Stoughton Dam

Sediment Assessment Report

Submitted to:
City of Stoughton
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Stoughton, WI 53589

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Table of Contents

Introduction

The City of Stoughton currently operates the Stoughton Dam (also known as the City Plant Dam, Key Seq. No 247, Field File No. 13.10) at the 4th Street bridge in the City of Stoughton, WI. The dam is located on the Yahara River, has a hydraulic height of 9 feet, and creates an impoundment called the Stoughton Millpond (Figure 1). The dam was originally built in 1916 and was reconstructed in 2009. The City of Stoughton is currently exploring alternative uses of the park surrounding the impoundment, including a potential whitewater kayak park. The first phase of that planning process involves an assessment of the quantity and character of impounded sediment. Inter-Fluve was contracted with the City to perform an assessment of the impounded sediments.

Inter-Fluve staff have performed investigations to assess the quantity and quality of sediments impounded by Stoughton Dam. The investigation includes a bathymetric and sediment depth survey of the Stoughton Millpond in May 2019 and sediment coring and contaminant analyses in July 2019.

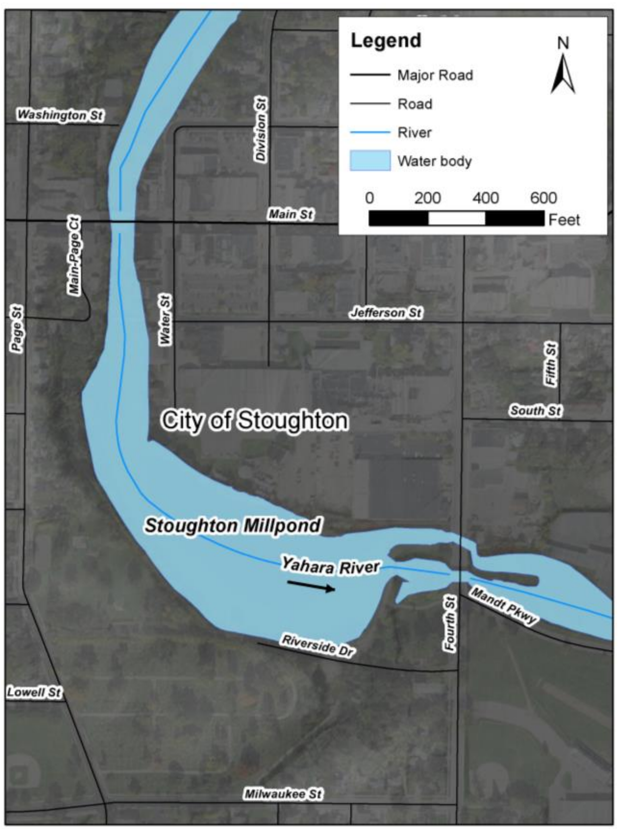


Figure 1. The Yahara River at Stoughton Dam showing the location of the impoundment, Stoughton Millpond.

Sediment Volume Assessment

METHODS

Inter-Fluve completed a bathymetric survey and depth-to-refusal probing in Stoughton Millpond in May of 2019. The bathymetric survey in Stoughton Millpond involved manually surveying the channel and impoundment bed with a survey-grade RTK-GPS unit. A series of 10 cross-sections were surveyed to create an existing conditions surface of the bottom of the impoundment. In addition, a Hydrone equipped with single beam sonar data was used to survey areas of greater than 3-foot water depths. Sediment deposit thickness was measured at a minimum of 10 points along each survey cross-section. This involved manually driving a ½-inch diameter fiberglass rod into the sediment until a refusal layer was encountered. The type of material encountered at refusal was noted at each location tested. Refusal material was determined by the abruptness of the rod stopping, and the noise and vibration associated with the refusal. Three classifications of material were noted with this method based on validation at other sites: (1) cobble and larger rock, (2) gravels, and (3) sand or finer material. In locations where the pre-dam channel existed, gravel and cobble were usually encountered at refusal. In locations that were likely floodplain areas prior to dam construction, a firm, compact layer of sand or finer material was encountered.

Following field data collection, the survey data were integrated in AutoCAD® Civil3D® to create an existing conditions surface of the bottom of the impoundment and a refusal-depth surface based on the probing data. Differencing elevations between the two surface models produced estimates of the total accumulated sediment volume in the impoundment.

RESULTS

The total estimated volume of impounded sediment in Stoughton Millpond is 46,700 cubic yards. This volume is limited to within the area between Stoughton Dam and a cross section 400 ft downstream of the Pedestrian Bridge. The volume of the thick sediment deposit on the left bank (north side) of the Stoughton Millpond is 34,700 cubic yards. Probing revealed sediments in the broad shallow area of the impoundment in which 1-9 feet of looser organic soils overlie a firmer surface which possibly corresponds to former floodplain soils. Deeper areas on the south side of the impoundment correspond to the thalweg of the Yahara River; almost no sediment has accumulated in these areas and the stream substrate is largely composed of gravel and cobble (Appendix A).

It should be noted that depth-to-refusal does not pick up all surficial deposits, especially near the dam where sediment thickness could not be safely measured.

Due Diligence Review Summary

- To determine the appropriate sediment quality testing regime, a due diligence review of potential contaminant sources was completed. We reviewed watershed land uses and potential point sources of contaminants such as large chemical users, historic spills, underground utilities and storage tanks. Additionally, we collected spill data from The Bureau for Remediation and Redevelopment Tracking System (BRRTS) database which contains information on the investigation and cleanup of potential and confirmed contamination to soil and groundwater in the State of Wisconsin. This search revealed the following information:
- Six small incidents that are still open investigations. Contaminants at these sites consist of petroleum, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), heavy metals, and perchloroethylene (PCE).
- Thirty-seven closed incidents throughout the watershed in which included petroleum, chlorinated hydrocarbons, diesel range organics, heavy metals, and VOCs.

The Stoughton City Landfill is on the National Priorities List (NPL) and is within the contributing watershed to the Stoughton impoundment. The Stoughton City Landfill is a 27-acre municipal landfill that operated between 1952 and 1969. Commercial and municipal waste was disposed in the landfill including plastics and rubber manufacturing by-products (solvents, liquid chemicals, vinyl plastic scrap). Prior to site cleanup in 1998, testing of groundwater near the site showed the presence of hazardous chemicals. The site is currently subject to monitoring.

The due diligence results indicate a likelihood of minor contamination typically found in urban areas, including heavy metals and hydrocarbons. Because we did not include an extensive review of historic land use in Stoughton, sediment contamination testing included a wide sweep using the Priority Pollutant Metals identified by the EPA. PAHs are ubiquitous in urban areas and should be expected in some concentration. Polychlorinated biphenyls (PCBs) can be found downstream of pre-Clean Water Act industrial sites.

Agricultural land use in the watershed suggest the possible presence of nutrients, nitrates, and in select areas, organochlorine insecticides and organophosphate pesticides, including DDT, DDE, and derivatives.

Sediment Contamination

In general, dams act as sediment traps. Reduced water velocity in the impoundment limits the transport of coarse sediment and creates areas where fine materials, including silt, clay and organics, can fall out of suspension. Pollutants often adsorb to particles of fine materials, so contaminant concentrations may be elevated in dam impoundments where these sediments accumulate. In order to access the magnitude and distribution of any sediment contamination in the Stoughton Millpond, we collected sediment samples at 11 locations, including 10 within the impoundment and one control point upstream of the impoundment (Figure 2). The samples were analyzed for a range of inorganic (e.g., metals) and organic (e.g., PCBs, VOCs, PAHs, pesticides) pollutants as well as physical characteristics.

SAMPLING LOCATIONS

Control Samples

We collected and analyzed one sample from upstream of the impoundment (US-1). The upstream sample site is immediately downstream of the W. Jefferson St. pedestrian bridge. This sample provided a guide for assessing a potential background level of pollutants in the Yahara River which may be transported into the impoundment. We did not collect a downstream control because sediments for below Stoughton Dam were too coarse to sample.

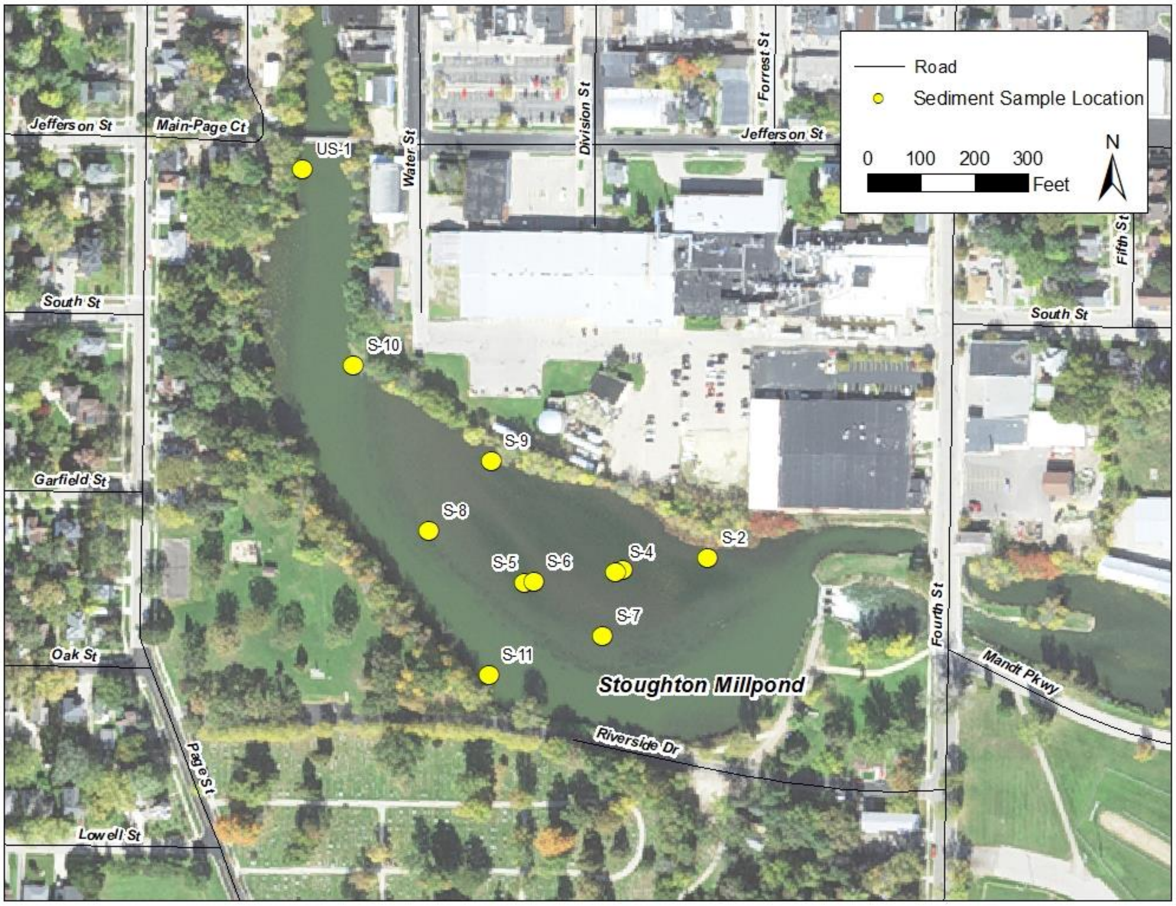


Figure 2. Sediment cores obtained in Stoughton Millpond on July 10th, 2019.

Impoundment Samples

In addition to the upstream control sample, ten (10) sediment core samples were collected within the Stoughton Millpond (Figure 2). Of these 10 sediment cores, nine (9) were obtained from the relatively thicker sediment deposit in the impoundment and one, S-11, was located along the right bank of the Yahara River.

Samples were planned to cover the length and breadth of the thick sediment deposit on the north side of the impoundment. Samples S-2 and S-9 are located along the left bank of the Yahara River; samples S-3, S-4, S-5, S-6, and S-8 are located within the central portion of the impoundment; sample S-10 is located near the upstream extent of the deposit; and sample S-7 is located in the deepest portion of the sediment deposit as identified during the depth-to-refusal probing. Samples S-3 and S-4 are replicate samples intended to assess the quality of the sampling.

Samples S-5 and S-6 represent a stratified sample: S-5 is composed of the possible floodplain soil underlying the thick sediment deposit, while S-6 is composed of materials in the sediment deposit directly overlying S-5. Apart from Samples S5 and S6, cores were not stratified vertically, and occasionally composited small quantities of underlying relict floodplain soils and impoundment sediments.

Coring was not possible in the thalweg of the Yahara River due to the coarse sediments on the bottom and lack of fine material deposits.

METHODS

Sampling and handling methods were consistent with protocols and methods presented in Inter-Fluve's "Sediment Sampling for Dam Removal Projects" (Appendix B) and Wisconsin Administrative Code NR 347.06. Samples were collected with a 3-inch diameter push corer, and included vertical, continuous lengths of sediment. Upon retrieval of each sediment core, the sample was thoroughly mixed using stainless steel buckets and mixing tools, placed in coolers, and stored on ice until they reached the testing laboratory.

Each sample was analyzed by CT Laboratories (Baraboo, WI) for metals, VOCs, PCBs, PAHs, insecticides, pesticides, inorganics, hydrocarbons, and physical characteristics (Table 1). Analyses were conducted using standard laboratory methods. Some of the PAHs are also included in the VOC group, and were therefore analyzed multiple times using different methods. Differences between these results may reflect heterogeneity in the sample and/or volatilization of containments during sample mixing and bottling.

All sites were analyzed for the full suite of contaminants with a few exceptions. PCBs and were not tested at S-6, S-10, S-11, and US-1, and trivalent and hexavalent chromium were not tested at S-6, S-11, and US-1, based on consultation with WDNR prior to testing.

Table 1. Analytical parameters and methods used in sampling at Stoughton Millpond.

Category	Specific Parameters	Laboratory Method
Metals	Antimony, Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Silver, Thallium, Zinc, Trivalent Chromium Mercury Hexavalent Chromium	EPA 6010C EPA 7471B EPA 7196A
Organics	PAHs PCBs VOCs	EPA 8270D-SIM EPA 8082A EPA 8260C

	Organochlorine insecticides Organophosphate pesticides Petroleum Hydrocarbons	EPA 8081B EPA 8151A WDNR DRO/GRO
Nutrients	Total Phosphorous, Nitrate, Nitrite, Ammonia, TKN	EPA 365.4, EPA 9056A, SM 4500-NH3H, EPA 351.2
Physical	TOC (%), solids (%), grain size distribution, bulk density	MOSA 29-, EPA 8000C, ASTM C136-84A

PCB – polychlorinated biphenyls
VOC – volatile organic compound
PAH – polycyclic aromatic hydrocarbon
TKN – total Kjeldahl nitrogen
TOC – total organic carbon

CONTAMINANT CONCENTRATIONS

Sediment Quality Guidelines

Several state and federal laws and regulations exist to protect aquatic wildlife and humans that may come into direct or indirect contact with the pollutants in rivers. Aquatic wildlife, such as fish and macroinvertebrates, and humans can experience chronic and/or acute toxicity from direct contact with sediments in the water column or bed sediment. River sediments left exposed after dam removal or dredging can also pose risk of exposure through several routes: direct contact to sediment pollutants by people may be possible depending on future land use; burrowing animals may be exposed to contaminants; and runoff and infiltration can move both sediment and sediment-adsorbed and leached contaminants into groundwater and surface water.

We compared analytical results to two sets of published thresholds: the Consensus-based Sediment Quality guidelines (CBSQG) summarized by the Wisconsin Department of Natural Resources (WDNR, 2002), and the Residual Contaminant Levels (RCLs) for compounds based on Wis. Adm. Code Section NR 720. NR 720 RCLs considered include the Direct Contact Not to Exceed RCLs and Groundwater RCLs (WDNR, 2018). Results are also compared to background threshold values provided by WDNR (WDNR, 2018)

The WDNR screening levels include the Threshold Effects Concentration (TEC), the Midpoint Effects Concentration (MEC), and the Probable Effects Concentration (PEC). Concentrations of contaminants below the TEC are expected to have no impact on benthic aquatic organisms. Concentrations of contaminants above the PEC are considered likely to have adverse impacts on benthic aquatic organisms. The MEC simply allows a quick indication of whether the contaminant concentration is closer to the PEC or the TEC.

