011. However, total taxa richness increased significantly (t-test result) in 2011 compared to 2006 (note: not significant in a One Way ANOVA, see above). The value (9.6) observed in 2011 was the same value observed in 1993 (Table 1), but it was still significantly less than the values observed in 1994 and 2002.

At Loon's Foot Landing (WL-2), densities and total taxa richness were not significantly different between 2006 and 2011 (post-remediation). In addition, year to year comparisons between pre- and post-remediation revealed only one significantly different value in each metric, suggesting that the fauna was similar among all the years in which the fauna was sampled.

LITERATURE CITED

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TABLE 3.

Hog Island Macroinvertebrates - Numbers per Core Sample - Raw Data June 24, 2011

Taxon	Loon's Foot Landing (Reference)							HI-1							HI-10							HI-30						
Replicate	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD	2	3	4	5	6	Mean	STD	1	2	3	4	5	Mean	STD
CHIRONOMIDAE																												
Chironomini (too immature)		1	5	5																								
Chironomus					1			2	1		2	2				1						1			1			
Cladopelma	2	1	1	2											1			1										
Cryptochironomus	1																											
Cryptotendipes	16	6	11	27	13			1			1				1	5	2	1					1	1	2			
Dicrotendipes fumidus		1		1																								
Elrfeldia								1	2		2	1																
Endochironomus subtendens grp.																2		1				3		2	3	2		
Glyptotendipes sp. group B			1																									
Microchironomus																	1											
Microtendipes pedellus grp.					1																							
Phaenopsectra punctipes grp.																							1					
Polypedilum halterale grp.	1	1	3	6	1			2	8	2	9				1	4	1		4						2			
Polypedilum sp.				1	2																							
Stictochironomus	1																											
Tribelos																3		1					1		2			
TOTAL CHIRONOMINI	21	10	21	42	18	22.4	11.8	6	11	2	14	3	7.2	5.2	3	15	4	4	4	6.0	5.0	4	3	3	10	2	4.4	3.2
Cladotanytarsus	25	8	5	16	2			4								1							2		2			
Micropsectra																		1	1									
Paratanytarsus			1																									
Tanytarsus	29	9	7	32	17							1							1									
TOTAL TANYTARSINI	54	17	13	48	19	30.2	19.2	4	0	0	0	1	1.0	1.7	0	1	0	1	2	0.8	0.8	0	2	0	2	0	0.8	1.1
Cricotopus sylvestris grp.	2	1	4	1	2																							
Corymoneura																1												
Psectrocladius	2	1			2																							
TOTAL ORTHOCLADIINAE	4	2	4	1	4	3.0	1.4	0	0	0	0	0	0.0	0.0	0	1	0	0	0	0.2	0.4	0	0	0	0	0	0.0	0.0
Tanypodinae																								1				
Procladius	1															1		1										
Tanypus		1																							1			
TOTAL TANYPODINAE	1	1	0	0	0	0.4	0.5	0	0	0	0	0	0.0	0.0	0	1	0	1	0	0.4	0.5	0	0	1	1	0	0.4	0.5
TOTAL CHIRONOMIDAE	80	30	38	91	41	56.0	27.5	10	11	2	14	4	8.2	5.0	3	18	4	6	6	7.4	6.1	4	5	4	13	2	5.6	4.3
CERATOPOGONIDAE																												
Ceratopogoninae																								1				
Bezzia/Palpomyia	1			1												1								1				
TRICHOPTERA (caddisflies)																												
Oecetis	1			1																								
HETEROPTERA (true bugs)																												
Corixidae (nymph)		1							1																			
ODONATA (dragonflies)																												
Aeshnidae (too immature)																							1					
COLEOPTERA (beetles)																												
Stenelmis (larva)																								1				

Continued

Taxon	Loon's Foot Landing (Reference)							HI-1							HI-10							HI-30						
Replicate	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD	2	3	4	5	6	Mean	STD	1	2	3	4	5	Mean	STD
OLIGOCHAETA																												
Enchytraeidae																			1				1					
Naidinae																												
Arcteonais lomondi								11	11	5	16	5			1								5	1	7	2		
Chaetogaster diaphanus	2			1												2								2				
Dero																2		3					2		3			
Nais bretscheri/pardalis																1												
Nais communis	1								1														1	1				
Nais simplex	16	3		20	10			2	2			1											1	1				
Nais variabilis	1		3	3	1			8	20	4	13	10			2	6		4	2			1	7	17	5	9		
Ophidonais serpentina											1							1								1		
Quistadrilus multisetosus																							1					
Slavina appendiculata	1															2		1					1		1			
Stylaria lacustris									1		1																	
Uncinais uncinata								4	3	1		1																
Vejdovskyella intermedia															4	16							1					
Tubificinae																												
immature tubificids w/o hairs	110	28	16	119	53					3	3	1			38	88	15	16	21			10	68	16	78	17		
immature tubificids with hairs				4											6	29		2	1			1	8		7	2		
Aulodrilus limnobius	1			7																								
Aulodrilus pigueti																1												
Ilyodrilus templetoni																1		1							1			
Limnodrilus near *tortilipenis*	2																											
Limnodrilus cervix										1					5	1			1				1		1	4		
Limnodrilus claparedeianus	5	4		4	3					2	1																	
Limnodrilus hoffmeisteri	3		1		1			1	2	2	5				12	2		1					3	1	5	5		
TOTAL OLIGOCHAETA	142	35	20	158	68	84.6	62.4	26	40	18	40	18	28.4	11.1	68	151	15	29	25	57.6	56.0	12	99	39	108	40	59.6	41.7
Pisidium (clam)																						2	3		1			
zebra mussels																								5				
Valvata	3		6															1						2				
TOTAL MOLLUSCA	3	0	6	0	0	1.8	2.7	0	0	0	0	0	0.0	0.0	0	0	0	1	0	0.2	0.4	2	3	7	1	0	2.6	2.7
Caecidotea sp. (sowbug)	2																					1	6	2	4			
Gammarus sp. (scud)																2							2	1		2		
Hydrachnida (mites)																	1											
TURBELLARIA															2													
TOTAL ORGANISMS	229	66	64	251	109	143.8	90.0	36	52	20	54	22	36.8	16.0	73	172	20	36	31	66.4	62.3	19	116	56	126	44	72.2	46.6
TAXA RICHNESS	24	14	13	18	14	16.6	4.6	10	11	8	11	8	9.6	1.5	11	22	5	15	8	12.2	6.6	7	21	17	18	9	14.4	6.1

TABLE 4.

Hog Island Macroinvertebrates - Numbers per Meter Square (Core Samples) June 24, 2011

Taxon	Loon's Foot Landing (Reference)							HI-1							HI-10							HI-30						
Replicate	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD	2	3	4	5	6	Mean	STD	1	2	3	4	5	Mean	STD
CHIRONOMIDAE																												
Chironomini (too immature)	0	220	1102	1102	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Chironomus	0	0	0	0	220			441	220	0	441	441			0	220	0	0	0			220	0	0	220	0		
Cladopelma	441	220	220	441	0			0	0	0	0	0			220	0	0	220	0			0	0	0	0	0		
Cryptochironomus	220	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Cryptotendipes	3526	1322	2424	5951	2865			220	0	0	220	0			220	1102	441	220	0			0	220	220	441	0		
Dicrotendipes fumidus	0	220	0	220	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Einfeldia	0	0	0	0	0			220	441	0	441	220			0	0	0	0	0			0	0	0	0	0		
Endochironomus subtendens grp.	0	0	0	0	0			0	0	0	0	0			0	441	0	220	0			661	0	441	661	441		
Glyptotendipes sp. group B	0	0	220	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Microchironomus	0	0	0	0	0			0	0	0	0	0			0	0	220	0	0			0	0	0	0	0		
Microtendipes pedellus grp.	0	0	0	0	220			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Phaenopsectra punctipes grp.	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	220	0	0	0		
Polypedilum halterale grp.	220	220	661	1322	220			441	1763	441	1984	0			220	882	220	0	882			0	0	0	441	0		
Polypedilum sp.	0	0	0	220	441			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Stictochironomus	220	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Tribelos	0	0	0	0	0			0	0	0	0	0			0	661	0	220	0			0	220	0	441	0		
TOTAL CHIRONOMINI	4628	2204	4628	9257	3967	4937	2611	1322	2424	441	3086	661	1587	1139	661	3306	882	882	882	1322	1113	882	661	661	2204	441	970	707
Cladotanytarsus mancus grp.	5510	1763	1102	3526	441			882	0	0	0	0			0	220	0	0	0			0	0	0	0	0		
Micropsectra	0	0	0	0	0			0	0	0	0	0			0	0	0	220	220			0	441	0	441	0		
Paratanytarsus	0	0	220	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Tanytarsus	6392	1984	1543	7053	3747			0	0	0	0	220			0	0	0	0	220			0	0	0	0	0		
TOTAL TANYTARSINI	11902	3747	2865	10579	4188	6656	4238	882	0	0	0	220	220	382	0	220	0	220	441	176	184	0	441	0	441	0	176	241
Cricotopus sylvestris grp.	441	220	882	220	441			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Corynoneura	0	0	0	0	0			0	0	0	0	0			0	220	0	0	0			0	0	0	0	0		
Psectrocladius	441	220	0	0	441			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
TOTAL ORTHOCLADIINAE	882	441	882	220	882	661	312	0	0	0	0	0	0	0	0	220	0	0	0	44	99	0	0	0	0	0	0	0
Tanypodinae	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	220	0	0		
Procladius	220	0	0	0	0			0	0	0	0	0			0	220	0	220	0			0	0	0	0	0		
Tanypus	0	220	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	220	0		
TOTAL TANYPODINAE	220.4	220.4	0	0	0	88	121	0	0	0	0	0	0	0	0	220.4	0	220.4	0	88	121	0	0	220.4	220.4	0	88	121
TOTAL CHIRONOMIDAE	17632	6612	8375	20056	9036	12342	6062	2204	2424	441	3086	882	1807	1106	661	3967	882	1322	1322	1631	1337	882	1102	882	2865	441	1234	943
CERATOPOGONIDAE																												
Ceratopogoninae	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	220	0	0		
Bezzia/Palpomyia	220	0	0	220	0			0	0	0	0	0			0	220	0	0	0			0	0	220	0	0		
TRICHOPTERA																												
Oecetis	220	0	0	220	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
HETEROPTERA (true bugs)																												
Corixidae (nymph)	0	220	0	0	0			0	220	0	0	0			0	0	0	0	0			0	0	0	0	0		
ODONATA (dragonflies)																												
Aeshnidae (too immature)	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	220	0	0	0		
COLEOPTERA (beetles)																												
Stenelmis (larva)	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	220	0	0		

Continued

Taxon	Loon's Foot Landing (Reference)							HI-1							HI-10							HI-30						
Replicate	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD	2	3	4	5	6	Mean	STD	1	2	3	4	5	Mean	STD
OLIGOCHAETA																												
Enchytraeidae	0	0	0	0	0			0	0	0	0	0			0	0	0	0	220			0	220	0	0	0		
Naidinae																												
Arcteonais lomondi	0	0	0	0	0			2424	2424	1102	3526	1102			220	0	0	0	0			0	1102	220	1543	441		
Chaetogaster diaphanus	441	0	0	220	0			0	0	0	0	0			0	441	0	0	0			0	0	441	0	0		
Dero	0	0	0	0	0			0	0	0	0	0			0	441	0	661	0			0	441	0	661	0		
Nais bretscheri/pardalis	0	0	0	0	0			0	0	0	0	0			0	220	0	0	0			0	0	0	0	0		
Nais communis	220	0	0	0	0			0	220	0	0	0			0	0	0	0	0			0	220	220	0	0		
Nais simplex	3526	661	0	4408	2204			441	441	0	0	220			0	0	0	0	0			0	220	220	0	0		
Nais variabilis	220	0	661	661	220			1763	4408	882	2865	2204			441	1322	0	882	441			220	1543	3747	1102	1984		
Ophidonais serpentina	0	0	0	0	0			0	0	0	220	0			0	0	0	220	0			0	0	0	0	220		
Quistadrilus multisetosus	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	220	0	0	0		
Slavina appendiculata	220	0	0	0	0			0	0	0	0	0			0	441	0	220	0			0	220	0	220	0		
Stylaria lacustris	0	0	0	0	0			0	220	0	220	0			0	0	0	0	0			0	0	0	0	0		
Uncinais uncinata	0	0	0	0	0			882	661	220	0	220			0	0	0	0	0			0	0	0	0	0		
Vejdovskyella intermedia	0	0	0	0	0			0	0	0	0	0			882	3526	0	0	0			0	220	0	0	0		
Tubificinae																												
immature tubificids w/o hairs	24244	6171	3526	26228	11681			0	0	661	661	220			8375	19395	3306	3526	4628			2204	14987	3526	17191	3747		
immature tubificids with hairs	0	0	0	882	0			0	0	0	0	0			1322	6392	0	441	220			220	1763	0	1543	441		
Aulodrilus limnobius	220	0	0	1543	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Aulodrilus pigueti	0	0	0	0	0			0	0	0	0	0			0	220	0	0	0			0	0	0	0	0		
Ilyodrilus templetoni	0	0	0	0	0			0	0	0	0	0			0	220	0	220	0			0	0	0	220	0		
Limnodrilus near *tortilpenis*	441	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Limnodrilus cervix	0	0	0	0	0			0	0	220	0	0			1102	220	0	0	220			0	220	0	220	882		
Limnodrilus claparedeianus	1102	882	0	882	661			0	0	441	220	0			0	0	0	0	0			0	0	0	0	0		
Limnodrilus hoffmeisteri	661	0	220	0	220			220	441	441	1102	0			2645	441	0	220	0			0	661	220	1102	1102		
TOTAL OLIGOCHAETA	31297	7714	4408	34823	14987	18646	13760	5730	8816	3967	8816	3967	6259	2442	14987	33280	3306	6392	5510	12695	12334	2645	21820	8596	23803	8816	13136	9200
Pisidium (clam)	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			441	661	0	220	0		
Musculium/Sphaerium (clam)	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	1102	0	0		
Valvata	661	0	1322	0	0			0	0	0	0	0			0	0	0	220	0			0	0	441	0	0		
TOTAL MOLLUSCA	661	0	1322	0	0	397	591	0	0	0	0	0	0	0	0	0	0	220	0	44	99	441	661	1543	220	0	573	595
Caecidotea sp. (sowbug)	441	0	0	0	0	88	197	0	0	0	0	0			0	0	0	0	0			220	1322	441	882	0	573	531
Gammarus sp. (scud)	0	0	0	0	0			0	0	0	0	0			0	441	0	0	0	88	197	0	441	220	0	441	220	220
Hydrachnida (mites)	0	0	0	0	0			0	0	0	0	0			0	0	220	0	0			0	0	0	0	0		
TURBELLARIA	0	0	0	0	0			0	0	0	0	0			441	0	0	0	0			0	0	0	0	0		
TOTAL ORGANISMS	50472	14546	14106	55320	24024	31694	19831	7934	11461	4408	11902	4849	8111	3535	16089	37909	4408	7934	6832	14635	13731	4188	25566	12342	27770	9698	15913	10279
TAXA RICHNESS	24	14	13	18	14	16.6	4.6	10	11	8	11	8	9.6	1.5	11	22	5	15	8	12.2	6.6	7	21	17	18	9	14.4	6.1

TABLE 5.

Hog Island Macroinvertebrates - Numbers per Core Sample - Raw Data June 14-15, 2006