The NR 720 RCLs are based on risk assessments to human health for pathways involving direct and indirect contact with soil and groundwater. Soil RCLs are provided for non-industrial and industrial cases, and differences between the two standards are based on assumptions of exposure to soil in various land uses. Exposure to soil is assumed to be much more frequent in non-industrial areas than in industrial areas. In a dam removal scenario, a portion of the area currently inundated due to the impoundment could become exposed upland with human visitation and use. Therefore, the non-industrial direct contact RCLs were considered.

It should be noted that contamination results presented here are not normalized to 1% total organic carbon (TOC). CBSQG for metals are reported as non-normalized values and are considered here. CBSQG for non-metal compounds are reported as normalized values and are not considered.

ANALYSIS RESULTS

The sediment analysis results for the samples obtained from the Stoughton Millpond reveal contamination commonly associated with industrial, agricultural, and urban land uses within the watershed. Sediment sample analysis results are summarized in the following sections, and all results are included in the tables in Appendix C. Appendix C includes the detection limits for those parameters that were not detected. Detection limits varied between individual samples due to three factors – amount of sample used during extract preparation, percent solids in the sample, and dilution factor necessary. Each of these factors is accounted for as the instrument detection limit of a prepared extract is translated to a concentration of contaminant in the sample in terms of milligrams or micrograms of contaminant per kilogram of dry sample.

Inter-Fluve reviewed sediment chemistry results in detail and identified results not suitable for use in this study. In Appendix C, data qualifiers are recorded in the data table. Data qualifiers returned with sediment analysis results are provided in Table 2. Results with qualifiers of B, J, and L were considered to be valid results, while results with qualifiers of M, P, V, and Z were not considered valid results.

Table 1. Sediment results qualifiers from laboratory analysis.

Code	Comments	Result Valid?
B	Analyte (Phosphorus) detected in the associated Method Blank. Expected maximum contribution from blank is less than 10%	Yes
J	Result is above limit of detection and below limit of quantitation. Result is an estimated concentration.	Yes
L	Significant peaks were detected outside the chromatographic window. Reported results (diesel range organics) not affected.	Yes
M	Matrix spike and/or Matrix Spike duplicate recovery outside acceptance limits. Results may be biased high or low.	No
P	Concentration of analyte differs more than 40% between primary and confirmation analysis. May indicate co-eluting compounds.	No
V	Sample matrix interference prevented lower sample dilution. Result not detectable at analyzed dilution	No
Z	Specified calibration criteria not met due to matrix interference.	No

Upstream Control (Sample US-1)

The sample collected at the upstream control location was relatively coarse and contained 6% fines (< No. 200 sieve). Because most of the contaminants of concern bind to fines, contamination in this sample is expected to be relatively low. However, the control sample did contain elevated concentrations of a few contaminants:

- Metals: A total of 3 metals were found above NR 720 RCL and/or CBSQG values:
    - Arsenic: The NR 720 non-industrial direct contact RCL was exceeded for arsenic at US-1. This value is below the background threshold value.
    - Lead: The NR 720 soil-to-groundwater RCL was exceeded for lead US-1. The TEC for lead was also exceeded at US-1. The sample concentration exceeds the background threshold value.
    - Thallium: The NR 720 non-industrial direct contact RCL was exceeded for thallium at US-1.
- PAHs:
    - Benzo(a)pyrene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at US-1.

  - Benzo(a)anthracene: The NR 720 non-industrial direct contact RCL was exceeded at US-1.
  - Benzo(b)fluoranthene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at US-1.
  - Dibenzo(a,h)anthracene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at US-1.
  - Indeno(1,2,3-cd)pyrene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at US-1.

Main Deposit Sediments (S-3, S-4, S-6, S-7, S-8)

The samples collected in the main sediment deposit in Stoughton Impoundment were primarily sandy with 10-31% fines. These sediments are relatively loose and are have likely been deposited on the historical floodplain terrace since the construction of the dam. Dense aquatic vegetation growth in this area stabilizes the sediments during the growing season. Sediment thickness in this area ranges from 1 to 9 feet.

- Metals: A total of 8 metals were found above NR 720 and/or CBSQG values:
  - Arsenic: The NR 720 non-industrial direct contact RCL was exceeded for arsenic at S-3, S-4, S-6, S-7, and S-8. Samples S-3, S-4 and S-6 have arsenic concentrations above the background threshold value.
  - Copper: The TEC for copper was exceeded at S-3, S-4, S-6, and S-7.
  - Lead: The NR 720 soil-to-groundwater RCL was exceeded for lead at S-3, S-4, S-6, S-7, and S-8. The TEC for lead was exceeded at S-3, S-4, and S-7; the MEC for lead was exceeded at S-6 and S-8.
  - Nickel: The NR 720 soil-to-groundwater RCL was exceeded for nickel at S-6.
  - Thallium: The NR 720 non-industrial direct contact RCL was exceeded for thallium at S-3, S-4, S-6, S-7, and S-8.
  - Mercury: The NR 720 soil-to-groundwater RCL was exceeded for mercury at S-3, S-4, S-6, S-7, and S-8. The TEC for mercury was exceeded at S-3, S-4, and S-7; the MEC for mercury was exceeded at S-6 and S-8.
  - Zinc: The TEC for zinc was exceeded at S-3, S-4, S-6, S-7, and S-8. Samples S-4, S-6, and S-8 have concentrations above the background threshold value.
  - Hexavalent Chromium: The NR 720 non-industrial direct contact RCL was exceeded for Hexavalent Chromium at S-8.

- PAHs:
    - Benzo(a)pyrene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at S-3, S-4, S-6, S-7, and S-8.
    - Benzo(a)anthracene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at S-6 and S-8.
    - Benzo(b)fluoranthene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at S-6, S-7, and S-8.
    - Dibenzo(a,h)anthracene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at S-6 and S-8.
- Insecticides: The NR 720 non-industrial direct contact RCL was exceeded for alpha-BHC at S-8.

Left Bank Channel Sediments (S-2, S-9, S-10)

The samples collected along the left bank of the impoundment were primarily sandy and contained 16.5-24.4% fines. The upland areas directly adjoining the left bank have been primarily industrial.

- Metals: A total of 9 metals were found above NR 720 and/or CBSQG values:
    - Arsenic: The NR 720 non-industrial direct contact RCL was exceeded for arsenic at S-2, S-9, and S-10. Sample S-9 exceeds the arsenic PEC and exceeds the background threshold value.
    - Copper: The TEC for copper was exceeded at S-9 and S-10. Sample S-9 exceeds the background threshold value.
    - Lead: The NR 720 soil-to-groundwater RCL was exceeded for lead at S-2, S-9, and S-10. The TEC was exceeded at S-2 and S-9, and the PEC was exceeded at S-10. The background threshold value was exceeded at S-9 and S-10.
    - Nickel: The NR 720 soil-to-groundwater RCL was exceeded for nickel at S-9.
    - Selenium: The NR 720 soil-to-groundwater RCL was exceeded for selenium at S-2.
    - Thallium: The NR 720 non-industrial direct contact RCL was exceeded for thallium at S-2, S-9, and S-10.

   - Mercury: The NR 720 soil-to-groundwater RCL was exceeded for mercury at S-2, S-9, and S-10. The TEC for mercury was exceeded at S-2, S-9, and S-10.
   - Zinc: The TEC for zinc was exceeded at S-2, S-9, and S-10.
   - Hexavalent Chromium: The NR 720 non-industrial direct contact RCL was exceeded for Hexavalent Chromium at S-2
- PAHs:
   - Benzo(a)pyrene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at S-2, S-9, and S-10.
   - Benzo(b)fluoranthene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at S-10
   - Dibenzo(a,h)anthracene: The NR 720 non-industrial direct contact RCL was exceeded was exceeded at S-10
- Insecticides: The NR 720 non-industrial direct contact RCL was exceeded for alpha-BHC at S-9.

Relict Floodplain Soil Sediments (S-5)

This sample was collected from the relict floodplain soil found below the loose depositional soils in the impoundment. It is co-located with S-6 for comparison purposes. This stratum likely reflects the floodplain surface prior to dam construction and corresponds in most areas to the refusal surface found during depth-to-refusal probing. It is characterized by slightly lower amounts of sand and slightly higher amounts of gravel/pebbles than the overlying depositional sediments. Because it was present before dam construction, it is likely to have lower contaminant concentrations, though contamination may be present from leaching or contamination experienced prior to dam construction.

- Metals – Two metals was found above NR 720 and/or CBSQG values:
   - Arsenic: The NR 720 non-industrial direct contact RCL was exceeded for arsenic at S-5. The TEC was exceeded at S-5, and the sample concentration exceeds the background threshold value.
   - Zinc: The MEC for zinc is exceeded at S-5, and the sample concentration exceeds the background threshold value.
- Insecticides: The NR 720 soil-to-groundwater RCL was exceeded for heptachlor epoxide at S-5.

Right Bank Channel Sediments (S-11)

Sample location S-11 is located along the right bank (looking downstream) of the Yahara River near a heavily vegetated shoreline with downed trees. Sediments along this bank are more actively transported than along the left bank, and depositional features are thinner than the main sediment deposit in the impoundment. The sediment core was collected between two downed trees which created a depositional bed feature. The sample contained more fines (31.1%) than any site except S-8. Chemistry results returned no exceedances of NR 720 RCLs or CBSQGs.

Sediment Mobility Assessment

We performed a preliminary assessment to determine the potential mobility of sediments under existing conditions and a possible dam removal scenario. This assessment utilized the existing effective hydraulic model for the Yahara River available from WDNR to approximate hydraulic conditions, and common sediment mobility values to approximate sediment incipient motion. To assess potential conditions following a dam removal, the Stoughton Dam was removed from the hydraulic model, with no other changes to the model.

Because the model's intended use is to assess flood hydraulics, the flows considered in this analysis range from the 10-year flow to the 500-year flow. Note that this analysis considers only average parameters across a cross-section and relies on an existing model which does not include fully accurate impoundment bathymetry. Therefore, the findings of this analysis should be considered approximations of the actual sediment transport behavior of the Yahara River at Stoughton Dam.

Under existing conditions, the Yahara River in the impoundment upstream of Stoughton Dam would be capable of mobilizing particles larger than coarse sand only during extreme (i.e., 100- and 500-year) flood events. During smaller flood events (i.e., the 10-year flood), silt and fine sand particles may be mobilized. Findings of primarily sand-sized sediments in the impoundment cores support this finding. Areas in the thalweg experience higher velocities and shear stresses than the depositional area, accounting for gravel and cobble channel bottom found in those areas.

Under a potential dam removal scenario, velocities would increase and water levels would decrease in the impoundment. Analysis suggests that shear stresses would increase under a dam removal scenario such that sand-sized sediments would be mobilized regularly, and gravel-sized sediments would be mobilized during more frequent (i.e., 10-year and smaller) events. As a first-order approximation, this analysis demonstrates that accumulated sediment in the Stoughton Millpond would mobilize following a dam removal.

Sediment Management

Study Findings

Sediment volume and chemistry results presented herein document a fairly typical impoundment for a watershed with a long history of urban, industrial, and agricultural land uses. Depth-to-refusal probing and bathymetric surveys found a main sediment deposit on the north side of the impoundment consisting of relatively homogenous fine sediments varying in thickness from 1 to 9 feet overlying a relic floodplain soil. The main thalweg of the Yahara River was found to have a substrate of gravel and cobble with little sediment deposition.

Sediment chemistry results indicate the main sediment deposit has elevated levels of metals, PAHs, and a couple insecticides. Three metals, arsenic, thallium, and hexavalent chromium, were found in concentrations exceeding NR 720 non-industrial direct-contact RCLs. Four metals, lead, nickel, selenium, and mercury, exceed NR 720 soil-to-groundwater RCLs. Arsenic, copper, lead, zinc, and mercury were found in excess of WDNR consensus-based sediment quality guidelines. Of these contaminants, RCLs or CBSQGs were exceeded over large areas of the main sediment deposit for arsenic, lead, thallium, copper, zinc, and mercury.

PAHs were found in concentrations exceeding NR 720 non-industrial direct contact RCLs. In particular, elevated levels of benzo(a)pyrene were found in every core of the main sediment deposit. Other PAHs exceeding NR 720 standards include Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, and Indeno(1,2,3-cd)pyrene.

Two insecticides were found to have concentrations exceeding NR 720 guidelines. Alpha-BHC was found in excess of NR 720 non-industrial direct contact RCLs at S-8 and S-9, and heptachlor epoxide was found in excess of NR 720 soil-to-groundwater guidelines at S-5.

The results taken together indicate that the bulk of elevated metals, PAH, and insecticide concentrations are located within the main sediment deposit. One metal, arsenic, and one insecticide, heptachlor epoxide, were found in excess of standards in the underlying relic floodplain soil. Sediment samples obtained near the south bank of the Yahara River where significant deposition is absent were found not exceed NR 720 standards.

Passive Sediment Management

Passive restoration of a stream entails removing the major impediment to natural river function, in this case the Stoughton Dam, and allowing the river to restore itself over time. The channel within the impoundment freely adjusts its slope and form via incision, widening, and meandering, while the resulting eroded sediment flushes downstream unimpeded. These adjustments continue until the channel develops a form appropriate for the flows and sediment regime imposed on it. The exposed sediment that is not flushed downstream becomes floodplain and the existing seedbank in those soils contributes vegetation to stabilize the surface.

The advantage of passive restoration is the low cost, as it requires little work in the impoundment to control sediment or develop more natural channel characteristics. Low cost comes at the expense of time, as the river will evolve through a process of erosion and migration that may take decades following dam removal. It can also have a negative short-term impact on downstream reaches if large volumes of sediment, including any mobilized contaminated materials, are delivered to reaches downstream of the dam.

Active Sediment Management

Active sediment management requires that at least some of the sediment within the impoundment would be mechanically removed and channel form and adjustment would be controlled via design and construction. If sediments are highly contaminated, active management may also include capping or excavation and replacement of sediment along the channel margins that are expected to become future floodplain areas. Active restoration results in reduced sediment load to the downstream river reaches, immediately stable channel form, and a higher degree of ecological function in a shorter time. These advantages are realized at a higher project cost.

Proposed Sediment Management

The results in this study indicate widespread contamination in excess of state standards within the thick depositional sediment layer in the impoundment, and that this sediment would likely be mobilized under a dam removal scenario. Accordingly, if the

Stoughton Dam were to be removed, sediments within the thick depositional layer would likely need to be remediated or removed through active management.

The existing channel of the Yahara River through the impoundment is well established and upstream lakes and dams control the amount of sediment delivered to the site. Channel materials are primarily gravels and cobbles, while overlying sediment deposits appear to be less contaminated than those in the thicker impoundment deposit.

Inter-Fluve has not conducted the analysis necessary to determine the frequency of inundation of this area under a dam removal scenario. If Stoughton Dam were to be removed along with the thick sediment deposit, it is possible that sediments would need to be either stabilized in place or capped with clean material to avoid human contact.

Further specifics of sediment management activities are beyond the scope of this report, and must be developed in concert with plans for dam removal and associated restoration, river use, and land use plans.

It is unlikely additional sampling would likely confirm findings presented here and would be unlikely to determine locations with the main sediment deposit where contaminant concentrations significantly differ.

Preliminary Cost Estimate

The following preliminary cost estimate is meant to provide a ballpark estimate for the complete removal of contaminated sediments from the Stoughton Millpond and associated dam removal and active restoration. Of the cost items, contaminated sediment removal and disposal is by far the costliest. Here, we give a range of costs per yard for removal and disposal of a range of sediment volumes. WDNR regulations may dictate special handling of sediments, which can also modify the costs for removal. Other restoration and habitat costs are lumped together and are meant to provide planning-level estimates that do not reflect a developed concept design.