Taxon	Loon's Foot Landing (Reference)							HI-1							HI-10							HI-30						
Replicate	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD
CHIRONOMIDAE																												
Chironomus								14	2	8	18	10			2	2	2	2	8			2	4	4	12	2		
Cryptochironomus			2					2																				
Cryptotendipes	8		8	2																								
Dicrotendipes fumidus	22	12	4	16	16																							
Endochironomus subtendens grp.																												
Microtendipes pedellus grp.				2																								
Parachironomus			2		2																		2					
Polypedilum halterale grp.	6	2	6	4																								
Stictochironomus				2																								
TOTAL CHIRONOMINI	36	14	22	26	18	23.2	8.4	16	2	8	18	10	10.8	6.4	2	2	2	2	8	3.2	2.7	2	6	4	12	2	5.2	4.1
Cladotanytarsus mancus grp.		4		8	2																							
Micropsectra																							2					
Paratanytarsus	2			10	2																							
Tanytarsus	28	26	24	36	14					2					2			2	2				2	4				
TOTAL TANYTARSINI	30	30	24	54	18	31.2	13.7	0	0	2	0	0	0.4	0.9	2	0	0	2	2	1.2	1.1	0	4	4	0	0	1.6	2.2
Cricotopus sylvestris grp.	2			4																								
Cricotopus/Orthocladius					2																							
Psectrocladius	2	2																										
TOTAL ORTHOCLADIINAE	4	2	0	4	2	2.4	1.7	0	0	0	0	0	0.0	0.0	0	0	0	0	0	0.0	0.0	0	0	0	0	0	0.0	0.0
Procladius		2	2	2												2									2			
TOTAL TANYPODINAE	0	2	2	2	0	1.2	1.1	0	0	0	0	0	0.0	0.0	0	2	0	0	0	0.4	0.9	0	0	0	2	0	0.4	0.9
TOTAL CHIRONOMIDAE	70	48	48	86	38	58.0	19.5	16	2	10	18	10	11.2	6.3	4	4	2	4	10	4.8	3.0	2	10	8	14	2	7.2	5.2
TRICHOPTERA (caddisflies)																												
Oecetis	4																											
OLIGOCHAETA																												
Naididae																												
Arcteonais lomondi	2	2	2	4						2	4	2						2	6									
Chaetogaster diaphanus	4			4																		2						
Dero		2	2	4				2	2	6	6	2				6		6	4				8	6				
Nais bretscheri/pardalis	18	12	12	6	8													2										
Nais communis	2																	4	2									
Nais simplex		2		2	2																							
Nais variabilis	40	76	16	38	72			2								2		6	8			4	4					
Ophidonais serpentina					2																							
Paranais frici																		6	4									
Slavina appendiculata	4	4		4											2													
Specaria josinae																	2											
Stylaria lacustris				2																								
Uncinais uncinata	2			2																								
Vejdovskyella intermedia																4		2	2									
Tubificidae																												
immature tubificids w/o hairs	72	64	32	186	60			6	8	24	32	76			8		2	4	6				12					
immature tubificids with hairs	6	6	2	18	2			8	2	4	20	16					2	6										
Aulodrilus limnobius				2																								
Ilyodrilus templetoni				2																								
Limnodrilus cervix										2																		
Limnodrilus claparedeianus					2																							
Limnodrilus hoffmeisteri	4							6		4	2	4																
TOTAL OLIGOCHAETA	152	166	64	270	148	160.0	73.4	24	12	40	60	98	46.8	33.8	10	12	6	36	26	18.0	12.6	6	24	6	0	0	7.2	9.9
Pisidium (clam)	8	10	6	4	8																							
Musculium/Sphaerium (clam)				4																								
Gyraulus (snail)				2																								
Valvata	2																											
TOTAL MOLLUSCA	10	10	6	10	8	8.8	1.8	0	0	0	0	0	0.0	0.0	0	0	0	0	0	0.0	0.0	0	0	0	0	0	0.0	0.0
Caecidotea sp. (isopod)				4																						2		
Hydrachnida (mites)		2																										
Helobdella stagnalis (leech)					2														2									
TOTAL ORGANISMS	236	226	118	370	196	229.2	91.3	40	14	50	78	108	58.0	36.1	14	16	8	40	38	23.2	14.7	8	34	14	14	4	14.8	11.5
TAXA RICHNESS	20	16	14	27	15	18.4	5.3	7	4	8	6	6	6.2	1.5	4	5	4	11	10	6.8	3.4	3	7	3	2	2	3.4	2.1

TABLE 6.

Hog Island Macroinvertebrates - Numbers per Meter Square (Core Sample) June 14-15, 2006

Taxon	Loon's Foot Landing (Reference)							HI-1							HI-10							HI-30						
Replicate	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD	1	2	3	4	5	Mean	STD
CHIRONOMIDAE																												
Chironomus	0	0	0	0	0			3086	441	1763	3967	2204			441	441	441	441	1763			441	882	882	2645	441		
Cryptochironomus	0	0	441	0	0			441	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Cryptotendipes	1763	0	1763	441	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Dicrotendipes fumidus	4849	2645	882	3526	3526			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Endochironomus subtendens grp.	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Microtendipes pedellus grp.	0	0	0	441	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Parachironomus	0	0	441	0	441			0	0	0	0	0			0	0	0	0	0			0	441	0	0	0		
Polypedilum halterale grp.	1322	441	1322	882	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Stictochironomus	0	0	0	441	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
TOTAL CHIRONOMINI	7934	3086	4849	5730	3967	5113	1860	3526	441	1763	3967	2204	2380	1415	441	441	441	441	1763	705	591	441	1322	882	2645	441	1146	914
Cladotanytarsus mancus grp.	0	882	0	1763	441			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Micropsectra	0	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	441	0	0	0		
Paratanytarsus	441	0	0	2204	441			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Tanytarsus	5171	5730	5290	7934	3086			0	0	441	0	0			441	0	0	441	441			0	441	882	0	0		
TOTAL TANYTARSINI	6612	6612	5290	11902	3967	6876	3016	0	0	441	0	0	88	197	441	0	0	441	441	264	241	0	882	882	0	0	353	483
Cricotopus sylvestris grp.	441	0	0	882	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Cricotopus/Orthocladius	0	0	0	0	441			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Psectrocladius	441	441	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
TOTAL ORTHOCLADIINAE	882	441	0	882	441	529	369	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Procladius	0	441	441	441	0			0	0	0	0	0			0	441	0	0	0			0	0	0	441	0		
TOTAL TANYPODINAE	0	441	441	441	0	264	241	0	0	0	0	0	0	0	0	441	0	0	0	88	197	0	0	0	441	0	88	197
TOTAL CHIRONOMIDAE	15428	10579	10579	18954	8375	12783	4308	3526	441	2204	3967	2204	2468	1380	882	882	441	882	2204	1058	669	441	2204	1763	3086	441	1587	1149
TRICHOPTERA																												
Oecetis	882	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
OLIGOCHAETA																												
Naididae																												
Arcteonais lomondi	441	441	441	882	0			0	0	441	882	441			0	0	0	441	1322			0	0	0	0	0		
Chaetogaster diaphanus	882	0	0	882	0			0	0	0	0	0			0	0	0	0	0			441	0	0	0	0		
Dero	0	441	441	882	0			441	441	1322	1322	441			0	1322	0	1322	882			0	1763	1322	0	0		
Nais bretscheri/pardalis	3967	2645	2645	1322	1763			0	0	0	0	0			0	0	0	441	0			0	0	0	0	0		
Nais communis	441	0	0	0	0			0	0	0	0	0			0	0	0	882	441			0	0	0	0	0		
Nais simplex	0	441	0	441	441			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Nais variabilis	8816	16750	3526	8375	15869			441	0	0	0	0			0	441	0	1322	1763			882	882	0	0	0		
Ophidonais serpentina	0	0	0	0	441			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Paranais frici	0	0	0	0	0			0	0	0	0	0			0	0	0	1322	882			0	0	0	0	0		
Slavina appendiculata	882	882	0	882	0			0	0	0	0	0			441	0	0	0	0			0	0	0	0	0		
Specaria josinae	0	0	0	0	0			0	0	0	0	0			0	0	441	0	0			0	0	0	0	0		
Stylaria lacustris	0	0	0	441	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Uncinais uncinata	441	0	0	441	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Vejdovskyella intermedia	0	0	0	0	0			0	0	0	0	0			0	882	0	441	441			0	0	0	0	0		
Tubificidae																												
immature tubificids w/o hairs	15869	14106	7053	40994	13224			1322	1763	5290	7053	16750			1763	0	441	882	1322			0	2645	0	0	0		
immature tubificids with hairs	1322	1322	441	3967	441			1763	441	882	4408	3526			0	0	441	1322	0			0	0	0	0	0		
Aulodrilus limnobius	0	0	0	441	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Ilyodrilus templetoni	0	0	0	441	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Limnodrilus cervix	0	0	0	0	0			0	0	441	0	0			0	0	0	0	0			0	0	0	0	0		
Limnodrilus claparedeianus	0	0	0	0	441			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Limnodrilus hoffmeisteri	882	0	0	0	0			1322	0	882	441	882			0	0	0	0	0			0	0	0	0	0		
TOTAL OLIGOCHAETA	33501	36586	14106	59508	32619	35264	16181	5290	2645	8816	13224	21599	10315	7452	2204	2645	1322	7934	5730	3967	2770	1322	5290	1322	0	0	1587	2173
Pisidium (clam)	1763	2204	1322	882	1763			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Musculium/Sphaerium (clam)	0	0	0	882	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Gyraulus (snail)	0	0	0	441	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Valvata	441	0	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
TOTAL MOLLUSCA	2204	2204	1322	2204	1763	1940	394	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caecidotea sp. (sowbug)	0	0	0	882	0	176	394	0	0	0	0	0			0	0	0	0	0			0	0	0	0	441	88	197
Hydrachnida (mites)	0	441	0	0	0			0	0	0	0	0			0	0	0	0	0			0	0	0	0	0		
Helobdella stagnalis (leech)	0	0	0	0	441			0	0	0	0	0			0	0	0	0	441			0	0	0	0	0		
TOTAL ORGANISMS	52014	49810	26007	81548	43198	50516	20124	8816	3086	11020	17191	23803	12783	7965	3086	3526	1763	8816	8375	5113	3248	1763	7494	3086	3086	882	3262	2544
TAXA RICHNESS	20	16	14	27	15	18.4	5.3	7	4	8	6	6	6.2	1.5	4	5	4	11	10	6.8	3.4	3	7	3	2	2	3.4	2.1

Appendix B

PACE Analytical Services, Inc., Green Bay, WI. DRO analytical report. WT135 Hog Island Isthmus Project #4048228. July 21, 2011.

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

July 21, 2011

Walk-In
PACE ANALYTICAL SERVICES, INC.
1241 BELLEVUE STREET
SUITE 9
Green Bay, WI 54302

RE: Project: WT135 HOG ISLAND ISTHMUS
Pace Project No.: 4048228

Dear Walk-In:
Enclosed are the analytical results for sample(s) received by the laboratory on July 13, 2011. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards, where applicable, unless otherwise narrated in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Steven Mleczko

steve.mleczko@pacelabs.com
Project Manager

Enclosures

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
Green Bay, WI 54302
(920)469-2436

CERTIFICATIONS

Project: WT135 HOG ISLAND ISTHMUS
Pace Project No.: 4048228

Green Bay Certification IDs

1241 Bellevue Street, Green Bay, WI 54302
Florida/NELAP Certification #: E87948
Illinois Certification #: 200050
Kentucky Certification #: 82
Louisiana Certification #: 04168
Minnesota Certification #: 055-999-334
New York Certification #: 11888
North Carolina Certification #: 503
North Dakota Certification #: R-150
South Carolina Certification #: 83006001
US Dept of Agriculture #: S-76505
Wisconsin Certification #: 405132750
Wisconsin DATCP Certification #: 105-444

Pace Analytical Services, Inc.
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Green Bay, WI 54302
(920)469-2436

SAMPLE SUMMARY

Project: WT135 HOG ISLAND ISTHMUS
Pace Project No.: 4048228

Lab ID	Sample ID	Matrix	Date Collected	Date Received
4048228001	**WL-2**	Solid	07/12/11 10:22	07/13/11 09:30
4048228002	**IM-SD-2**	Solid	07/12/11 10:41	07/13/11 09:30
4048228003	**IM-SD-3**	Solid	07/12/11 11:14	07/13/11 09:30
4048228004	**IM-SD-4**	Solid	07/12/11 11:36	07/13/11 09:30

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SAMPLE ANALYTE COUNT

Project: WT135 HOG ISLAND ISTHMUS
Pace Project No.: 4048228

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
4048228001	**WL-2**	WI MOD DRO	KHB	1	PASI-G
		ASTM D2974-87	AKC	1	PASI-G
4048228002	**IM-SD-2**	WI MOD DRO	KHB	1	PASI-G
		ASTM D2974-87	AKC	1	PASI-G
4048228003	**IM-SD-3**	WI MOD DRO	KHB	1	PASI-G
		ASTM D2974-87	AKC	1	PASI-G
4048228004	**IM-SD-4**	WI MOD DRO	KHB	1	PASI-G
		ASTM D2974-87	AKC	1	PASI-G

Pace Analytical Services, Inc.
1241 Bellevue Street - Suite 9
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(920)469-2436

ANALYTICAL RESULTS

Project: WT135 HOG ISLAND ISTHMUS
Pace Project No.: 4048228

Sample: WL-2 **Lab ID: 4048228001** Collected: 07/12/11 10:22 Received: 07/13/11 09:30 Matrix: Solid
Results reported on a "dry-weight" basis

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO								
Diesel Range Organics	**11.3**	mg/kg	2.5	1.2	1	07/14/11 12:00	07/20/11 11:41		G2
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**48.1**	%	0.10	0.10	1		07/14/11 08:03		

Sample: IM-SD-2 **Lab ID: 4048228002** Collected: 07/12/11 10:41 Received: 07/13/11 09:30 Matrix: Solid
Results reported on a "dry-weight" basis

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO								
Diesel Range Organics	**4.8**	mg/kg	2.0	1.0	1	07/14/11 12:00	07/20/11 11:47		G2
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**49.0**	%	0.10	0.10	1		07/14/11 08:03		

Sample: IM-SD-3 **Lab ID: 4048228003** Collected: 07/12/11 11:14 Received: 07/13/11 09:30 Matrix: Solid
Results reported on a "dry-weight" basis

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO								
Diesel Range Organics	**12.1**	mg/kg	2.1	1.1	1	07/14/11 12:00	07/20/11 11:53		G2
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**50.8**	%	0.10	0.10	1		07/14/11 08:03		

Sample: IM-SD-4 **Lab ID: 4048228004** Collected: 07/12/11 11:36 Received: 07/13/11 09:30 Matrix: Solid
Results reported on a "dry-weight" basis

Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO								
Diesel Range Organics	**14.8**	mg/kg	5.3	2.6	1	07/14/11 12:00	07/20/11 11:58		G2
Percent Moisture	Analytical Method: ASTM D2974-87								
Percent Moisture	**82.0**	%	0.10	0.10	1		07/14/11 08:03		

Pace Analytical Services, Inc.
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QUALITY CONTROL DATA

Project: WT135 HOG ISLAND ISTHMUS
Pace Project No.: 4048228

QC Batch: OEXT/11834 Analysis Method: WI MOD DRO
QC Batch Method: WI MOD DRO Analysis Description: WIDRO GCS
Associated Lab Samples: 4048228001, 4048228002, 4048228003, 4048228004

METHOD BLANK: 477184 Matrix: Solid
Associated Lab Samples: 4048228001, 4048228002, 4048228003, 4048228004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Diesel Range Organics	mg/kg	<0.99	2.0	07/20/11 10:13	

LABORATORY CONTROL SAMPLE & LCSD: 477185 477186

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Diesel Range Organics	mg/kg	40	29.4	31.0	73	78	70-120	6	20	

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QUALITY CONTROL DATA

Project: WT135 HOG ISLAND ISTHMUS
Pace Project No.: 4048228

QC Batch: PMST/5780 Analysis Method: ASTM D2974-87
QC Batch Method: ASTM D2974-87 Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 4048228001, 4048228002, 4048228003, 4048228004

SAMPLE DUPLICATE: 476870

Parameter	Units	4048226001 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	7.9	8.0	.8	10	

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QUALIFIERS

Project: WT135 HOG ISLAND ISTHMUS
Pace Project No.: 4048228

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

LABORATORIES

PASI-G	Pace Analytical Services - Green Bay

ANALYTE QUALIFIERS

G2	The sample weight in the container did not meet method specifications.

Appendix C

State Laboratory of Hygiene, Madison, WI. Hog Island Isthmus Transect. Lead Analysis Report, 8/11/2011. PAH and TOC Analyses Report, 8/19/2011.