Description	Unit Price	Quantity	Unit	Subtotal
Mobilization and Erosion Control			LS	10% of other construction costs
Dam demolition and concrete removal with dewatering			LS	$150,000 - 250,000
Contaminated Sediment Removal	$50-100	10,000 - 47,000	CY	$500,000 - 4,700,000
Upstream channel restoration			LS	$20,000 - 200,000

Total (w/ Mobilization)				**$740,000 - 5,670,000**

Summary

The Stoughton Dam was constructed in 1916 and creates an impoundment in the Yahara River commonly referred to as the Stoughton Millpond. Inter-Fluve conducted a bathymetry survey, depth-to-refusal probing, and sediment coring for contaminant testing during the summer of 2019 to help the City of Stoughton determine the quantity of sediment impounded by the dam and contamination levels within the impoundment.

The Stoughton Millpond features the main channel of the Yahara River on the river-right (south) side of the impoundment, and a thick deposit of accumulated sediment on the left (north) side of the impoundment. The thick sediment deposit is generally uniform in composition and consists of 60-80% sand and 10-30% silt and clay. Depth-to-refusal probing indicates that this accumulated sediment layer varies from approximately 1 to 9 feet thick, with a typical depth of 4 feet. A continuous relict soil surface is found underneath the accumulated sediment deposit and is believed to represent the pre-dam floodplain. Little accumulated sediment is found in the main channel of the Yahara River; the channel bottom is primarily composed of gravel and cobble. The total volume of accumulated sediment in Stoughton Millpond is estimated at 46,700 cubic yards.

A due diligence review of possible contamination sources within the contributing watershed to Stoughton Millpond shows a legacy of urban, industrial, and agricultural pollution. Contaminant testing results from sediment cores support this claim. As expected, the accumulated sediment deposit contains the highest concentrations of contaminants found. Sediment cores from the main impoundment deposit contained concentrations exceeding NR 720 non-industrial soil RCLs for metals, including arsenic, thallium, and hexavalent chromium. NR 720 soil-to-groundwater RCLs were exceeded in the main impoundment for lead, nickel, selenium, and mercury. Five metals were found in excess of WDNR consensus-based sediment quality guidelines including arsenic, copper, mercury, zinc, and lead.

Five PAHs were found at concentrations exceeding NR 720 non-industrial RCLs in the main sediment deposit. Two cores found levels of alpha-BHC, an insecticide, above NR 720 non-industrial direct-contact RCLs, and one core sampling the relic floodplain soil returned concentrations of the insecticide heptachlor epoxide in excess of NR 720 soil-to-groundwater RCLs. Concentrations of PCBs, VOCs, pesticides, and insecticides not mentioned previously returned results below exposure limits and/or laboratory detection limits.

The widespread concentrations of metals and relatively mobile sediments means that active management of the main accumulated sediment deposit at Stoughton Millpond would likely be necessary in the event of the removal of Stoughton Dam. Future work and collaboration with WDNR will ultimately determine the remediation requirements for the sediments at Stoughton Millpond. The WDNR permitting process will ultimately dictate the amount of material needed for removal and any special handling required.

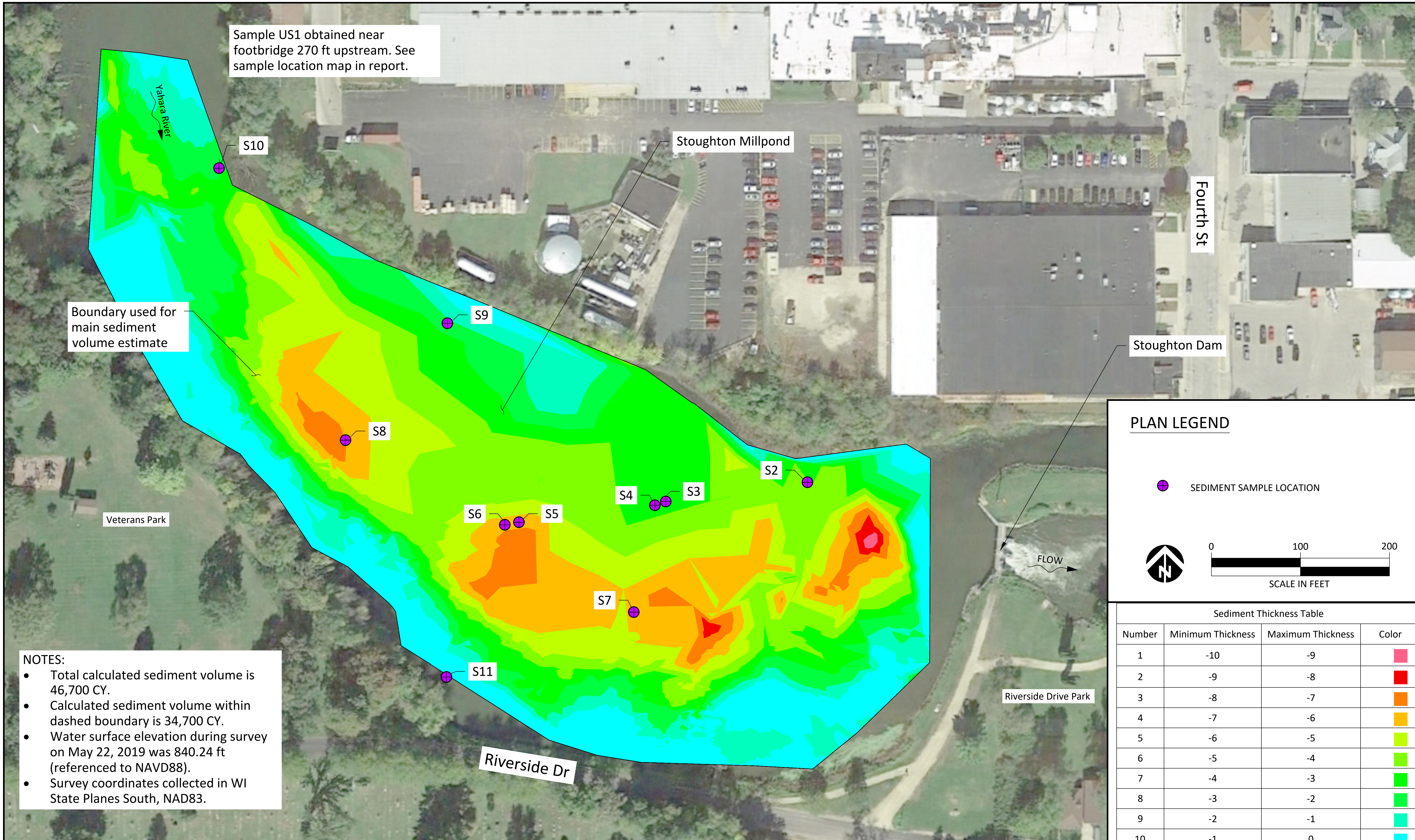
References

Inter-Fluve, Inc. 2007. *Sediment Sampling for Dam Removal Projects – General Sample Collection Guidelines for Contaminant Testing.* Internal company protocol, Madison, WI.

Wisconsin Department of Natural Resources. 2002. *Consensus-Based Sediment Quality Guidelines. Recommendations for Use and Applications*. Interim Guidance. WT-732. 35pp. http://dnr.wi.gov/topic/brownfields/documents/cbsqg_interim_final.pdf

Wisconsin Department of Natural Resources. 2018. NR 720 RR Soil RCL Worksheets. Worksheets available from: https://dnr.wi.gov/topic/Brownfields/soil.html

Appendix A – Stoughton Millpond Survey Data and Sample Locations



NOTES:

- Total calculated sediment volume is 46,700 CY.
- Calculated sediment volume within dashed boundary is 34,700 CY.
- Water surface elevation during survey on May 22, 2019 was 840.24 ft (referenced to NAVD88).
- Survey coordinates collected in WI State Planes South, NAD83.

Sediment Thickness Table

Number	Minimum Thickness	Maximum Thickness	Color
1	-10	-9	
2	-9	-8	
3	-8	-7	
4	-7	-6	
5	-6	-5	
6	-5	-4	
7	-4	-3	
8	-3	-2	
9	-2	-1	
10	-1	0	

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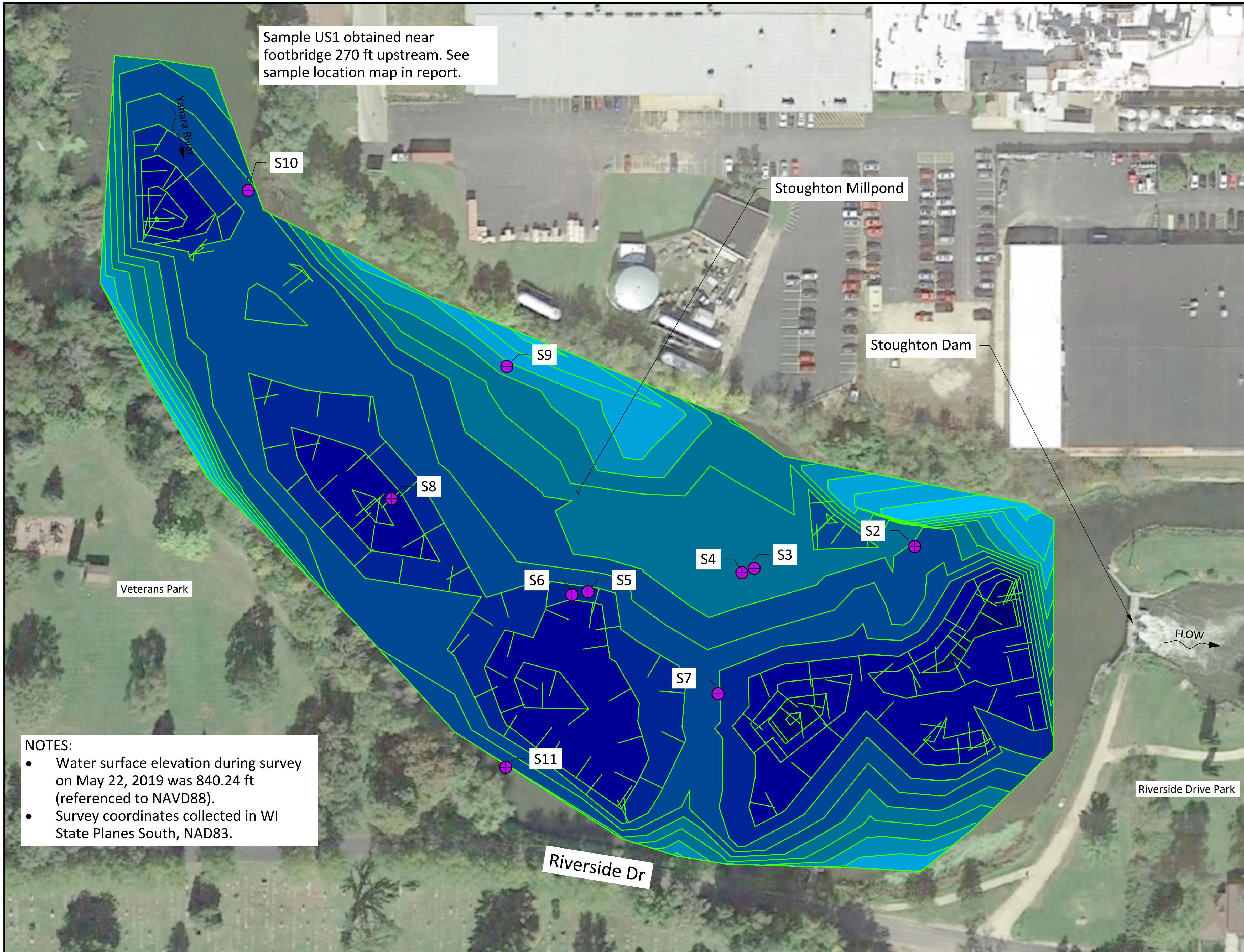
Stoughton Dam Sediment Analysis

Sediment Thickness Map

October 23, 2019



NOTES:

- Water surface elevation during survey on May 22, 2019 was 840.24 ft (referenced to NAVD88).
- Survey coordinates collected in WI State Planes South, NAD83.

PLAN LEGEND

EXISTING REFUSAL SURFACE 1 FT CONTOUR

PROPOSED SEDIMENT SAMPLING LOCATION

0 100 200

SCALE IN FEET

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	828	829	
2	829	830	
3	830	831	
4	831	832	
5	832	833	
6	833	834	
7	834	835	
8	835	836	
9	836	837	
10	837	838	
11	838	839	
12	839	840	
13	840	841	
14	841	842	

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Stoughton Dam Sediment Analysis

Refusal Surface

October 23, 2019

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Stoughton Dam Sediment Analysis

Bed Surface Contours

October 23, 2019

Appendix B – Inter-Fluve Sediment Sampling Protocols

Sediment Sampling for Dam Removal Projects

General sample collection guidelines for contaminant testing

April 25, 2007

inter-fluve, inc.

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This document is intended as a general guideline for sampling sediment deposited upstream of dams in relation to Inter-Fluve projects involving dam removal or modification, where testing of potential contaminants is required.

These guidelines are taken largely from the State of Wisconsin sampling guidelines and are generally in accordance with standard protocols as presented in US- EPA-823-B-01-002, 2001, *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analysis: Technical Manual*. Refer to the EPA manual for a more detailed discussion of study plans, collection, and processing of samples. Individual projects and states may have specific requirements, and individual laboratories may have alternative instructions for data collection.

This document covers sampling procedures, and does not address sampling experimental design. For more detailed guidance in designing statistically robust sampling plans, consult the US EPA and the local state environmental agency.

Part 1: General Sediment Sampling Procedure

1. Scope

1.1. This section describes general procedures for sediment sampling and the use of common sediment sampling equipment. Study goals may require additional or alternate equipment or procedures other than those discussed herein. Any procedure changes should be based on sound scientific and practical reasons and should ultimately help further the goals of the study without the loss of quality assurance and control.

2. Equipment and Supplies

2.1. Below is a suggested list of equipment needed for most sediment sampling efforts. This list suggests equipment that may be necessary for your project and should not be considered exhaustive. Equipment that is specific to a specialized type of sampling may be included only in the section describing the particular type of sampling.

2.2. Equipment Checklist

- Boat, anchor, motor, gas tank, tow vehicle
- Life jackets
- Protective clothing: boots, waders, gloves, rain gear, etc.
- First aid kit
- Mobile phone
- Maps: road and site maps
- Compass and measuring equipment
- Electronic location device (Loran or GPS)
- Field notebook and field sheets
- Waterproof pens and pencils
- Field measurement equipment (temperature, dissolved oxygen, etc.)
- Sample containers
- Sample labeling tape or paper and permanent marker
- Sediment pole for measuring depth
- Coring device and dredge or grab with adequate rope and extension poles (grab is backup for corer in sandy sediments), including extension poles.
- Slide hammer for corer
- Pliers, wrenches, etc. for adjusting equipment
- Mixing bowl and spoon
- Cleaning (decontamination) supplies (non-ionic detergent, tub, brushes, etc.)
- Wash bottles
- Ice chest and ice for cooling samples
- Extra rope

2.3. Equipment suitability for chemical analysis:

2.3.1. All equipment or sample containers that will come into contact with a sediment sample for chemical analysis should be constructed of materials that will not affect the concentration of contaminants in the sediment sample. In general, sediment samples to be analyzed for metals should not touch metallic surfaces (other than stainless steel), and samples for organic analysis should not contact materials that can react with organic substances. The level of care that needs to be taken with the materials used will depend on the level and types of contaminants associated with the sediment and the quality assurance needs and study goals.

2.3.2. For **organic analysis**, equipment and containers should be constructed of: *glass, teflon, polycarbonate, nylon, aluminum, galvanized steel, stainless steel or porcelain*. *Acrylic* core tubes are also acceptable for almost all sampling needs.

2.3.3. For **inorganic analysis**, equipment and sample containers should be constructed of: *glass, teflon, polyethylene polycarbonate*, *stainless steel* or *acrylic*.