Wisconsin Department of Natural Resources
Laboratory Report

Laboratory: **Wisconsin State Laboratory of Hygiene** *DNR ID* **113133790**
2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:		*Sample #:*	**IW000779**
Collection Start:	**07/12/2011 10:22 am**	*Collection End:*	
Collected by:	**GRAHAM/LEDDER/LAVING**	*Waterbody/Outfall Id:*	**2751220**
ID #:		*ID Point #:*	
County:	**Douglas**	*Account #:*	**WT135**
Sample Location:	**HOG ISLAND ISTHMUS TRANSECT**		
Sample Description:	**WL-2 / HAND SCOOP**		
Sample Source:	**Sediment**	*Sample Depth:*	**F0**
Date Reported:	**08/11/2011**	*Sample Status:*	**COMPLETE**
Project No:		*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
DIG 750.1, ICP, SOLIDS (SW846 3050B)	**07/21/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99393	**PREP DIG SOLIDS 750.1 SW846 3050B**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
LEAD, ICP, DRY WT (SW846 6010B)	**07/28/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
1052	**LEAD**	**13.**	MG/KG	1		3

Analysis Method	*Analysis Date*	*Lab Comment*
PREP AT 103 DEG.C	**07/19/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99394	**PREP SAMPLE HANDLING**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
FIELD TESTS		

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99196	**BOTTOM OF SAMPLING INTERVAL - (FEET)**	**0.5**	FT			
99195	**TOP OF SAMPLING INTERVAL - (FEET)**	**0**	FT			

Laboratory: **Wisconsin State Laboratory of Hygiene** *DNR ID* **113133790**
2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:		*Sample #:*	**IW000780**
Collection Start:	**07/12/2011 10:41 am**	*Collection End:*	
Collected by:	**GRAHAM/LEDDER/LAVING**	*Waterbody/Outfall Id:*	**2751220**
ID #:		*ID Point #:*	
County:	**Douglas**	*Account #:*	**WT135**
Sample Location:	**HOG ISLAND ISTHMUS TRANSECT**		
Sample Description:	**IM-SD-2 / HAND SCOOP**		
Sample Source:	**Sediment**	*Sample Depth:*	**F0**
Date Reported:	**08/11/2011**	*Sample Status:*	**COMPLETE**
Project No:		*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
DIG 750.1, ICP, SOLIDS (SW846 3050B)	**07/21/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99393	**PREP DIG SOLIDS 750.1 SW846 3050B**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
LEAD, ICP, DRY WT (SW846 6010B)	**07/28/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
1052	**LEAD**	**20.**	MG/KG	1		3

Analysis Method	*Analysis Date*	*Lab Comment*
PREP AT 103 DEG.C	**07/19/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99394	**PREP SAMPLE HANDLING**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
FIELD TESTS		

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99196	**BOTTOM OF SAMPLING INTERVAL - (FEET)**	**0.5**	FT			
99195	**TOP OF SAMPLING INTERVAL - (FEET)**	**0**	FT			

Laboratory: **Wisconsin State Laboratory of Hygiene** *DNR ID* **113133790**
2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:		*Sample #:*	**IW000781**
Collection Start:	**07/12/2011 11:14 am**	*Collection End:*	
Collected by:	**GRAHAM/LEDDER/LAVING**	*Waterbody/Outfall Id:*	**2751220**
ID #:		*ID Point #:*	
County:	**Douglas**	*Account #:*	**WT135**
Sample Location:	**HOG ISLAND ISTHMUS TRANSECT**		
Sample Description:	**IM-SD-3**		
Sample Source:	**Sediment**	*Sample Depth:*	**F0**
Date Reported:	**08/11/2011**	*Sample Status:*	**COMPLETE**
Project No:		*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
DIG 750.1, ICP, SOLIDS (SW846 3050B)	**07/21/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99393	**PREP DIG SOLIDS 750.1 SW846 3050B**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
LEAD, ICP, DRY WT (SW846 6010B)	**07/28/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
1052	**LEAD**	**20.**	MG/KG	1		3

Analysis Method	*Analysis Date*	*Lab Comment*
PREP AT 103 DEG.C	**07/19/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99394	**PREP SAMPLE HANDLING**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
FIELD TESTS		

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99196	**BOTTOM OF SAMPLING INTERVAL - (FEET)**	**0.5**	FT			
99195	**TOP OF SAMPLING INTERVAL - (FEET)**	**0**	FT			

Wisconsin Department of Natural Resources
Laboratory Report

Laboratory: **Wisconsin State Laboratory of Hygiene** *DNR ID* **113133790**
2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:		*Sample #:*	**IW000782**
Collection Start:	**07/12/2011 11:36 am**	*Collection End:*	
Collected by:	**GRAHAM/LEDDER/LAVING**	*Waterbody/Outfall Id:*	**2751220**
ID #:		*ID Point #:*	
County:	**Douglas**	*Account #:*	**WT135**
Sample Location:	**HOG ISLAND ISTHMUS TRANSECT**		
Sample Description:	**IM-SD-4 / HAND SCOOP**		
Sample Source:	**Sediment**	*Sample Depth:*	**F0**
Date Reported:	**08/11/2011**	*Sample Status:*	**COMPLETE**
Project No:		*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
DIG 750.1, ICP, SOLIDS (SW846 3050B)	**07/21/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99393	**PREP DIG SOLIDS 750.1 SW846 3050B**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
LEAD, ICP, DRY WT (SW846 6010B)	**07/28/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
1052	**LEAD**	**43.**	MG/KG	1		3

Analysis Method	*Analysis Date*	*Lab Comment*
PREP AT 103 DEG.C	**07/19/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99394	**PREP SAMPLE HANDLING**	**COMPLETE**				

Wisconsin Department of Natural Resources
Laboratory Report

Laboratory: **Wisconsin State Laboratory of Hygiene** *DNR ID* **113133790**
2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:		*Sample #:*	**OW000103**
Collection Start:	**07/12/2011 10:22 am**	*Collection End:*	
Collected by:	**GRAHAM/LEDDER/LA VIN**	*Waterbody/Outfall Id:*	**2751220**
ID #:		*ID Point #:*	
County:	**Douglas**	*Account #:*	**WT135**
Sample Location:	**HOG ISLAND ISTHMUS TRANSECT**		
Sample Description:	**WL-2 / HAND SCOOP**		
Sample Source:	**Sediment**	*Sample Depth:*	
Date Reported:	**08/15/2011**	*Sample Status:*	**COMPLETE**
Project No:		*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
TEMPERATURE ON RECEIPT-ICED - O950	**07/13/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
136	**TEMPERATURE AT LAB**	**ICED**			9999999	

Analysis Method	*Analysis Date*	*Lab Comment*
TOC IN SOIL/SED. BY SLURRY METHOD-SW	**08/03/2011**	**MSD EXCEEDS UPPER QC LIMITS**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
81951	**CARBON TOTAL ORGANIC**	**25600.**	UG/G, DRY	1500.		4720.

Analysis Method	*Analysis Date*	*Lab Comment*
TOTAL ORGANIC CARBON IN SEDIMENT BY	**08/02/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99411	**PREP TOTAL ORGANIC CARBON IN SEDIMENT**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
PAHS IN SOIL/SED BY GC/MS	**07/15/2011**	**SEE OW000103.MM2**

Lab Memo

```
THE FOLLOWING QUALIFIERS EXIST FOR THE DATA THAT IS REPORTED FOR
WISCONSIN STATE LABORATORY OF HYGIENE (WSLH) SAMPLE OW000103.

THE INTERNAL STANDARD QC LIMIT IS EXCEEDED - *IS.

THE DRY WEIGHT CONCENTRATION FOR THIS COMPOUND IS INDETERMINATE
INDICATED BY *E.

       QUALITATIVELY IDENTIFIED THOUGH NOT QUANTITATED WERE:
       ----------------------------------------------------
```

Lab Memo 1)10,18-BISNORABIETA-5,7,9(10),11,13-PENTAENE

2)1-METHYL-7-(1-METHYLETHYL)-PHENANTHRENE

IF YOU HAVE ANY QUESTIONS, CONTACT STEVE GEIS AT (608) 224-6269.

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
61078	**1-METHYLNAPHTHALENE**	**ND**	NG/G, WET	10		32
85786	**1-METHYLNAPHTHALENE**	***E**	NG/G, DRY		0	
78868	**2-METHYLNAPHTHALENE**	**27.**	NG/G, DRY		0	
78305	**2-METHYLNAPHTHALENE**	**16.**	NG/G, WET	5.0		16
99167	**3,6-DIMETHYLNAPHTHALENE (DRY WT)**	**21.**	NG/G, DRY		0	
99484	**3,6-DIMETHYLNAPHTHALENE (WET WT)**	**12.**	NG/G, WET	10		32
34208	**ACENAPHTHENE**	***E**	NG/G, DRY		0	
78309	**ACENAPHTHENE**	**ND**	NG/G, WET	10		32
78347	**ACENAPHTHYLENE**	**ND**	NG/G, WET	5.0		16
34203	**ACENAPHTHYLENE**	***E**	NG/G, DRY		0	
34223	**ANTHRACENE**	**40.**	NG/G, DRY		0	
78348	**ANTHRACENE**	**23.**	NG/G, WET	5.0		16
78342	**BENZO (A) ANTHRACENE**	**74.**	NG/G, WET	10		32
85755	**BENZO (A) ANTHRACENE**	**130.**	NG/G, DRY		0	
85754	**BENZO (A) PYRENE**	**110.**	NG/G, DRY		0	
78343	**BENZO (A) PYRENE**	**63.**	NG/G, WET	10.0		32
34233	**BENZO (B) FLUORANTHENE**	**110.**	NG/G, DRY		0	
78344	**BENZO (B) FLUORANTHENE**	**62.**	NG/G, WET	10.0		32
49743	**BENZO (E) PYRENE**	**96.**	NG/G, DRY		0	
61075	**BENZO (E) PYRENE**	**55.**	NG/G, WET	5.0		16
78828	**BENZO (G H I) PERYLENE**	**77.**	NG/G, DRY		0	
78349	**BENZO (G H I) PERYLENE**	**44.**	NG/G, WET	10.0		32
78345	**BENZO (K) FLUORANTHENE**	**57.**	NG/G, WET	10.0		32
34245	**BENZO (K) FLUORANTHENE**	**99.**	NG/G, DRY		0	
78346	**CHRYSENE**	**80.**	NG/G, WET	10		32
34323	**CHRYSENE**	**140.**	NG/G, DRY		0	
34559	**DIBENZO (A H) ANTHRACENE**	***E**	NG/G, DRY		0	
78352	**DIBENZO (A H) ANTHRACENE**	***IS ND**	NG/G, WET	10.0		32

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
34379	**FLUORANTHENE**	**280.**	NG/G, DRY		0	
78323	**FLUORANTHENE**	**160.**	NG/G, WET	5.0		16
34384	**FLUORENE**	**33.**	NG/G, DRY		0	
78350	**FLUORENE**	**19.**	NG/G, WET	5.0		16
78353	**INDENO (1,2,3-C D) PYRENE**	**53.**	NG/G, WET	10.0		32
34406	**INDENO (1,2,3-C D) PYRENE**	**93.**	NG/G, DRY		0	
34445	**NAPHTHALENE**	***E**	NG/G, DRY		0	
78331	**NAPHTHALENE**	**ND**	NG/G, WET	10		32
78351	**PHENANTHRENE**	**84.**	NG/G, WET	5.0		16
34464	**PHENANTHRENE**	**150.**	NG/G, DRY		0	
34472	**PYRENE**	**290.**	NG/G, DRY		0	
78354	**PYRENE**	**170.**	NG/G, WET	5.0		16
70318	**SOLIDS PERCENT**	**58.**	%		0	

Analysis Method	*Analysis Date*	*Lab Comment*
PAHS IN SOIL/SEDIMENT-PREP-SW846-METI	**07/13/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99412	**PREP PAHS IN SOIL SEDIMENT SW846 3550B/3630**	**COMPLETE**				

Laboratory: **Wisconsin State Laboratory of Hygiene** *DNR ID* **113133790**
2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:		*Sample #:*	**OW000104**
Collection Start:	**07/12/2011 10:41 am**	*Collection End:*	
Collected by:	**GRAHAM/LEDDER/LA VIN**	*Waterbody/Outfall Id:*	**2751220**
ID #:		*ID Point #:*	
County:	**Douglas**	*Account #:*	**WT135**
Sample Location:	**HOG ISLAND ISTHMUS TRANSECT**		
Sample Description:	**IM-SD-2 / HAND SCOOP**		
Sample Source:	**Sediment**	*Sample Depth:*	
Date Reported:	**08/15/2011**	*Sample Status:*	**COMPLETE**
Project No:		*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
TEMPERATURE ON RECEIPT-ICED - O950	**07/13/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
136	**TEMPERATURE AT LAB**	**ICED**			9999999	

Analysis Method	*Analysis Date*	*Lab Comment*
TOC IN SOIL/SED. BY SLURRY METHOD-SW	**08/03/2011**	**MSD EXCEEDS UPPER QC LIMITS**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
81951	**CARBON TOTAL ORGANIC**	**45100.**	UG/G, DRY	1500.		4720.

Analysis Method	*Analysis Date*	*Lab Comment*
TOTAL ORGANIC CARBON IN SEDIMENT BY	**08/02/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99411	**PREP TOTAL ORGANIC CARBON IN SEDIMENT**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
PAHS IN SOIL/SED BY GC/MS	**07/22/2011**	**SEE OW000104.MM2**

Lab Memo

```
THE FOLLOWING QUALIFIERS EXIST FOR THE DATA THAT IS REPORTED FOR
WISCONSIN STATE LABORATORY OF HYGIENE (WSLH) SAMPLE OW000104.

THE INTERNAL STANDARD QC LIMIT IS EXCEEDED - *IS.

SURROGATE RECOVERY DOES NOT MEET LOWER QC LIMIT.

THE DRY WEIGHT CONCENTRATION FOR THIS COMPOUND IS INDETERMINATE
INDICATED BY *E.
```

Lab Memo

QUALITATIVELY IDENTIFIED THOUGH NOT QUANTITATED WERE:
---
1)10,18-BISNORABIETA-5,7,9(10),11,13-PENTAENE

2)1-METHYL-7-(1-METHYLETHYL)-PHENANTHRENE

IF YOU HAVE ANY QUESTIONS, CONTACT STEVE GEIS AT (608) 224-6269.

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
61078	**1-METHYLNAPHTHALENE**	**17.**	NG/G, WET	10		32
85786	**1-METHYLNAPHTHALENE**	**31.**	NG/G, DRY		0	
78868	**2-METHYLNAPHTHALENE**	**47.**	NG/G, DRY		0	
78305	**2-METHYLNAPHTHALENE**	**25.**	NG/G, WET	5.0		16
99167	**3,6-DIMETHYLNAPHTHALENE (DRY WT)**	**33.**	NG/G, DRY		0	
99484	**3,6-DIMETHYLNAPHTHALENE (WET WT)**	**17.**	NG/G, WET	10		32
34208	**ACENAPHTHENE**	***E**	NG/G, DRY		0	
78309	**ACENAPHTHENE**	**ND**	NG/G, WET	10		32
78347	**ACENAPHTHYLENE**	**ND**	NG/G, WET	5.0		16
34203	**ACENAPHTHYLENE**	***E**	NG/G, DRY		0	
34223	**ANTHRACENE**	**39.**	NG/G, DRY		0	
78348	**ANTHRACENE**	**21.**	NG/G, WET	5.0		16
78342	**BENZO (A) ANTHRACENE**	**75.**	NG/G, WET	10		32
85755	**BENZO (A) ANTHRACENE**	**140.**	NG/G, DRY		0	
85754	**BENZO (A) PYRENE**	**140.**	NG/G, DRY		0	
78343	**BENZO (A) PYRENE**	**74.**	NG/G, WET	10.0		32
34233	**BENZO (B) FLUORANTHENE**	**160.**	NG/G, DRY		0	
78344	**BENZO (B) FLUORANTHENE**	**84.**	NG/G, WET	10.0		32
49743	**BENZO (E) PYRENE**	**120.**	NG/G, DRY		0	
61075	**BENZO (E) PYRENE**	**65.**	NG/G, WET	5.0		16
78828	**BENZO (G H I) PERYLENE**	**110.**	NG/G, DRY		0	
78349	**BENZO (G H I) PERYLENE**	**59.**	NG/G, WET	10.0		32
78345	**BENZO (K) FLUORANTHENE**	**60.**	NG/G, WET	10.0		32
34245	**BENZO (K) FLUORANTHENE**	**110.**	NG/G, DRY		0	
78346	**CHRYSENE**	**87.**	NG/G, WET	10		32
34323	**CHRYSENE**	**160.**	NG/G, DRY		0	
34559	**DIBENZO (A H) ANTHRACENE**	***E**	NG/G, DRY		0	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
78352	**DIBENZO (A H) ANTHRACENE**	***IS 16.**	NG/G, WET	10.0		32
34379	**FLUORANTHENE**	**290.**	NG/G, DRY		0	
78323	**FLUORANTHENE**	**150.**	NG/G, WET	5.0		16
34384	**FLUORENE**	**49.**	NG/G, DRY		0	
78350	**FLUORENE**	**26.**	NG/G, WET	5.0		16
78353	**INDENO (1,2,3-C D) PYRENE**	**73.**	NG/G, WET	10.0		32
34406	**INDENO (1,2,3-C D) PYRENE**	**140.**	NG/G, DRY		0	
34445	**NAPHTHALENE**	**34.**	NG/G, DRY		0	
78331	**NAPHTHALENE**	**18.**	NG/G, WET	10		32
78351	**PHENANTHRENE**	**70.**	NG/G, WET	5.0		16
34464	**PHENANTHRENE**	**130.**	NG/G, DRY		0	
34472	**PYRENE**	**270.**	NG/G, DRY		0	
78354	**PYRENE**	**140.**	NG/G, WET	5.0		16
70318	**SOLIDS PERCENT**	**53.**	%		0	