3. Basic Sediment Sampling Procedures

3.1. Preparation

3.1.1. Sampling Plan - Sampling strategy decisions and sampling locations should be made well before going into the field, and should be designed to collect quality data that will best answer the questions or meet the goals of the study or monitoring program. Reconnaissance level or statistically robust screening level plans should be in place prior to field work. Decisions should be made ahead of time about sample location, number of replicates at each site (sampling strategy), and what chemical analyses to be performed on the samples. This will help ensure that appropriate and quality samples are collected.

3.1.2. Safety - All field staff should be aware of and fully understand the possible physical and chemical safety hazards posed by any site. Precautions should be taken to prevent exposure to contaminated sediments.

3.1.3. Equipment - Make all the preparations necessary to obtain suitable collecting equipment, protective clothing, vehicle and boat. Test and calibrate any equipment according to manufacturer's instructions. Record in the field notebook information about the instrument tests and calibrations including: dates, results and person testing the equipment. It may help to label sample containers for each site prior to sampling.

3.1.4. Cleaning Equipment - All equipment should be cleaned *before going into the field and between sites and samples* to prevent contaminating sediment samples. Equipment should be washed with clean scrub brushes using a non-phosphate detergent that leaves no residue when rinsed such as Alconox powdered or Liqui-nox liquid detergent (Liqui-nox is the EPA standard detergent for sampling apparatus). To properly clean equipment, wash apparatus thoroughly with detergent, then rinse 5-6 times with tap water and 3 times with deionized/distilled water if available. Rinse the apparatus with site water before taking the first sediment sample.

3.1.5. Field Observations - Take turbidity or Secchi readings first if possible, before the sediment is suspended by other sampling procedures. Record all field measurements and observations.

3.2. General Procedures in the Field

3.2.1. Turn on any equipment that needs to warm up (like a DO meter) first or before reaching the site.

3.2.2. Make sure all equipment is clean and ready to use.

3.2.3. When working from a boat, two or three anchors or spuds driven into the sediment in shallow water will help stabilize boat in breezy, open water conditions.

3.2.4. Each grab or core attempt, whether for a composite sample or replicates, should be taken from undisturbed sediment at the site. Avoid disturbing sediments with a boat motor or by walking on the site. Approach sites from downstream to avoid suspending sediment into the water column over the site.

3.2.5. Have container ready to accept entire sample quickly upon retrieval.

3.2.6. Label every sample container with a permanent marker on labeling tape on the side of the jar or wherever the label will not come off accidentally. Information on the label should include: **Sample #, replicate #, date, collector name** and **analysis type** (organic, inorganic).

3.2.7. Record all site information in a field notebook or on fieldsheets before leaving site. Information usually includes: field measurements, time and date, persons collecting samples, number and types of samples taken including field blanks, etc., labels assigned to each sample, and any general observations. Keep records of all samples, how they were labeled and any blanks or controls that are submitted for analysis.

3.3. Collecting Composite Samples

3.3.1. Composite samples are generally used to estimate the average concentration of the individual samples that make up the composite. Multiple grabs or cores for a composite sample should be taken from a relatively homogeneous sediment deposit (i.e., all grabs should be of similar sand/silt content). In some cases, composite samples are needed to generate sufficient sample volume for all analyses. It is best to know the rough boundaries of the sediment deposit or "site" before sampling.

3.3.2. Place each grab or core into a single mixing bowl (made of suitable material), remove any large objects such as sticks, leaves or stones, etc. and stir thoroughly with a spoon to homogenize. A single grab or core should be mixed at least two minutes. Multiple grab or core samples should be mixed five minutes or longer if necessary.

3.3.3. Fill sample jars with the sediment mixture by placing one spoonful sequentially into each jar until the jars are full (see section on sample containers). This sub-sampling system assures that each sample container contains a sample as similar as possible to the other containers.

3.4. Collecting Replicate Samples

3.4.1. Replicate samples can be obtained at different stages of the sampling for different purposes depending on the objectives of the study. A study plan should describe where and how much replication is necessary. The procedures described here are for collecting distinct field replicate samples where the object is to determine the variability within a deposit and compare one field site to another.

3.4.2. When collecting replicate samples to statistically compare sediment deposits, sample sites within each deposit should be randomly located for statistical comparisons to be valid.

3.4.3. Be sure each sample is taken from an undisturbed area of sediment

3.4.4. If the replicate samples are fairly similar, the equipment need only be rinsed with site water between samples. But, if the replicates are not similar, and some contain significantly more fines than others, than the core tube or dredge may need to be washed with a non-ionic detergent (see equipment) and rinsed in between samples to prevent cross-contamination and to keep replicate samples independent for valid statistical analysis of the data. Use a tub of water in the boat to wash equipment to prevent getting detergent in the site water while sampling.

4. Procedures for Core and Grab Sampling Devices

4.1. Sediment samples are most commonly collected using a coring device, dredge or grab sampler. The type of collecting equipment chosen will depend on sediment texture, site location (depth and current velocity), analyses to be performed and study goals. See **References** for more detailed discussion of the pros and cons of various sampling devices.

4.2. Piston Corer

4.2.1. Preparation and Scope

4.2.1.1. A corer allows excellent quantitative and qualitative sampling to a specified sediment depth with little disturbance of the sediment water interface. Samples can be separated or stratified by depth or color/texture to analyze distinct layers of sediment, although the sediment along the side of the core may smear as the core penetrates, slightly distorting the stratification of the sediment.

4.2.1.2. A corer may not be able to penetrate and/or retain very sandy substrates. Coring in high clay-content sediments where grabs won't work is possible if the water is not too deep, but may be difficult with a push corer and may require the use of a slide hammer or vibrating corer.

4.2.1.3. A large bore corer will provide a larger volume of sediment per attempt. This is important if discreet sample replicates are desired, and enough sample must be collected for a specific analysis or test. Even with the large bore core tube, samples may need to be combined to obtain enough sediment volume for the required analyses and/or tests.

4.2.1.4. A hand-operated, 3 inch diameter core sampler with an optional piston and extensions for deeper water can be effectively used in soft sediments with some silt/clay content in water up to ~30 ft deep. Core samplers may not be able to penetrate or retain very sandy sediments.

4.2.2. Collection Procedure

4.2.2.1. This procedure can be used for a push corer with or without a piston. A piston may not be necessary in high clay sediments. Disregard directions for use of the piston if piston will not be used.

4.2.2.2. Assemble the corer. Adjust the piston (the nut on the bottom adjusts piston diameter) so that it fits snugly. If the piston is too loose, it will not stay in place until the corer reaches the sediment. If too tight, the piston will not move sufficiently when the corer is being pushed into the sediment, and compaction of the sediment core may occur.

4.2.2.3. Position the piston at the bottom of the core tube (open end), with the rope attached and threaded through the core head.

4.2.2.4. With the piston in place, let the core tube fill with water from the top, then lower the corer slowly and vertically to the sediment. If the piston falls out the bottom or moves up the core tube before reaching the sediment, tighten piston slightly and try again.

4.2.2.5. With the bottom edge of the corer and the piston in contact with the sediment in a vertical position, push the core tube into the sediment while maintaining some tension on the piston rope. The piston should remain at the sediment surface while the core tube moves into the sediment. In difficult sediments, it may be necessary to actually pull on the rope as the corer is pushed into the sediment. The object however is to maintain the piston in a fixed position at the sediment-water interface without compacting the sediment.

4.2.2.6. In hard or clay sediments where it is difficult to push the corer into the sediment by hand, a slide hammer designed specifically for the core sampler should be used. Do not pound on the core head or extension tubes with a hammer or anything else as this could break or damage the core head or other parts, and is generally less effective than the slide hammer.

4.2.2.7. After core is pushed to desired depth, pull up the corer slowly while maintaining the position of the piston by holding the piston rope in place. Even with the piston, some sediment may be lost from the bottom of the corer if the sediment is sandy. To help prevent sample loss, bring the corer into a horizontal position as it reaches the surface. A plug can also be inserted into the bottom of the sampler before removal from the water.

4.2.2.8. Place the corer on the work surface (boat or ice) over the receiving container. The sediment core can be extruded from the top or bottom of the core tube, depending on the purpose of the sample and study goals. Generally, cores collected for macroinvertebrate work should be extruded out the bottom, and cores collected for chemical analysis should be extruded out the top of the core tube if only part of the segment is needed to reduce contamination of the sample segment from other layers.

4.2.2.9. To extrude through the bottom, remove the sampler head, insert a pole through the top and push down on the piston eyebolt. Extrude the core into a waste container until the desired length of core remains, then extrude the remaining sediment into the sample container. To extrude through the top, remove the sampler head and place an extrusion pole and rubber plug at the bottom of the sampler and push sediment out through the top slowly. A premarked acrylic or polycarbonate (clear) core tube is helpful for measuring core lengths.

4.3. Grab Samplers

4.3.1. Preparation and Scope

4.3.1.1. Grab samplers rely on their own weight and gravity to penetrate the sediment as well as the leverage from the closing of the jaws. For this reason, they are not as efficient in water flowing over one meter per second. They normally take a discreet "bite" of sediment to a fairly consistent and measurable depth. Grabs often cause a shock wave upon descent which may disturb very fine sediment at the sediment-water interface.

4.3.1.2. Many grabs and dredges such as the petite Ponar and Ekman dredge can be used. These two can be hand operated from a suitably sized boat, preferably flat-bottomed. The Ponar is better suited to sampling hard or sandy sediments because of the greater ability to penetrate. The Ekman is more suited to sampling in soft sediments in low flow waters. Neither grab will effectively sample hard clays where a coring device or shovel such as a sharpshooter spade can be used.

4.3.1.3. Have a sample tub ready to receive sediment that is large enough to receive the entire contents of the sampler.

4.3.1.4. Understand and be careful of the closing mechanism and moving parts on a sampler.

4.3.2. Collection Procedure

4.3.2.1. Set closing mechanism and lower grab slowly to substrate, being careful to avoid a shock wave caused by too rapid of a descent near the sediment.

4.3.2.2. Initiate closure mechanism of grab. This is usually a messenger sent down the rope or a sharp pull on the rope.

4.3.2.3. When it feels like the grab has closed and contains sediment, raise grab at a steady rate and immediately position over large bucket. If jaws are not completely closed due to obstructions, discard entire grab contents away from sampling area and try again.

Make sure to move the sampling site at least several feet away from the previous attempt(s) to avoid sampling a disturbed area.

4.3.2.4. If the study dictates careful sampling for metals analysis, the middle portion of the sample not touching the metal grab can be collected with a teflon or plastic spoon, and the rest of the sample discarded.

4.3.2.5. Empty entire contents of grab into mixing bowl if sample needs to be mixed.

4.3.2.6. Place appropriate volume of sediment into sample container.

4.3.3. Quality Control Measures

4.3.3.1. Sediment samples should be collected from the reference or control sites first when possible to reduce the chances of cross-contamination from other sites.

4.3.3.2. All samples in a study should be handled identically, including using the same sampling equipment, stirring times, etc.

4.3.3.3. When collecting samples for chemical or toxicity tests, take appropriate measures to prevent contamination from other sources such as vehicle and boat motor exhaust or associated contaminants and other contaminated sites. The person operating the boat motor should either not handle sediment samples or make sure to put on clean gloves to prevent contamination from the motor.

5. References

Baudo, R., Giesy, J., and H. Muntau, (Eds.). 1990. *Sediments: Chemistry and Toxicity of In-Place Pollutants*. Lewis Publishers, Boca Raton, FL.

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EPA. 1994. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates.

Green, Roger H. 1979. Sampling design and statistical methods for environmental biologists. John Wiley & Sons. New York. 257 pp.

Klemm, D.J., P.A. Lewis, F. Fulk, and J.M. Lazorchak. 1990. Macroinvertebrate field and laboratory methods for evaluating the biological integrity of surface waters. Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Cincinnati, OH 45268. EPA/600/4-90/030.

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Part 2: Collecting and Processing Samples for Chemical and Physical Analysis

1. Scope

1.1. Quality data can only be obtained from environmental samples that are properly collected, preserved and promptly shipped to the laboratory for analysis. The procedures involved in this process include: 1) collecting the samples using appropriate sampling techniques; 2) selecting proper sample containers; 3) preserving the samples immediately after collection either chemically or by cooling to 4°C, whichever is appropriate; 4) clearly identifying the samples and completing the corresponding laboratory sheets; and 5) carefully packaging and promptly shipping the samples to the laboratory for analysis.

1.2. Sediments for organic and inorganic chemical analyses are most often collected using grab, dredge or core methods. The chosen method should target the goals of the study plan and complement any other biological tests that may be conducted at the site or with sediments from the site. Samples slated for different types of physical and chemical analysis may need to be collected and handled in slightly different ways. The level of precautions that must be taken to prevent contamination of samples will depend on the type of analysis to be performed and the study objectives.

2. Equipment

2.1. Sample Containers - Samples for organic analysis and inorganic (metals) analysis must be in separate containers. Containers are prepared by and should be obtained from the laboratory doing the analyses. General guidelines are as follows:

2.2. Sample Containers for Inorganic Analysis

2.2.1. Sediment samples should be submitted to the laboratory in a container appropriate for the analyses requested.

2.2.2. Metals - Samples that require metals analyses should be submitted either in 250 mL "metals" bottles or a glass quart mason jar with teflon lid. One 250 mL "metals" bottle (same as for water) provides enough sample to perform all of the routine metals analyses and solids analyses.

2.2.3. Nutrients - Samples that require nitrogen, phosphorus and solids analyses should be submitted in 250 mL "nutrient" bottles or a glass quart mason jar with teflon lid.

2.2.4. Oil & Grease - Samples for Oil & Grease are analyzed by the inorganic section and must be in a glass quart jar with a teflon lined lid. Fill jar 3/4 full or more. Separate containers for metals or nutrients are not necessary if the glass quart jar is used.

2.2.5. Additional information can be obtained from:

<u>*East Coast*</u>

Tim Byrne
GeoLabs, Inc.
Sales Director/
Environmental Scientist
45 Johnson Lane
Braintree, MA 02184
P 1-781-848-7844
F 1-781-848-7811
C 1-781-420-1178

2.3. Sample Containers for Organic Analysis

2.3.1. Soil and sediment samples should be submitted to the laboratory in a container appropriate for the analyses requested.

2.3.2. Organics (PCBs, PAHs, etc.) - Samples for all regular organics analysis should be contained in glass quart jars with teflon lined lids. Jars should be 3/4 full or more. If analyzing for semi- or volatile organics fill jar completely so no air space exists.

2.3.3. Volatile Organic Carbon (VOC) and Gasoline Range Organics (GRO) - A 60 milliliter glass vial with a septum top should be used for soil and sediment samples that are to be analyzed for VOC and GRO. The laboratory will provide three pre-weighed sample vials for each sample site. The vials should be filled with sediment to the "Fill to here---" label (approx. 25g) found on the side of each vial. A water and methanol "trip blank" will be included in each sample mailer.

2.3.4. Diesel Range Organics (DRO) - A 60 milliliter glass vial should be used for soil samples that are to be analyzed for DRO. The laboratory will provide three preweighed sample vials for each sample site. The vials should be filled with soil to the "Fill to here---" label (approx. 25g) found on the side of each vial.

2.4. Samples for Bioassays <u>and</u> Chemical and Physical analyses

2.4.1. If chemical and/or physical analyses are required on sediment samples also slated for toxicity or bioaccumulation tests, the lab can perform the sediment homogenization and fill sample jars for the chemical analyses from the same sediment that will be used for the bioassays. The testing lab should be contacted for information on appropriate sample containers and procedures.

2.5. Samples for Particle size analysis

2.5.1. Quart-size plastic bags (from the store) can be used for particle size samples. **Double bag** the sample and fill 1/2-3/4 full. Label **both** bags in permanent marker with Sample #, date and collector's name. Particle size analysis is usually contracted for every chemical analysis sample, but be sure to clarify this testing with the lab and collect sediment for this analysis.