Analysis Method	*Analysis Date*	*Lab Comment*
PAHS IN SOIL/SEDIMENT-PREP-SW846-METI	**07/14/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99412	**PREP PAHS IN SOIL SEDIMENT SW846 3550B/3630**	**COMPLETE**				

Laboratory: **Wisconsin State Laboratory of Hygiene** *DNR ID* **113133790**
2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:		*Sample #:*	**OW000105**
Collection Start:	**07/12/2011 11:14 am**	*Collection End:*	
Collected by:	**GRAHAM/LEDDER/LA VIN**	*Waterbody/Outfall Id:*	**2751220**
ID #:		*ID Point #:*	
County:	**Douglas**	*Account #:*	**WT135**
Sample Location:	**HOG ISLAND ISTHMUS TRANSECT**		
Sample Description:	**IM-SD-3 / HAND SCOOP**		
Sample Source:	**Sediment**	*Sample Depth:*	
Date Reported:	**08/15/2011**	*Sample Status:*	**COMPLETE**
Project No:		*Sample Reason:*	

Analyses and Results:

Analysis Method	*Analysis Date*	*Lab Comment*
TEMPERATURE ON RECEIPT-ICED - O950	**07/13/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
136	**TEMPERATURE AT LAB**	**ICED**			9999999	

Analysis Method	*Analysis Date*	*Lab Comment*
TOC IN SOIL/SED. BY SLURRY METHOD-SW	**08/04/2011**	**MSD EXCEEDS UPPER QC LIMITS**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
81951	**CARBON TOTAL ORGANIC**	**44800.**	UG/G, DRY	1500.		4720.

Analysis Method	*Analysis Date*	*Lab Comment*
TOTAL ORGANIC CARBON IN SEDIMENT BY	**08/02/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99411	**PREP TOTAL ORGANIC CARBON IN SEDIMENT**	**COMPLETE**				

Analysis Method	*Analysis Date*	*Lab Comment*
PAHS IN SOIL/SED BY GC/MS	**07/22/2011**	**SEE OW000105.MM2**

Lab Memo

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THE FOLLOWING QUALIFIERS EXIST FOR THE DATA THAT IS REPORTED FOR
WISCONSIN STATE LABORATORY OF HYGIENE (WSLH) SAMPLE OW000105.

INTERFERENCE INDICATED BY *I.

THE DRY WEIGHT CONCENTRATION FOR THIS COMPOUND IS INDETERMINATE
INDICATED BY *E.

       QUALITATIVELY IDENTIFIED THOUGH NOT QUANTITATED WERE:
       ----------------------------------------------------
```

Lab Memo 1)10,18-BISNORABIETA-5,7,9(10),11,13-PENTAENE

2)1-METHYL-7-(1-METHYLETHYL)-PHENANTHRENE

IF YOU HAVE ANY QUESTIONS, CONTACT STEVE GEIS AT (608) 224-6269.

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
61078	**1-METHYLNAPHTHALENE**	**ND**	NG/G, WET	10		32
85786	**1-METHYLNAPHTHALENE**	***E**	NG/G, DRY		0	
78868	**2-METHYLNAPHTHALENE**	**44.**	NG/G, DRY		0	
78305	**2-METHYLNAPHTHALENE**	**22.**	NG/G, WET	5.0		16
99167	**3,6-DIMETHYLNAPHTHALENE (DRY WT)**	**41.**	NG/G, DRY		0	
99484	**3,6-DIMETHYLNAPHTHALENE (WET WT)**	**21.**	NG/G, WET	10		32
34208	**ACENAPHTHENE**	***E**	NG/G, DRY		0	
78309	**ACENAPHTHENE**	**ND**	NG/G, WET	10		32
78347	**ACENAPHTHYLENE**	**ND**	NG/G, WET	5.0		16
34203	**ACENAPHTHYLENE**	***E**	NG/G, DRY		0	
34223	**ANTHRACENE**	**68.**	NG/G, DRY		0	
78348	**ANTHRACENE**	**34.**	NG/G, WET	5.0		16
78342	**BENZO (A) ANTHRACENE**	**110.**	NG/G, WET	10		32
85755	**BENZO (A) ANTHRACENE**	**220.**	NG/G, DRY		0	
85754	**BENZO (A) PYRENE**	**190.**	NG/G, DRY		0	
78343	**BENZO (A) PYRENE**	**95.**	NG/G, WET	10.0		32
34233	**BENZO (B) FLUORANTHENE**	**200.**	NG/G, DRY		0	
78344	**BENZO (B) FLUORANTHENE**	**100.**	NG/G, WET	10.0		32
49743	**BENZO (E) PYRENE**	**180.**	NG/G, DRY		0	
61075	**BENZO (E) PYRENE**	**90.**	NG/G, WET	5.0		16
78828	**BENZO (G H I) PERYLENE**	**150.**	NG/G, DRY		0	
78349	**BENZO (G H I) PERYLENE**	**78.**	NG/G, WET	10.0		32
78345	**BENZO (K) FLUORANTHENE**	**80.**	NG/G, WET	10.0		32
34245	**BENZO (K) FLUORANTHENE**	**160.**	NG/G, DRY		0	
78346	**CHRYSENE**	**140.**	NG/G, WET	10		32
34323	**CHRYSENE**	**270.**	NG/G, DRY		0	
34559	**DIBENZO (A H) ANTHRACENE**	***E**	NG/G, DRY		0	
78352	**DIBENZO (A H) ANTHRACENE**	***I <25.**	NG/G, WET	10.0		32

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
34379	**FLUORANTHENE**	**460.**	NG/G, DRY		0	
78323	**FLUORANTHENE**	**230.**	NG/G, WET	5.0		16
34384	**FLUORENE**	**55.**	NG/G, DRY		0	
78350	**FLUORENE**	**28.**	NG/G, WET	5.0		16
78353	**INDENO (1,2,3-C D) PYRENE**	**92.**	NG/G, WET	10.0		32
34406	**INDENO (1,2,3-C D) PYRENE**	**180.**	NG/G, DRY		0	
34445	**NAPHTHALENE**	**31.**	NG/G, DRY		0	
78331	**NAPHTHALENE**	**16.**	NG/G, WET	10		32
78351	**PHENANTHRENE**	**120.**	NG/G, WET	5.0		16
34464	**PHENANTHRENE**	**230.**	NG/G, DRY		0	
34472	**PYRENE**	**430.**	NG/G, DRY		0	
78354	**PYRENE**	**220.**	NG/G, WET	5.0		16
70318	**SOLIDS PERCENT**	**51.**	%		0	

Analysis Method	*Analysis Date*	*Lab Comment*
PAHS IN SOIL/SEDIMENT-PREP-SW846-METI	**07/14/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99412	**PREP PAHS IN SOIL SEDIMENT SW846 3550B/3630**	**COMPLETE**				

Laboratory: **Wisconsin State Laboratory of Hygiene** *DNR ID* **113133790**
2601 Agriculture Dr
Madison **WI** **53718**
Phone : **800-442-4618** *Fax Phone :* **608-224-6213**

Sample:

Field #:		*Sample #:*	**OW000106**
Collection Start:	**07/12/2011 11:36 am**	*Collection End:*	
Collected by:	**GRAHAM/LEDDER/LA VIN**	*Waterbody/Outfall Id:*	**2751220**
ID #:		*ID Point #:*	
County:	**Douglas**	*Account #:*	**WT135**
Sample Location:	**HOG ISLAND ISTHMUS TRANSECT**		
Sample Description:	**IM-SD-4 / HAND SCOOP**		
Sample Source:	**Sediment**	*Sample Depth:*	
Date Reported:	**08/15/2011**	*Sample Status:*	**COMPLETE**
Project No:		*Sample Reason:*	

Analyses and Results:

Analysis Method *Analysis Date* *Lab Comment*

TEMPERATURE ON RECEIPT-ICED - O950 **07/13/2011**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
136	**TEMPERATURE AT LAB**	**ICED**			9999999	

Analysis Method *Analysis Date* *Lab Comment*

TOC IN SOIL/SED. BY SLURRY METHOD-SW **08/04/2011** **MSD EXCEEDS UPPER QC LIMITS**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
81951	**CARBON TOTAL ORGANIC**	**109000.**	UG/G, DRY	1500.		4720.

Analysis Method *Analysis Date* *Lab Comment*

TOTAL ORGANIC CARBON IN SEDIMENT BY **08/02/2011**

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99411	**PREP TOTAL ORGANIC CARBON IN SEDIMENT**	**COMPLETE**				

Analysis Method *Analysis Date* *Lab Comment*

PAHS IN SOIL/SED BY GC/MS **07/22/2011** **SEE OW000106.MM2**

Lab Memo

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THE FOLLOWING QUALIFIERS EXIST FOR THE DATA THAT IS REPORTED FOR
WISCONSIN STATE LABORATORY OF HYGIENE (WSLH) SAMPLE OW000106.

THE DRY WEIGHT CONCENTRATION FOR THIS COMPOUND IS INDETERMINATE
INDICATED BY *E.

      QUALITATIVELY IDENTIFIED THOUGH NOT QUANTITATED WERE:
      ----------------------------------------------------
      1)10,18-BISNORABIETA-5,7,9(10),11,13-PENTAENE
```