2.6. Quality Control of Sample Containers

2.6.1. Quality control audits should be conducted for chemical analysis to verify that they are free from contaminants. These audits are performed before any bottles are approved for use. Because of the considerable effort expended in assuring the quality of sample bottles, it is important that they be used only for the parameters specified on the label.

2.6.2. To make sure appropriate procedures are used to prevent contamination, quality control information should be obtained from analysis laboratories when the contract for service is generated.

3. Cleaning Sediment Collection Equipment

3.1. The following steps for cleaning new or used sediment sampling equipment and containers are recommended by EPA (1994):

3.1.1. Soak 15 min in tap water, and scrub with detergent.

3.1.2. Rinse twice with tap water.

3.1.3. Rinse once with fresh, dilute (10% V:V) hydrochloric or nitric acid. To prepare a 10% solution of acid, add 10 ml of concentrated acid to 90 ml of deionized water.

3.1.4. Rinse twice with deionized water.

3.1.5. Rinse once with full-strength, pesticide-grade acetone (use a fume hood or canopy).

3.1.6. Rinse three times with deionized water.

3.1.7. Rinse field collection equipment with site water immediately before use. Lab equipment should be rinsed with test dilution water immediately before use in a test.

3.1.8. Clean equipment can be protected from contamination during transport (i.e., exhaust, pickup beds, boat motors, etc.) by wrapping in aluminum foil.

3.1.9. Quality control procedures to be followed at the sites should be written down for all field staff.

4. <u>Sample Preservation</u>

4.1. All sediment samples for chemical analysis should be preserved as soon as possible after collection by cooling to and **maintaining** a temperature of ~4°C (ice cold) by putting samples on ice in a cooler.

4.2. Keep samples shaded from sunlight to prevent breakdown of chemicals by UV light.

4.3. Ice packs should be included in each sample kit designed for VOC, GRO and DRO analysis, although samples should first be cooled to 4°C on ice. Plastic bottles can also be filled with water, frozen, and placed in the shipping container. Samples should be pre-chilled if these cooling materials are used for shipping.

4.4. For soil or sediment samples to be analyzed for GRO, it may be required to add 25 ml of premeasured methanol to two of the sample vials at the time of collection. (Vials of methanol should be provided by the lab) A third vial is used for determining moisture of the sample.

4.5. For soil samples to be analyzed for VOCs, the collector should consult the laboratory and the individual program needs for the appropriate preservation requirements which may include methanol preservation.

4.6. Contact the contracted laboratory for additional preservative requirements for specific parameter requests.

5. <u>Packaging and Shipping</u>

5.1. Cooling Samples

5.1.1. When cooling is required during shipping, the samples should be pre-cooled in an ice chest, and later placed in a field pack with a suitable quantity of ice or "Blue Ice". Ice should not be placed in the field pack loose. It should be securely sealed in a heavy plastic bag to prevent leakage during shipment. DO NOT USE metals bottles, nutrient bottles, or bottles designated for specific tests as ice containers.

5.2. Packing Samples

5.2.1. Properly packaging sediment samples for shipping is important for maintaining sample quality and safety of persons contacting the samples.

5.2.2. After collection, check each sample to make sure the container lid is securely closed and the sample is properly preserved. The exterior of each sample container should be wiped clean with a wet cloth.

5.2.3. Check all samples for secure, correct and complete labels that match the accompanying lab sheets (see below).

5.2.4. A whirl-pak or ziploc plastic bag should be used to protect the laboratory sheets from moisture damage during shipment. Dividers, included in the packs, help protect the sample bottles during shipment and should be used whenever possible. When sealing the field packs, secure all four sides of the lid by wrapping with reinforced tape. The tape should be completely wrapped around the pack to make sure that the lid is secure. When more than one field pack is needed to ship various sample portions from a single sampling site, tape the field packs together. This will prevent sample sorting errors and will allow the lab to match the bottles with the correct laboratory sheets.

5.2.5. A cooler lined with a polyethylene bag can be used instead of the foam pack if necessary, but be sure to pack sample jars to avoid breakage during shipping and handling.

5.3. Laboratory Sheets

5.3.1. Different laboratories may have their own lab sheets that should accompany all samples. Generally, lab sheets should include:

- Sample identification
- Sample description
- Sampling program
- Name and address of the person to whom the report should be sent
- Last name of the sample collector
- Field information
- Tests (parameters) requested

5.3.2. The laboratory sheet is an important link between the laboratory and field personnel. The laboratory relies on the sheet to obtain the information necessary to prepare and analyze the sample properly.

5.4. Shipping Samples

5.4.1. If storage time limitations are recommended for the sample parameters, coordinate with the laboratory before collecting samples to let them know the sampling schedule.

5.4.2. Alert the receiving laboratory of any samples that are known or believed to contain high levels of specific contaminants, including an estimated concentration if possible. This can be done either over the phone before the samples arrive or with an enclosed written warning. The advanced notice allows the lab to handle highly contaminated samples in a way to prevent human exposure as well as cross-contamination of samples in the lab. Additionally, the lab will be able to process and analyze the samples more quickly if they know before analysis that the contaminant concentration is high.

5.4.3. Samples should be shipped with an "overnight" mail service or personally delivered to the laboratory for temporary storage so that the samples arrive before all of the ice melts in the shipping container. Monday, Tuesday or Wednesday are the best days to ship samples to assure they do not sit in a mail room with no refrigeration over the weekend. Even "overnight mail" can take longer than 24 hours, so Thursdays can be risky. DO NOT send samples on Fridays unless you have made previous arrangements with the lab.

5.5. Shipping Safety

5.5.1. If a sample bottle seal is questionable and no additional bottles are available, place the entire bottle in a whirl-pak (250 mL bottles only). This will contain the sample and prevent any preservative from contaminating other samples in the field pack.

5.5.2. The outside of the sample containers should be completely free of contaminated material before the samples are shipped. If this is not possible, the laboratory should be made aware of these samples before shipment.

5.5.3. If the submitter believes a sample contains a Department of Transportation (DOT) regulated material or hazardous material, refer to individual state shipping guidelines for hazardous materials.

6. References

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WI State Laboratory of Hygiene. 1994. Organic Chemistry Manual.

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Adapted from State of Wisconsin Sediment Sampling Guidelines

Appendix C – Sediment Contamination Results

Constituent	CAS Number	Units	Method	NR 720 Non-Industrial DC RCL	NR 720 Soil to Groundwater RCL (DF = 2)	Background Threshold Value (BTV)	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	US-1
Inorganics																	
Solids, Percent		%Passing	EPA 8000C	-	-	-	16.6	22.3	20.7	18.3	19.4	16.8	22.0	27.5	30.7	13.8	50.5
Ammonia Nitrogen	7664-41-7	mg/kg	SM 4500-NH3H	-	-	-	2.93 [M]	2.74 [M]	2.36	4.78	10.1	5.44	24.8	1.54	3.22	8.04	0.471
Bulk Density		gTS/cm3		-	-	-	0.26	0.20	0.24	0.21	0.24	0.27	0.17	0.25	0.28	0.21	0.71
Phosphorus	7723-14-0	mg/kg	EPA 365.4	-	-	-	1090 [M,B]	1750	2080 [B]	2760 [B]	1370 [B]	1090 [B]	510 [B]	1520 [B]	1120 [B]	424	531
Total Organic Carbon as % OM		%	MOSA 29-4,3,2,4	-	-	-	25.5	31.9 [M,B]	30.1	68.8	23.3	25.0	19.0	21.2	17.3	24.1	9.9
Nitrogen Kjeldahl		mg/kg	EPA 351.2	-	-	-	98.2 [M]	160	212	380	114	138	35.5	106	71.7	31.3	42.4
Nitrate Nitrogen	14797-55-8	mg/kg	EPA 9056A	100000	-	-	<2.4	4.86	4.89	<2.2	5.04	<2.4	4.50	3.48	4.16	<2.9	2.04
Nitrite Nitrogen	14797-65-0	mg/kg	EPA 9056A	7820	-	-	<9.0	12.8	12.2	<8.2	<7.7	<8.9	8.63	6.21	6.77	<11	3.70
Metals																	
Antimony	7440-36-0	mg/kg	EPA 6010C	31.3	0.542	-	<2.0	<4.9	<5.6	<6.5	<5.9	<1.9	<1.5	<4.1	<3.6	<2.5	<2.2
Arsenic	7440-38-2	mg/kg	EPA 6010C	0.677	0.584	8	5.3	9.0	8.5	11.7	8.2	4.7	7.3	33.2	4.5	<1.3	1.3
Beryllium	7440-41-7	mg/kg	EPA 6010C	156	6.32	-	0.13	0.31	0.34	0.10	0.26	0.16	0.22	0.41	0.28	<0.040	0.066
Cadmium	7440-43-9	mg/kg	EPA 6010C	71.1	0.752	1	<0.076	<0.19	<0.21	<0.24	<0.22	<0.070	<0.058	<0.16	<0.14	<0.092	<0.084
Chromium	7440-47-3	mg/kg	EPA 6010C	-	360000	44	4.1	14.0	16.0	<7.2	16.3	13.7	12.1	14.9	10.7	<2.7	9.3
Copper	7440-50-8	mg/kg	EPA 6010C	3130	91.6	35	1.4	41.8	45.3	2.0	39.5	36.6	30.5	38.6	32.0	14.2	15.3
Lead	7439-92-1	mg/kg	EPA 6010C	400	27	52	43.0	74.9	68.2	8.5	111	55.0	97.9	65.7	151	4.9	53.8
Nickel	7440-02-0	mg/kg	EPA 6010C	1550	13.0612	31	3.3	11.6	12.8	5.2	13.1	9.1	9.7	20.0	11.0	1.7	10.1
Selenium	7782-49-2	mg/kg	EPA 6010C	391	0.52	-	4.1	<6.5	<7.3	<8.4	<7.7	<2.4	<2.0	<5.4	<4.7	<3.2	<2.9
Silver	7440-22-4	mg/kg	EPA 6010C	391	0.849	-	<0.51	<1.3	<1.4	<1.6	<1.5	0.57	0.58	<1.1	<0.91	<0.62	<0.56
Thallium	7440-28-0	mg/kg	EPA 6010C	0.78	0.284	-	3.3	2.5	2.2	<2.3	2.3	1.5	1.5	3.2	2.4	<0.89	1.1
Zinc	7440-66-6	mg/kg	EPA 6010C	23500	-	150	48.9	127	226	308	217	138	163	135	227	38.7	116
Mercury	7439-97-6	mg/kg	EPA 7471B	3.13	0.208	-	0.60	0.54	0.63	<0.015 [V]	0.71	0.32	1.1	0.48	0.56	<0.0038	0.034
Trivalent Chromium	16065-83-1	mg/kg	EPA 6010C	100000	-	-	<2.3	14.0	16.0	<7.2	-	13.7	8.40	14.9	10.7	-	-
Hexavalent Chromiunm	18540-29-9	mg/kg	EPA 7196 A	0.301	-	-	3.43 [J]	<1.70	<1.70	<1.70	-	<1.70	3.68 [J]	<1.70	<1.70	-	-
PCBs																	
Aroclor-1016	12674-11-2	mg/kg	EPA 8082A	4.11	-	-	<0.024	<0.018	<0.019	<0.020	-	<0.024	<0.018	<0.014	-	-	-
Aroclor-1221	11104-28-2	mg/kg	EPA 8082A	0.21	-	-	<0.042	<0.031	<0.034	<0.036	-	<0.042	<0.031	<0.025	-	-	-
Aroclor-1232	11141-16-5	mg/kg	EPA 8082A	0.19	-	-	<0.042	<0.031	<0.034	<0.036	-	<0.042	<0.031	<0.025	-	-	-
Aroclor-1242	53469-21-9	mg/kg	EPA 8082A	0.24	-	-	<0.036	<0.027	<0.029	<0.031	-	<0.036	<0.027	<0.022	-	-	-
Aroclor-1248	12672-29-6	mg/kg	EPA 8082A	0.24	-	-	<0.030	<0.022	<0.024	<0.026	-	<0.030	<0.022	<0.018	-	-	-
Aroclor-1254	11097-69-1	mg/kg	EPA 8082A	0.24	-	-	<0.030	<0.022	<0.024	<0.026	-	<0.030	<0.022	<0.018	-	-	-
Aroclor-1260	11096-82-5	mg/kg	EPA 8082A	0.24	-	-	<0.018	<0.013	<0.014	<0.015	-	<0.018	<0.013	<0.011	-	-	-
Total PCBs	1336-36-3	mg/kg	EPA 8082A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrocarbons																	
Diesel Range Organics		mg/kg	WDNR DRO	-	-	-	393 [L]	26.5 [L]	68.8 [L]	37.8 [L]	294 [L]	121 [L]	261 [L]	133 [L]	191 [L]	214 [L]	138 [L]
Gasoline Range Organics		mg/kg	WDNR GRO	-	-	-	<6.6	<4.9	<5.3	<6.0	<5.7	<6.5	<5.0	<4.0	<3.6	<8.0	<2.2
VOCs																	
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg	EPA 8260C	2.78	0.0534	-	<0.17	<0.13	<0.14	<0.15	<0.14	<0.17	<0.13	<0.10	<0.091	<0.20	<0.055
1,1,1-Trichloroethane	71-55-6	mg/kg	EPA 8260C	640	0.1402	-	<0.14	<0.11	<0.12	<0.13	<0.12	<0.14	<0.11	<0.087	<0.078	<0.17	<0.047
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	EPA 8260C	0.81	0.000156	-	<0.13	<0.099	<0.11	<0.12	<0.11	<0.13	<0.10	<0.080	<0.072	<0.16	<0.044