Lab Memo 2)1-METHYL-7-(1-METHYLETHYL)-PHENANTHRENE

IF YOU HAVE ANY QUESTIONS, CONTACT STEVE GEIS AT (608) 224-6269.

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
61078	**1-METHYLNAPHTHALENE**	**19.**	NG/G, WET	10		32
85786	**1-METHYLNAPHTHALENE**	**64.**	NG/G, DRY		0	
78868	**2-METHYLNAPHTHALENE**	**95.**	NG/G, DRY		0	
78305	**2-METHYLNAPHTHALENE**	**28.**	NG/G, WET	5.0		16
99167	**3,6-DIMETHYLNAPHTHALENE (DRY WT)**	**83.**	NG/G, DRY		0	
99484	**3,6-DIMETHYLNAPHTHALENE (WET WT)**	**24.**	NG/G, WET	10		32
34208	**ACENAPHTHENE**	***E**	NG/G, DRY		0	
78309	**ACENAPHTHENE**	**ND**	NG/G, WET	10		32
78347	**ACENAPHTHYLENE**	**ND**	NG/G, WET	5.0		16
34203	**ACENAPHTHYLENE**	***E**	NG/G, DRY		0	
34223	**ANTHRACENE**	**92.**	NG/G, DRY		0	
78348	**ANTHRACENE**	**27.**	NG/G, WET	5.0		16
78342	**BENZO (A) ANTHRACENE**	**110.**	NG/G, WET	10		32
85755	**BENZO (A) ANTHRACENE**	**360.**	NG/G, DRY		0	
85754	**BENZO (A) PYRENE**	**350.**	NG/G, DRY		0	
78343	**BENZO (A) PYRENE**	**100.**	NG/G, WET	10.0		32
34233	**BENZO (B) FLUORANTHENE**	**420.**	NG/G, DRY		0	
78344	**BENZO (B) FLUORANTHENE**	**120.**	NG/G, WET	10.0		32
49743	**BENZO (E) PYRENE**	**350.**	NG/G, DRY		0	
61075	**BENZO (E) PYRENE**	**100.**	NG/G, WET	5.0		16
78828	**BENZO (G H I) PERYLENE**	**290.**	NG/G, DRY		0	
78349	**BENZO (G H I) PERYLENE**	**85.**	NG/G, WET	10.0		32
78345	**BENZO (K) FLUORANTHENE**	**92.**	NG/G, WET	10.0		32
34245	**BENZO (K) FLUORANTHENE**	**310.**	NG/G, DRY		0	
78346	**CHRYSENE**	**150.**	NG/G, WET	10		32
34323	**CHRYSENE**	**500.**	NG/G, DRY		0	
34559	**DIBENZO (A H) ANTHRACENE**	**160.**	NG/G, DRY		0	
78352	**DIBENZO (A H) ANTHRACENE**	**47.**	NG/G, WET	10.0		32
34379	**FLUORANTHENE**	**680.**	NG/G, DRY		0	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
78323	**FLUORANTHENE**	**200.**	NG/G, WET	5.0		16
34384	**FLUORENE**	**85.**	NG/G, DRY		0	
78350	**FLUORENE**	**25.**	NG/G, WET	5.0		16
78353	**INDENO (1,2,3-C D) PYRENE**	**110.**	NG/G, WET	10.0		32
34406	**INDENO (1,2,3-C D) PYRENE**	**370.**	NG/G, DRY		0	
34445	**NAPHTHALENE**	**69.**	NG/G, DRY		0	
78331	**NAPHTHALENE**	**20.**	NG/G, WET	10		32
78351	**PHENANTHRENE**	**75.**	NG/G, WET	5.0		16
34464	**PHENANTHRENE**	**250.**	NG/G, DRY		0	
34472	**PYRENE**	**710.**	NG/G, DRY		0	
78354	**PYRENE**	**210.**	NG/G, WET	5.0		16
70318	**SOLIDS PERCENT**	**29.**	%		0	

Analysis Method	*Analysis Date*	*Lab Comment*
PAHS IN SOIL/SEDIMENT-PREP-SW846-METI	**07/15/2011**	

Code	*Description*	*Result*	*Units*	*LOD*	*Report Limit*	*LOQ*
99412	**PREP PAHS IN SOIL SEDIMENT SW846 3550B/3630**	**COMPLETE**				

Appendix D

Henry Nehls-Lowe, Division of Public Health, Wisconsin Department of Health Services, electronic communication, 2/26/2012.

From: Nehls-Lowe, Henry L - DHS
Sent: Sunday, February 26, 2012 8:30 PM
To: Ledder, Tracey D - DNR
Subject: Re: Hog Island report
Tracey,

Thank you for the opportunity to review and comment on the draft report on the Hog Island Inlet Study 2011.

After reviewing the draft report and discussing with you this data and field observations that occurred during data gathering for the report, it appears that certain marshy portions of the isthmus contain elevated levels of petroleum-related compounds and possibly petroleum product.

The observations of sheens and reports of petroleum or coal tar-like odors in this area raises questions about whether there are safety concerns from direct contact with contamination at one or more discrete locations. Sampling at several locations also found elevated levels of similar petroleum-related compounds in sediments. These findings suggests there is are potential pockets with high concentrations or product of petroleum-related compounds.

There is clear evidence in the literature that a short term direct contact with high concentrations or product of petroleum-related compounds or coal tars can result in dermal irritation and increased photosensitivity to ultraviolet light. Such exposures can pose a human health hazard. You also described that one person who recently worked in this area and smelled a notable petroleum odor soon afterwards developed a headache. This and other reversible symptoms (burning eyes, coughing, sore throat) have been reported by others who noted similar odors at petroleum-contaminated sites.

As a result, I recommended that people who enter these areas are advised to use personal protection measures that prevents direct contact with the skin. Those who need to enter and wet wade in this area should don appropriate boots, waders, splash protection overalls, and gloves. Those who notice a slick or petroleum odors should leave the vicinity avoid direct contact and inhalation of vapors that have the potential for causing adverse health responses. Volatilization of lighter fractions of these substances could pose a greater exposure concern on hot, windless days. Entering this area during lower ambient air temperatures and windy days could reduce this risk.

Please call me if you would like to discuss this further.

Henry Nehls-Lowe
Division of Public Health
Wisconsin Department of Health Services

Henry Nehls-Lowe

On Feb 23, 2012, at 1:28 PM, "Ledder, Tracey D - DNR" <Tracey.Ledder@wisconsin.gov> wrote:

> Henry,
> I calculated the BaP TEC and they followed the same pattern as our sediment quality quidelines.
> SD-4 was the highest at 628, SD-3 was 251, SD-2 was 185 and the WL-2 reference area was 144.
> I could add that table as a reference (or not as this is an aquatic environment and so not the same exposure?).
> Are you sending an e-mail as we discussed?
>
> *Tracey Ledder*
> St. Louis River AOC Specialist
> Bureau of Watershed Management
> Wisconsin Department of Natural Resources
> (☎) **phone:** (715) 395-6904

(✉) **e-mail:** Tracey.Ledder@wisconsin.gov

"Are you part of the Solution or part of the Precipitate?"