Stoughton Millpond Sediment Sampling Results
Compared to NR 720 RCLs

Constituent	CAS Number	Units	Method	NR 720 Non-Industrial DC RCL	NR 720 Soil to Groundwater RCL (DF = 2)	Background Threshold Value (BTV)	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	US-1
1,1,2-Trichloroethane	79-00-5	mg/kg	EPA 8260C	1.59	0.0032	-	*<0.096*	*<0.072*	*<0.077*	*<0.087*	*<0.082*	*<0.095*	*<0.073*	*<0.058*	*<0.052*	*<0.12*	*<0.032*
1,1-Dichloroethane	75-34-3	mg/kg	EPA 8260C	5.06	0.4834	-	*<0.15*	*<0.11*	*<0.12*	*<0.14*	*<0.13*	*<0.15*	*<0.11*	*<0.091*	*<0.082*	*<0.18*	*<0.049*
1,1-Dichloroethene	75-35-4	mg/kg	EPA 8260C	-	0.0050	-	*<0.16*	*<0.12*	*<0.13*	*<0.14*	*<0.13*	*<0.15*	*<0.12*	*<0.094*	*<0.085*	*<0.19*	*<0.051*
1,1-Dichloropropene	563-58-6	mg/kg	EPA 8260C	-	-	-	*<0.066*	*<0.049*	*<0.053*	*<0.060*	*<0.057*	*<0.065*	*<0.050*	*<0.040*	*<0.036*	*<0.080*	*<0.022*
1,2,3-Trichlorobenzene	87-61-6	mg/kg	EPA 8260C	62.60	-	-	*<0.13*	*<0.099*	*<0.11*	*<0.12*	*<0.11*	*<0.13*	*<0.10*	*<0.080*	*<0.072*	*<0.16*	*<0.044*
1,2,3-Trichloropropane	96-18-4	mg/kg	EPA 8260C	0.01	0.052	-	*<0.13*	*<0.099*	*<0.11*	*<0.12*	*<0.11*	*<0.13*	*<0.10*	*<0.080*	*<0.072*	*<0.16*	*<0.044*
1,2,4-Trichlorobenzene	120-82-1	mg/kg	EPA 8260C	24	0.4080	-	*<0.18*	*<0.13*	*<0.15*	*<0.16*	*<0.15*	*<0.18*	*<0.14*	*<0.11*	*<0.098*	*<0.22*	*<0.059*
1,2,4-Trimethylbenzene	95-63-6	mg/kg	EPA 8260C	219	1.3788	-	*<0.16*	*<0.12*	*<0.13*	*<0.14*	*<0.13*	*<0.15*	*<0.12*	*<0.094*	*<0.085*	*<0.19*	*<0.051*
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg	EPA 8260C	0.0075	-	-	*<0.24*	*<0.18*	*<0.19*	*<0.22*	*<0.21*	*<0.24*	*<0.18*	*<0.15*	*<0.13*	*<0.29*	*<0.079*
1,2-Dibromoethane	106-93-4	mg/kg	EPA 8260C	0.05	0.000028	-	*<0.14*	*<0.10*	*<0.11*	*<0.13*	*<0.12*	*<0.14*	*<0.10*	*<0.083*	*<0.075*	*<0.17*	*<0.045*
1,2-Dichlorobenzene	95-50-1	mg/kg	EPA 8260C	376	1.168	-	*<0.17*	*<0.13*	*<0.14*	*<0.16*	*<0.15*	*<0.17*	*<0.13*	*<0.11*	*<0.095*	*<0.21*	*<0.057*
1,2-Dichloroethane	107-06-2	mg/kg	EPA 8260C	0.652	0.0028	-	*<0.14*	*<0.10*	*<0.11*	*<0.13*	*<0.12*	*<0.14*	*<0.10*	*<0.083*	*<0.075*	*<0.17*	*<0.045*
1,2-Dichloropropane	78-87-5	mg/kg	EPA 8260C	3.40	0.0034	-	*<0.072*	*<0.054*	*<0.058*	*<0.065*	*<0.062*	*<0.071*	*<0.055*	*<0.044*	*<0.039*	*<0.087*	*<0.024*
1,3,5-Trimethylbenzene	108-67-8	mg/kg	EPA 8260C	182	1.3788	-	*<0.13*	*<0.099*	*<0.11*	*<0.12*	*<0.11*	*<0.13*	*<0.10*	*<0.080*	*<0.072*	*<0.16*	*<0.044*
1,3-Dichlorobenzene	541-73-1	mg/kg	EPA 8260C	297	1.1528	-	*<0.16*	*<0.12*	*<0.13*	*<0.15*	*<0.14*	*<0.16*	*<0.12*	*<0.098*	*<0.088*	*<0.20*	*<0.053*
1,3-Dichloropropane	142-28-9	mg/kg	EPA 8260C	1490	-	-	*<0.18*	*<0.13*	*<0.15*	*<0.16*	*<0.15*	*<0.18*	*<0.14*	*<0.11*	*<0.098*	*<0.22*	*<0.059*
1,4-Dichlorobenzene	106-46-7	mg/kg	EPA 8260C	3.74	0.144	-	*<0.16*	*<0.12*	*<0.13*	*<0.15*	*<0.14*	*<0.16*	*<0.12*	*<0.098*	*<0.088*	*<0.20*	*<0.053*
2,2-Dichloropropane	594-20-7	mg/kg	EPA 8260C	191	-	-	*<0.11*	*<0.081*	*<0.087*	*<0.098*	*<0.093*	*<0.11*	*<0.082*	*<0.065*	*<0.059*	*<0.13*	*<0.036*
2-Butanone	78-93-3	mg/kg	EPA 8260C	28,400	-	-	*<0.54*	*<0.40*	*<0.44*	*<0.49*	*<0.46*	*<0.53*	*<0.41*	*<0.33*	*<0.29*	*<0.65*	*<0.18*
2-Chlorotoluene	95-49-8	mg/kg	EPA 8260C	907	-	-	*<0.16*	*<0.12*	*<0.13*	*<0.14*	*<0.13*	*<0.15*	*<0.12*	*<0.094*	*<0.085*	*<0.19*	*<0.051*
2-Hexanone	591-78-6	mg/kg	EPA 8260C	237	-	-	*<0.66*	*<0.49*	*<0.53*	*<0.60*	*<0.57*	*<0.65*	*<0.50*	*<0.40*	*<0.36*	*<0.80*	*<0.22*
4-Chlorotoluene	106-43-4	mg/kg	EPA 8260C	253	-	-	*<0.16*	*<0.12*	*<0.13*	*<0.14*	*<0.13*	*<0.15*	*<0.12*	*<0.094*	*<0.085*	*<0.19*	*<0.051*
4-Methyl-2-pentanone	108-10-1	mg/kg	EPA 8260C	3360	0.2252	-	*<0.42*	*<0.31*	*<0.34*	*<0.38*	*<0.36*	*<0.42*	*<0.32*	*<0.25*	*<0.23*	*<0.51*	*<0.14*
Acetone	67-64-1	mg/kg	EPA 8260C	63400	3.6766	-	*<1.7*	*<1.3*	*<1.4*	*<1.5*	*<1.4*	*<1.7*	*<1.3*	*<1.0*	*<0.91*	*<2.0*	*<0.55*
Benzene	71-43-2	mg/kg	EPA 8260C	1.60	0.0052	-	*<0.030*	*<0.022*	*<0.024*	*<0.027*	*<0.026*	*<0.030*	*<0.023*	*<0.018*	*<0.016*	*<0.036*	*<0.0099*
Bromobenzene	108-86-1	mg/kg	EPA 8260C	342	-	-	*<0.18*	*<0.13*	*<0.15*	*<0.16*	*<0.15*	*<0.18*	*<0.14*	*<0.11*	*<0.098*	*<0.22*	*<0.059*
Bromochloromethane	74-97-5	mg/kg	EPA 8260C	216	-	-	*<0.060*	*<0.045*	*<0.048*	*<0.055*	*<0.051*	*<0.059*	*<0.046*	*<0.036*	*<0.033*	*<0.072*	*<0.020*
Bromodichloromethane	75-27-4	mg/kg	EPA 8260C	0.42	0.004	-	*<0.096*	*<0.072*	*<0.077*	*<0.087*	*<0.082*	*<0.095*	*<0.073*	*<0.058*	*<0.052*	*<0.12*	*<0.032*
Bromoform	75-25-2	mg/kg	EPA 8260C	25.40	0.0024	-	*<0.11*	*<0.081*	*<0.087*	*<0.098*	*<0.093*	*<0.11*	*<0.082*	*<0.065*	*<0.059*	*<0.13*	*<0.036*
Bromomethane	74-83-9	mg/kg	EPA 8260C	9.60	0.005	-	*<0.24*	*<0.18*	*<0.19*	*<0.22*	*<0.21*	*<0.24*	*<0.18*	*<0.15*	*<0.13*	*<0.29*	*<0.079*
Carbon disulfide	75-15-0	mg/kg	EPA 8260C	738	0.5918	-	*<0.48*	*<0.36*	*<0.39*	*<0.44*	*<0.41*	*<0.48*	*<0.36*	*<0.29*	*<0.26*	*<0.58*	*<0.16*
Carbon tetrachloride	56-23-5	mg/kg	EPA 8260C	738	0.0038	-	*<0.13*	*<0.099*	*<0.11*	*<0.12*	*<0.11*	*<0.13*	*<0.10*	*<0.080*	*<0.072*	*<0.16*	*<0.044*
Chlorobenzene	108-90-7	mg/kg	EPA 8260C	370	-	-	*<0.14*	*<0.10*	*<0.11*	*<0.13*	*<0.12*	*<0.14*	*<0.10*	*<0.083*	*<0.075*	*<0.17*	*<0.045*
Chloroethane	75-00-3	mg/kg	EPA 8260C	-	0.2266	-	*<0.36*	*<0.27*	*<0.29*	*<0.33*	*<0.31*	*<0.36*	*<0.27*	*<0.22*	*<0.20*	*<0.43*	*<0.12*
Chloroform	67-66-3	mg/kg	EPA 8260C	0.45	0.0034	-	*<0.13*	*<0.094*	*<0.10*	*<0.11*	*<0.11*	*<0.12*	*<0.096*	*<0.076*	*<0.068*	*<0.15*	*<0.042*
Chloromethane	74-87-3	mg/kg	EPA 8260C	159	0.0156	-	*<0.30*	*<0.22*	*<0.24*	*<0.27*	*<0.26*	*<0.30*	*<0.23*	*<0.18*	*<0.16*	*<0.36*	*<0.099*
cis-1,2-Dichloroethene	156-59-2	mg/kg	EPA 8260C	156	0.0412	-	*<0.16*	*<0.12*	*<0.13*	*<0.15*	*<0.14*	*<0.16*	*<0.12*	*<0.098*	*<0.088*	*<0.20*	*<0.053*
cis-1,3-Dichloropropene	10061-01-5	mg/kg	EPA 8260C	1210	-	-	*<0.11*	*<0.085*	*<0.092*	*<0.10*	*<0.098*	*<0.11*	*<0.087*	*<0.069*	*<0.062*	*<0.14*	*<0.038*
Dibromochloromethane	124-48-1	mg/kg	EPA 8260C	8.28	0.032	-	*<0.11*	*<0.081*	*<0.087*	*<0.098*	*<0.093*	*<0.11*	*<0.082*	*<0.065*	*<0.059*	*<0.13*	*<0.036*
Dibromomethane	74-95-3	mg/kg	EPA 8260C	34	-	-	*<0.072*	*<0.054*	*<0.058*	*<0.065*	*<0.062*	*<0.071*	*<0.055*	*<0.044*	*<0.039*	*<0.087*	*<0.024*
Dichlorodifluoromethane	75-71-8	mg/kg	EPA 8260C	126	3.0862	-	*<0.24*	*<0.18*	*<0.19*	*<0.22*	*<0.21*	*<0.24*	*<0.18*	*<0.15*	*<0.13*	*<0.29*	*<0.079*
Diisopropyl ether	108-20-3	mg/kg	EPA 8260C	2260	-	-	*<0.18*	*<0.13*	*<0.15*	*<0.16*	*<0.15*	*<0.18*	*<0.14*	*<0.11*	*<0.098*	*<0.22*	*<0.059*
Ethylbenzene	100-41-4	mg/kg	EPA 8260C	8.02	1.57	-	*<0.13*	*<0.094*	*<0.10*	*<0.11*	*<0.11*	*<0.12*	*<0.096*	*<0.076*	*<0.068*	*<0.15*	*<0.042*

Constituent	CAS Number	Units	Method	NR 720 Non-Industrial DC RCL	NR 720 Soil to Groundwater RCL (DF = 2)	Background Threshold Value (BTV)	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	US-1
Hexachlorobutadiene	87-68-3	mg/kg	EPA 8260C	1.63	-	-	<0.17	<0.13	<0.14	<0.15	<0.14	<0.17	<0.13	<0.10	<0.091	<0.20	<0.055
Isopropylbenzene	98-82-8	mg/kg	EPA 8260C	-	-	-	<0.15	<0.11	<0.12	<0.14	<0.13	<0.15	<0.11	<0.091	<0.082	<0.18	<0.049
m & p-Xylene	179601-23-1	mg/kg	EPA 8260C	388	-	-	<0.16	<0.12	<0.13	<0.15	<0.14	<0.16	<0.12	<0.098	<0.088	<0.20	<0.053
Methyl tert-butyl ether	1634-04-4	mg/kg	EPA 8260C	63.80	0.027	-	<0.14	<0.11	<0.12	<0.13	<0.12	<0.14	<0.11	<0.087	<0.078	<0.17	<0.047
Methylene chloride	75-09-2	mg/kg	EPA 8260C	61.80	0.0026	-	<0.18	<0.13	<0.15	<0.16	<0.15	<0.18	<0.14	<0.11	<0.098	<0.22	<0.059
Naphthalene (PAH)	91-20-3	mg/kg	EPA 8260C	5.52	0.6582	-	<0.16	<0.12	<0.13	<0.14	<0.13	<0.15	<0.12	<0.094	<0.085	<0.19	<0.051
n-Butylbenzene	104-51-8	mg/kg	EPA 8260C	108	-	-	<0.16	<0.12	<0.13	<0.14	<0.13	<0.15	<0.12	<0.094	<0.085	<0.19	<0.051
n-Propylbenzene	103-65-1	mg/kg	EPA 8260C	264	-	-	<0.17	<0.13	<0.14	<0.16	<0.15	<0.17	<0.13	<0.11	<0.095	<0.21	<0.057
o-Xylene	95-47-6	mg/kg	EPA 8260C	434	-	-	<0.14	<0.11	<0.12	<0.13	<0.12	<0.14	<0.11	<0.087	<0.078	<0.17	<0.047
p-Isopropyltoluene	99-87-6	mg/kg	EPA 8260C	162	-	-	<0.13	<0.099	<0.11	<0.12	<0.11	<0.13	<0.10	<0.080	<0.072	<0.16	<0.044
sec-Butylbenzene	135-98-8	mg/kg	EPA 8260C	145	-	-	<0.17	<0.13	<0.14	<0.15	<0.14	<0.17	<0.13	<0.10	<0.091	<0.20	<0.055
Styrene	100-42-5	mg/kg	EPA 8260C	867	0.22	-	<0.17	<0.13	<0.14	<0.16	<0.15	<0.17	<0.13	<0.11	<0.095	<0.21	<0.057
tert-Butylbenzene	98-06-6	mg/kg	EPA 8260C	183	-	-	<0.15	<0.11	<0.12	<0.14	<0.13	<0.15	<0.11	<0.091	<0.082	<0.18	<0.049
Tetrachloroethene	127-18-4	mg/kg	EPA 8260C	33	0.0046	-	<0.078	<0.058	<0.063	<0.071	<0.067	<0.077	<0.059	<0.047	<0.042	<0.094	<0.026
Tetrahydrofuran	109-99-9	mg/kg	EPA 8260C	23300	-	-	<0.84	<0.63	<0.68	<0.76	<0.72	<0.83	<0.64	<0.51	<0.46	<1.0	<0.28
Toluene	108-88-3	mg/kg	EPA 8260C	818	1.1072	-	<0.078	<0.058	<0.063	<0.071	<0.067	<0.077	<0.059	<0.047	<0.042	<0.094	<0.026
trans-1,2-Dichloroethene	156-60-5	mg/kg	EPA 8260C	1560	-	-	<0.060	<0.045	<0.048	<0.055	<0.051	<0.059	<0.046	<0.036	<0.033	<0.072	<0.020
trans-1,3-Dichloropropene	10061-02-6	mg/kg	EPA 8260C	1510	-	-	<0.14	<0.10	<0.11	<0.13	<0.12	<0.14	<0.10	<0.083	<0.075	<0.17	<0.045
Trichloroethene	79-01-6	mg/kg	EPA 8260C	1.30	0.0036	-	<0.090	<0.067	<0.073	<0.082	<0.077	<0.089	<0.068	<0.054	<0.049	<0.11	<0.030
Trichlorofluoromethane	75-69-4	mg/kg	EPA 8260C	1230	-	-	<0.24	<0.18	<0.19	<0.22	<0.21	<0.24	<0.18	<0.15	<0.13	<0.29	<0.079
Vinyl acetate	108-05-4	mg/kg	EPA 8260C	1300	-	-	<0.72	<0.54	<0.58	<0.65	<0.62	<0.71	<0.55	<0.44	<0.39	<0.87	<0.24
Vinyl chloride	75-01-4	mg/kg	EPA 8260C	0.07	0.000138	-	<0.060	<0.045	<0.048	<0.055	<0.051	<0.059	<0.046	<0.036	<0.033	<0.072	<0.020
PAHs																	
1-Methylnaphthalene	90-12-0	ug/kg	EPA 8270D-SIM	17600	-	-	63.1	15.4	26.2	9.40	82.3	32.8	76.8	23.9	29.7	11.9	23.7
2-Methylnaphthalene	91-57-6	ug/kg	EPA 8270D-SIM	239000	-	-	111	25.4	44.9	19.6	215	67.4	161	38.1	48.2	19.7	29.2
Acenaphthene	83-32-9	ug/kg	EPA 8270D-SIM	3590000	-	-	76.2	17.6	30.5	4.29	55.7	43.9	64.8	23.9	18.9	13.3	74.6
Acenaphthylene	208-96-8	ug/kg	EPA 8270D-SIM	-	-	-	225	58.0	96.8	17.2	358	106	362	140	178	18.7	47.7
Anthracene	120-12-7	ug/kg	EPA 8270D-SIM	17900000	-	-	155	81.9	180	26.7	305	266	404	122	157	49.0	283
Benzo(a)anthracene	56-55-3	ug/kg	EPA 8270D-SIM	1140	-	-	425	422	714	73.4	1500	1020	1810	545	770	352	1590
Benzo(a)pyrene	50-32-8	ug/kg	EPA 8270D-SIM	115	-	-	321	268	563	48.9	1100	817	1370	468	640	404	1410
Benzo(b)fluoranthene	205-99-2	ug/kg	EPA 8270D-SIM	1150	-	-	518	678	936	195	1990	1360	2440	766	1160	693	2570
Benzo(g,h,i)perylene	191-24-2	ug/kg	EPA 8270D-SIM	-	-	-	290	300	426	43.4	836	528	933	329	492	324	1190
Benzo(k)fluoranthene	207-08-9	ug/kg	EPA 8270D-SIM	11500	-	-	131	168	210	23.2	547	322	644	206	215	183	510
Benzo(e)pyrene	192-97-2	ug/kg	EPA 8270D-SIM	-	-	-	319	308	416	69.1	920	600	1080	376	541	334	1100
Chrysene	218-01-9	ug/kg	EPA 8270D-SIM	115000	-	-	435	390	616	132	1350	801	1540	550	727	363	1350
Dibenzo(a,h)anthracene	53-70-3	ug/kg	EPA 8270D-SIM	115	-	-	61.0	63.9	84.9	6.5	188	83.1	220	71.9	115	23.0	213
Fluoranthene	206-44-0	ug/kg	EPA 8270D-SIM	2390000	-	-	998	1030	1660	325	2930	2110	3520	1140	1510	914	3800
Fluorene	86-73-7	ug/kg	EPA 8270D-SIM	2390000	-	-	180	72.6	114	26.3	207	175	228	72.7	73.5	36.9	127
Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	EPA 8270D-SIM	1150	-	-	286	320	446	67.9	851	568	952	347	500	342	1160
Naphthalene	91-20-3	ug/kg	EPA 8270D-SIM	5520	-	-	551	42.3	98.1	38.5	352	123	231	95.8	74.6	27.7	40.6
Phenanthrene	85-01-8	ug/kg	EPA 8270D-SIM	-	-	-	890	597	976	156	1800	1100	2230	645	806	310	1630
Pyrene	129-00-0	ug/kg	EPA 8270D-SIM	1790000	-	-	920	795	1250	161	2560	1590	2980	1020	1370	713	2940

Stoughton Millpond Sediment Sampling Results
Compared to NR 720 RCLs

Constituent	CAS Number	Units	Method	NR 720 Non-Industrial DC RCL	NR 720 Soil to Groundwater RCL (DF = 2)	Background Threshold Value (BTV)	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	US-1
TOTAL PAH		ug/kg		-	-	-	6955	5653	8888	1443	18147	11713	21247	6980	9426	5132	20089
Insecticides																	
4,4'-DDD	72-54-8	mg/kg	EPA 8081B	1.90	-	-	<0.0018	<0.0013	<0.0014	<0.0015	<0.0015	<0.0018	<0.0013	<0.0011	<0.00098	0.0816 [P]	0.0487 [P]
4,4'-DDE	72-55-9	mg/kg	EPA 8081B	2.00	-	-	<0.0014	0.00671 [P]	0.00385 [P]	<0.0012	<0.0012	0.0245 [P]	<0.0010	<0.00083	0.015 [P]	0.0788 [P]	0.00782 [P]
4,4'-DDT	50-29-3	mg/kg	EPA 8081B	1.89	-	-	<0.036	0.0313	<0.029	<0.031	<0.030	0.0657	0.0445	0.0288	0.0554 [P]	0.107	<0.012
Aldrin	309-00-2	mg/kg	EPA 8081B	0.04	-	-	0.0374 [P]	0.0188 [P]	0.0187 [P]	<0.0026	0.0254 [P]	<0.0030	0.0191 [P]	0.0165 [P]	<0.0016	<0.0036	<0.00098
alpha-BHC	319-84-6	mg/kg	EPA 8081B	0.09	-	-	0.159 [P]	0.0729	0.0471	0.0429 [P]	<0.0051	0.109 [P]	0.150	0.109	0.0584 [P]	0.102 [P]	0.0264 [P]
alpha-Chlordane	12789-03-6	mg/kg	EPA 8081B	1.74	-	-	<0.0013	<0.00098	<0.0011	0.0179 [P]	<0.0011	<0.0013	<0.00098	0.00396	<0.00072	0.0551	<0.00043
beta-BHC	319-85-7	mg/kg	EPA 8081B	0.30	-	-	0.136	0.0591 [P]	0.0769 [P]	<0.0041	0.0685 [P]	0.0896 [P]	0.0983	0.0784	0.0434 [P]	<0.0057	0.00801 [P]
Chlordane (Technical)	12789-03-6	mg/kg	EPA 8081B	1.74	-	-	<0.024	<0.018	<0.019	<0.020	<0.020	<0.024	<0.018	<0.014	<0.013	<0.029	<0.0078
delta-BHC	319-86-8	mg/kg	EPA 8081B	-	-	-	<0.016	<0.012	<0.013	0.0613 [P,Z]	<0.014	0.167 [P,Z]	<0.012	<0.0097	0.143 [P,Z]	0.358 [P,Z]	<0.0053
Dieldrin	309-00-2	mg/kg	EPA 8081B	0.03	-	-	0.00543 [P]	0.00179 [P]	<0.0012	<0.0013	<0.0013	0.0107 [P]	0.00756 [P]	0.00432 [P]	0.0088 [P]	0.0165 [P]	0.00352 [P]
Endosulfan I	115-29-7	mg/kg	EPA 8081B	469.00	-	-	0.00362 [P]	<0.00094	<0.0010	<0.0011	0.00152 [P]	<0.0013	0.00178 [P]	0.00432	<0.00068	<0.0015	0.00919 [P]
Endosulfan II	33213-65-9	mg/kg	EPA 8081B	-	-	-	0.00483	<0.0014	0.0024 [P]	<0.0016	0.00457 [P]	<0.0019	0.00445	0.00324	<0.0010	<0.0023	0.00235
Endosulfan sulfate	1031-07-8	mg/kg	EPA 8081B	-	-	-	<0.0030	<0.0022	<0.0024	<0.0025	<0.0025	<0.0029	<0.0022	<0.0018	<0.0016	<0.0035	<0.00096
Endrin	72-20-8	mg/kg	EPA 8081B	19.00	0.1616	-	<0.024	<0.018	<0.019	<0.020	<0.020	<0.024	<0.018	<0.014	<0.013	<0.029	<0.0078
Endrin aldehyde	72-20-8	mg/kg	EPA 8081B	19.00	-	-	<0.0030	<0.0022	<0.0024	0.0107	<0.0025	0.00836	0.00311	<0.0018	<0.0016	<0.0036	<0.00098
Endrin ketone	53494-70-5	mg/kg	EPA 8081B	-	-	-	<0.0030	<0.0022	<0.0024	<0.0026	0.00406	<0.0030	0.0089 [P]	0.00540	0.00424	<0.0036	0.00489
gamma-Chlordane	5566-34-7	mg/kg	EPA 8081B	-	-	-	<0.0024	<0.0018	<0.0019	0.0123 [P]	<0.0020	<0.0024	<0.0018	<0.0014	<0.0013	<0.0029	<0.00078
Heptachlor	76-44-8	mg/kg	EPA 8081B	0.14	0.0662	-	<0.019	<0.014	<0.015	<0.016	<0.016	<0.019	<0.014	<0.011	<0.010	<0.022	<0.0061
Heptachlor epoxide	1024-57-3	mg/kg	EPA 8081B	0.07	0.0082	-	<0.0013	<0.00098	<0.0011	0.0204	<0.0011	<0.0013	<0.00098	<0.00079	<0.00072	<0.0016	<0.00043
Lindane	58-89-9	mg/kg	EPA 8081B	0.57	0.0024	-	<0.015	<0.011	<0.012	<0.013	<0.013	<0.015	0.0445 [P]	<0.0090	<0.0082	<0.018	0.00977 [P]
Methoxychlor	72-43-5	mg/kg	EPA 8081B	316.00	4.32	-	<0.085	<0.063	<0.067	<0.071	<0.071	<0.084	<0.062	<0.050	<0.046	<0.10	<0.027
Toxaphene	8001-35-2	mg/kg	EPA 8081B	0.49	0.928	-	<0.024	<0.018	<0.019	<0.020	<0.020	<0.024	<0.018	<0.014	<0.013	<0.029	<0.0078
Pesticides																	
2,4-D	94-75-7	ug/kg	EPA 8151A 1996	699000	-	-	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14
2,4-DB	94-82-6	ug/kg	EPA 8151A 1996	1900000	-	-	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
2,4,5-TP (Silvex)	93-72-1	ug/kg	EPA 8151A 1996	506000	0.06	-	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
2,4,5-T	93-76-5	ug/kg	EPA 8151A 1996	632000	-	-	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29
Dalapon	75-99-0	ug/kg	EPA 8151A 1996	1900000	-	-	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11
Dicamba	1918-00-9	ug/kg	EPA 8151A 1996	1900000	0.16	-	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22
Dichloroprop	88-85-7	ug/kg	EPA 8151A 1996	-	-	-	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04
Dinoseb	88-85-7	ug/kg	EPA 8151A 1996	63200	0.12	-	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45
Pentachlorophenol	87-86-5	ug/kg	EPA 8151A 1996	1020	0.00	-	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24
Picloram	1918021	ug/kg	EPA 8151A 1996	4420000	0.28	-	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29
Bentazon	25057-89-0	ug/kg	EPA 8151A 1996	1900000	0.13	-	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
Acifluorfen	62476-59-9	ug/kg	EPA 8151A 1996	822000	-	-	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27
Grain Size																	
#4 Sieve	4.75mm	%Passing	ASTM C136-84A	-	-	-	99.7	99.7	100	98.3	99.6	100	100	100	96.7	100	92.3
#10 Sieve	2.0mm	%Passing	ASTM C136-84A	-	-	-	90.1	83.3	93.8	84.1	93.2	99.7	99.9	99.7	87.0	99.0	81.4
#20 Sieve	0.850mm	%Passing	ASTM C136-84A	-	-	-	58.5	44.9	53.4	47.9	62.5	93.1	96.5	91.8	76.2	87.1	68.9
#40 Sieve	0.425mm	%Passing	ASTM C136-84A	-	-	-	41.8	29.6	34.9	34.4	46.7	69.6	78.3	71.1	58.8	70.3	47.0

Stoughton Millpond Sediment Sampling Results
Compared to NR 720 RCLs

Constituent	*CAS Number*	*Units*	*Method*	*NR 720 Non-Industrial DC RCL*	*NR 720 Soil to Groundwater RCL (DF = 2)*	*Background Threshold Value (BTV)*	*S-2*	*S-3*	*S-4*	*S-5*	*S-6*	*S-7*	*S-8*	*S-9*	*S-10*	*S-11*	*US-1*
#60 Sieve	0.250mm	%Passing	ASTM C136-84A	-	-	-	**32.0**	**21.5**	**25.9**	**27.6**	**38.2**	**57.0**	**66.4**	**55.7**	**48.9**	**58.4**	**22.9**
#80 Sieve	0.180mm	%Passing	ASTM C136-84A	-	-	-	**26.4**	**17.5**	**21.4**	**23.6**	**32.7**	**49.4**	**56.8**	**46.0**	**39.6**	**49.8**	**14.5**
#100 Sieve	0.150mm	%Passing	ASTM C136-84A	-	-	-	**24.2**	**16.0**	**19.4**	**22.1**	**30.0**	**46.1**	**51.8**	**42.3**	**36.5**	**45.9**	**12.1**
#200 Sieve	0.075mm	%Passing	ASTM C136-84A	-	-	-	**16.5**	**9.7**	**12.5**	**13.2**	**19.5**	**28.1**	**31.4**	**23.2**	**24.4**	**31.1**	**6.0**
#230 Sieve	0.063mm	%Passing	ASTM C136-84A	-	-	-	**13.9**	**8.0**	**10.9**	**10.8**	**18.3**	**20.8**	**27.8**	**17.6**	**19.8**	**25.4**	**4.9**
% Sand				-	-	-	**73.6**	**73.6**	**81.3**	**70.9**	**73.7**	**71.6**	**68.5**	**76.5**	**62.6**	**67.9**	**75.4**
% Silt and clay				-	-	-	**16.5**	**9.7**	**12.5**	**13.2**	**19.5**	**28.1**	**31.4**	**23.2**	**24.4**	**31.1**	**6.0**
% Pebbles				-	-	-	**9.9**	**16.7**	**6.2**	**15.9**	**6.8**	**0.3**	**0.1**	**0.3**	**13.0**	**1.0**	**18.6**

Notes:

<000	*Below Limit of Detection (detection limit shown)*
000	Result Exceeds NR 720 Non-Industrial Direct Contact RCL
000	Result Exceeds NR 720 Soil to Groundwater RCL

Code

B	Analyte (Phosphorus) detected in the associated Method Blank. Expected maximum contribution from blank is less than 10%.
J	Result is above limit of detection and below limit of quantitation. Result is an estimated concentration.
L	Significant peaks were detected outside the chromatographic window. Reported results (diesel range organics) not affected.
M	Matrix spike and/or Matrix Spike duplicate recovery outside acceptance limits. Results may be biased high or low.
P	Concentration of analyte differs more than 40% between primary and confirmation analysis. May indicate co-eluting compounds.
V	Sample matrix interference prevented lower sample dilution. Result not detectable at analyzed dilution.
Z	Specified calibration criteria not met due to matrix interference.

Constituent	CAS Number	Units	Method	WI CBSQG (TEC)	WI CBSQG (MEC)	WI CBSQG (PEC)	Background Threshold Value (BTV)	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	US-1
Inorganics																		
Solids, Percent		%Passing	EPA 8000C				-	16.6	22.3	20.7	18.3	19.4	16.8	22.0	27.5	30.7	13.8	50.5
Ammonia Nitrogen	7664-41-7	mg/kg	SM 4500-				-	2.93 [M]	2.74 [M]	2.36	4.78	10.1	5.44	24.8	1.54	3.22	8.04	0.471
Bulk Density		gTS/cm3					-	0.26	0.20	0.24	0.21	0.24	0.27	0.17	0.25	0.28	0.21	0.71
Phosphorus	7723-14-0	mg/kg	EPA 365.4				-	1090 [M,B]	1750	2080 [B]	2760 [B]	1370 [B]	1090 [B]	510 [B]	1520 [B]	1120 [B]	424	531
Total Organic Carbon as % OM		%	MOSA 29-				-	25.5	31.9 [M,B]	30.1	68.8	23.3	25.0	19.0	21.2	17.3	24.1	9.9
Nitrogen Kjeldahl		mg/kg	EPA 351.2				-	98.2 [M]	160	212	380	114	138	35.5	106	71.7	31.3	42.4
Nitrate Nitrogen	14797-55-8	mg/kg	EPA 9056A				-	<2.4	4.86	4.89	<2.2	5.04	<2.4	4.50	3.48	4.16	<2.9	2.04
Nitrite Nitrogen	14797-65-0	mg/kg	EPA 9056A				-	<9.0	12.8	12.2	<8.2	<7.7	<8.9	8.63	6.21	6.77	<11	3.70
Metals																		
Antimony	7440-36-0	mg/kg	EPA 6010C	2	13.5	25	-	<2.0	<4.9	<5.6	<6.5	<5.9	<1.9	<1.5	<4.1	<3.6	<2.5	<2.2
Arsenic	7440-38-2	mg/kg	EPA 6010C	9.8	21.4	33	8	5.3	9.0	8.5	11.7	8.2	4.7	7.3	33.2	4.5	<1.3	1.3
Beryllium	7440-41-7	mg/kg	EPA 6010C				-	0.13	0.31	0.34	0.10	0.26	0.16	0.22	0.41	0.28	<0.040	0.066
Cadmium	7440-43-9	mg/kg	EPA 6010C	0.99	3	5	1	<0.076	<0.19	<0.21	<0.24	<0.22	<0.070	<0.058	<0.16	<0.14	<0.092	<0.084
Chromium	7440-47-3	mg/kg	EPA 6010C	43	76.5	110	44	4.1	14.0	16.0	<7.2	16.3	13.7	12.1	14.9	10.7	<2.7	9.3
Copper	7440-50-8	mg/kg	EPA 6010C	32	91	150	35	1.4	41.8	45.3	2.0	39.5	36.6	30.5	38.6	32.0	14.2	15.3
Lead	7439-92-1	mg/kg	EPA 6010C	36	83	130	52	43.0	74.9	68.2	8.5	111	55.0	97.9	65.7	151	4.9	53.8
Nickel	7440-02-0	mg/kg	EPA 6010C	23	36	49	31	3.3	11.6	12.8	5.2	13.1	9.1	9.7	20.0	11.0	1.7	10.1
Selenium	7782-49-2	mg/kg	EPA 6010C	11			-	4.1	<6.5	<7.3	<8.4	<7.7	<2.4	<2.0	<5.4	<4.7	<3.2	<2.9
Silver	7440-22-4	mg/kg	EPA 6010C	1.6			-	<0.51	<1.3	<1.4	<1.6	<1.5	0.57	0.58	<1.1	<0.91	<0.62	<0.56
Thallium	7440-28-0	mg/kg	EPA 6010C				-	3.3	2.5	2.2	<2.3	2.3	1.5	1.5	3.2	2.4	<0.89	1.1
Zinc	7440-66-6	mg/kg	EPA 6010C	120	290	460	150	48.9	127	226	308	217	138	163	135	227	38.7	116
Mercury	7439-97-6	mg/kg	EPA 7471B	0.18	0.64	1.1	-	0.60	0.54	0.63	<0.015 [V]	0.71	0.32	1.1	0.48	0.56	<0.0038	0.034
Trivalent Chromium	16065-83-1	mg/kg	EPA 6010C	43	76.5	110	-	<2.3	14.0	16.0	<7.2	-	13.7	8.40	14.9	10.7	-	-
Hexavalent Chromiunm	18540-29-9	mg/kg	EPA 7196 A				-	3.43 [J]	<1.70	<1.70	<1.70	-	<1.70	3.68 [J]	<1.70	<1.70	-	-
PCBs																		
Aroclor-1016	12674-11-2	mg/kg	EPA 8082A				-	<0.024	<0.018	<0.019	<0.020	-	<0.024	<0.018	<0.014	-	-	-
Aroclor-1221	11104-28-2	mg/kg	EPA 8082A				-	<0.042	<0.031	<0.034	<0.036	-	<0.042	<0.031	<0.025	-	-	-
Aroclor-1232	11141-16-5	mg/kg	EPA 8082A				-	<0.042	<0.031	<0.034	<0.036	-	<0.042	<0.031	<0.025	-	-	-
Aroclor-1242	53469-21-9	mg/kg	EPA 8082A				-	<0.036	<0.027	<0.029	<0.031	-	<0.036	<0.027	<0.022	-	-	-
Aroclor-1248	12672-29-6	mg/kg	EPA 8082A				-	<0.030	<0.022	<0.024	<0.026	-	<0.030	<0.022	<0.018	-	-	-
Aroclor-1254	11097-69-1	mg/kg	EPA 8082A				-	<0.030	<0.022	<0.024	<0.026	-	<0.030	<0.022	<0.018	-	-	-
Aroclor-1260	11096-82-5	mg/kg	EPA 8082A				-	<0.018	<0.013	<0.014	<0.015	-	<0.018	<0.013	<0.011	-	-	-
Total PCBs	1336-36-3	mg/kg	EPA 8082A	0.06	0.368	0.676	-	-	-	-	-	-	-	-	-	-	-	-
Hydrocarbons																		
Diesel Range Organics		mg/kg	WDNR DRO				-	393 [L]	26.5 [L]	68.8 [L]	37.8 [L]	294 [L]	121 [L]	261 [L]	133 [L]	191 [L]	214 [L]	138 [L]
Gasoline Range Organics		mg/kg	WDNR GRO				-	<6.6	<4.9	<5.3	<6.0	<5.7	<6.5	<5.0	<4.0	<3.6	<8.0	<2.2
VOCs																		
1,1,1,2-Tetrachloroethane	630-20-6	mg/kg	EPA 8260C				-	<0.17	<0.13	<0.14	<0.15	<0.14	<0.17	<0.13	<0.10	<0.091	<0.20	<0.055
1,1,1-Trichloroethane	71-55-6	mg/kg	EPA 8260C				-	<0.14	<0.11	<0.12	<0.13	<0.12	<0.14	<0.11	<0.087	<0.078	<0.17	<0.047
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	EPA 8260C				-	<0.13	<0.099	<0.11	<0.12	<0.11	<0.13	<0.10	<0.080	<0.072	<0.16	<0.044
1,1,2-Trichloroethane	79-00-5	mg/kg	EPA 8260C				-	<0.096	<0.072	<0.077	<0.087	<0.082	<0.095	<0.073	<0.058	<0.052	<0.12	<0.032

Constituent	CAS Number	Units	Method	WI CBSQG (TEC)	WI CBSQG (MEC)	WI CBSQG (PEC)	Background Threshold Value (BTV)	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	US-1
1,1-Dichloroethane	75-34-3	mg/kg	EPA 8260C				-	<0.15	<0.11	<0.12	<0.14	<0.13	<0.15	<0.11	<0.091	<0.082	<0.18	<0.049
1,1-Dichloroethene	75-35-4	mg/kg	EPA 8260C				-	<0.16	<0.12	<0.13	<0.14	<0.13	<0.15	<0.12	<0.094	<0.085	<0.19	<0.051
1,1-Dichloropropene	563-58-6	mg/kg	EPA 8260C				-	<0.066	<0.049	<0.053	<0.060	<0.057	<0.065	<0.050	<0.040	<0.036	<0.080	<0.022
1,2,3-Trichlorobenzene	87-61-6	mg/kg	EPA 8260C				-	<0.13	<0.099	<0.11	<0.12	<0.11	<0.13	<0.10	<0.080	<0.072	<0.16	<0.044
1,2,3-Trichloropropane	96-18-4	mg/kg	EPA 8260C				-	<0.13	<0.099	<0.11	<0.12	<0.11	<0.13	<0.10	<0.080	<0.072	<0.16	<0.044
1,2,4-Trichlorobenzene	120-82-1	mg/kg	EPA 8260C	0.008	0.013	0.018	-	<0.18	<0.13	<0.15	<0.16	<0.15	<0.18	<0.14	<0.11	<0.098	<0.22	<0.059
1,2,4-Trimethylbenzene	95-63-6	mg/kg	EPA 8260C				-	<0.16	<0.12	<0.13	<0.14	<0.13	<0.15	<0.12	<0.094	<0.085	<0.19	<0.051
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg	EPA 8260C				-	<0.24	<0.18	<0.19	<0.22	<0.21	<0.24	<0.18	<0.15	<0.13	<0.29	<0.079
1,2-Dibromoethane	106-93-4	mg/kg	EPA 8260C				-	<0.14	<0.10	<0.11	<0.13	<0.12	<0.14	<0.10	<0.083	<0.075	<0.17	<0.045
1,2-Dichlorobenzene	95-50-1	mg/kg	EPA 8260C	0.023		0.023	-	<0.17	<0.13	<0.14	<0.16	<0.15	<0.17	<0.13	<0.11	<0.095	<0.21	<0.057
1,2-Dichloroethane	107-06-2	mg/kg	EPA 8260C				-	<0.14	<0.10	<0.11	<0.13	<0.12	<0.14	<0.10	<0.083	<0.075	<0.17	<0.045
1,2-Dichloropropane	78-87-5	mg/kg	EPA 8260C				-	<0.072	<0.054	<0.058	<0.065	<0.062	<0.071	<0.055	<0.044	<0.039	<0.087	<0.024
1,3,5-Trimethylbenzene	108-67-8	mg/kg	EPA 8260C				-	<0.13	<0.099	<0.11	<0.12	<0.11	<0.13	<0.10	<0.080	<0.072	<0.16	<0.044
1,3-Dichlorobenzene	541-73-1	mg/kg	EPA 8260C				-	<0.16	<0.12	<0.13	<0.15	<0.14	<0.16	<0.12	<0.098	<0.088	<0.20	<0.053
1,3-Dichloropropane	142-28-9	mg/kg	EPA 8260C				-	<0.18	<0.13	<0.15	<0.16	<0.15	<0.18	<0.14	<0.11	<0.098	<0.22	<0.059
1,4-Dichlorobenzene	106-46-7	mg/kg	EPA 8260C	0.031	0.0605	0.9	-	<0.16	<0.12	<0.13	<0.15	<0.14	<0.16	<0.12	<0.098	<0.088	<0.20	<0.053
2,2-Dichloropropane	594-20-7	mg/kg	EPA 8260C				-	<0.11	<0.081	<0.087	<0.098	<0.093	<0.11	<0.082	<0.065	<0.059	<0.13	<0.036
2-Butanone	78-93-3	mg/kg	EPA 8260C				-	<0.54	<0.40	<0.44	<0.49	<0.46	<0.53	<0.41	<0.33	<0.29	<0.65	<0.18
2-Chlorotoluene	95-49-8	mg/kg	EPA 8260C				-	<0.16	<0.12	<0.13	<0.14	<0.13	<0.15	<0.12	<0.094	<0.085	<0.19	<0.051
2-Hexanone	591-78-6	mg/kg	EPA 8260C				-	<0.66	<0.49	<0.53	<0.60	<0.57	<0.65	<0.50	<0.40	<0.36	<0.80	<0.22
4-Chlorotoluene	106-43-4	mg/kg	EPA 8260C				-	<0.16	<0.12	<0.13	<0.14	<0.13	<0.15	<0.12	<0.094	<0.085	<0.19	<0.051
4-Methyl-2-pentanone	108-10-1	mg/kg	EPA 8260C				-	<0.42	<0.31	<0.34	<0.38	<0.36	<0.42	<0.32	<0.25	<0.23	<0.51	<0.14
Acetone	67-64-1	mg/kg	EPA 8260C				-	<1.7	<1.3	<1.4	<1.5	<1.4	<1.7	<1.3	<1.0	<0.91	<2.0	<0.55
Benzene	71-43-2	mg/kg	EPA 8260C	0.057	0.083	0.11	-	<0.030	<0.022	<0.024	<0.027	<0.026	<0.030	<0.023	<0.018	<0.016	<0.036	<0.0099
Bromobenzene	108-86-1	mg/kg	EPA 8260C				-	<0.18	<0.13	<0.15	<0.16	<0.15	<0.18	<0.14	<0.11	<0.098	<0.22	<0.059
Bromochloromethane	74-97-5	mg/kg	EPA 8260C				-	<0.060	<0.045	<0.048	<0.055	<0.051	<0.059	<0.046	<0.036	<0.033	<0.072	<0.020
Bromodichloromethane	75-27-4	mg/kg	EPA 8260C				-	<0.096	<0.072	<0.077	<0.087	<0.082	<0.095	<0.073	<0.058	<0.052	<0.12	<0.032
Bromoform	75-25-2	mg/kg	EPA 8260C				-	<0.11	<0.081	<0.087	<0.098	<0.093	<0.11	<0.082	<0.065	<0.059	<0.13	<0.036
Bromomethane	74-83-9	mg/kg	EPA 8260C				-	<0.24	<0.18	<0.19	<0.22	<0.21	<0.24	<0.18	<0.15	<0.13	<0.29	<0.079
Carbon disulfide	75-15-0	mg/kg	EPA 8260C				-	<0.48	<0.36	<0.39	<0.44	<0.41	<0.48	<0.36	<0.29	<0.26	<0.58	<0.16
Carbon tetrachloride	56-23-5	mg/kg	EPA 8260C				-	<0.13	<0.099	<0.11	<0.12	<0.11	<0.13	<0.10	<0.080	<0.072	<0.16	<0.044
Chlorobenzene	108-90-7	mg/kg	EPA 8260C				-	<0.14	<0.10	<0.11	<0.13	<0.12	<0.14	<0.10	<0.083	<0.075	<0.17	<0.045
Chloroethane	75-00-3	mg/kg	EPA 8260C				-	<0.36	<0.27	<0.29	<0.33	<0.31	<0.36	<0.27	<0.22	<0.20	<0.43	<0.12
Chloroform	67-66-3	mg/kg	EPA 8260C				-	<0.13	<0.094	<0.10	<0.11	<0.11	<0.12	<0.096	<0.076	<0.068	<0.15	<0.042
Chloromethane	74-87-3	mg/kg	EPA 8260C				-	<0.30	<0.22	<0.24	<0.27	<0.26	<0.30	<0.23	<0.18	<0.16	<0.36	<0.099
cis-1,2-Dichloroethene	156-59-2	mg/kg	EPA 8260C				-	<0.16	<0.12	<0.13	<0.15	<0.14	<0.16	<0.12	<0.098	<0.088	<0.20	<0.053
cis-1,3-Dichloropropene	10061-01-5	mg/kg	EPA 8260C				-	<0.11	<0.085	<0.092	<0.10	<0.098	<0.11	<0.087	<0.069	<0.062	<0.14	<0.038
Dibromochloromethane	124-48-1	mg/kg	EPA 8260C				-	<0.11	<0.081	<0.087	<0.098	<0.093	<0.11	<0.082	<0.065	<0.059	<0.13	<0.036
Dibromomethane	74-95-3	mg/kg	EPA 8260C				-	<0.072	<0.054	<0.058	<0.065	<0.062	<0.071	<0.055	<0.044	<0.039	<0.087	<0.024
Dichlorodifluoromethane	75-71-8	mg/kg	EPA 8260C				-	<0.24	<0.18	<0.19	<0.22	<0.21	<0.24	<0.18	<0.15	<0.13	<0.29	<0.079
Diisopropyl ether	108-20-3	mg/kg	EPA 8260C				-	<0.18	<0.13	<0.15	<0.16	<0.15	<0.18	<0.14	<0.11	<0.098	<0.22	<0.059
Ethylbenzene	100-41-4	mg/kg	EPA 8260C				-	<0.13	<0.094	<0.10	<0.11	<0.11	<0.12	<0.096	<0.076	<0.068	<0.15	<0.042
Hexachlorobutadiene	87-68-3	mg/kg	EPA 8260C				-	<0.17	<0.13	<0.14	<0.15	<0.14	<0.17	<0.13	<0.10	<0.091	<0.20	<0.055

Constituent	CAS Number	Units	Method	WI CBSQG (TEC)	WI CBSQG (MEC)	WI CBSQG (PEC)	Background Threshold Value (BTV)	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	US-1
Isopropylbenzene	98-82-8	mg/kg	EPA 8260C				-	<0.15	<0.11	<0.12	<0.14	<0.13	<0.15	<0.11	<0.091	<0.082	<0.18	<0.049
m & p-Xylene	179601-23-1	mg/kg	EPA 8260C				-	<0.16	<0.12	<0.13	<0.15	<0.14	<0.16	<0.12	<0.098	<0.088	<0.20	<0.053
Methyl tert-butyl ether	1634-04-4	mg/kg	EPA 8260C				-	<0.14	<0.11	<0.12	<0.13	<0.12	<0.14	<0.11	<0.087	<0.078	<0.17	<0.047
Methylene chloride	75-09-2	mg/kg	EPA 8260C				-	<0.18	<0.13	<0.15	<0.16	<0.15	<0.18	<0.14	<0.11	<0.098	<0.22	<0.059
Naphthalene (PAH)	91-20-3	mg/kg	EPA 8260C	0.176	0.369	0.561	-	<0.16	<0.12	<0.13	<0.14	<0.13	<0.15	<0.12	<0.094	<0.085	<0.19	<0.051
n-Butylbenzene	104-51-8	mg/kg	EPA 8260C				-	<0.16	<0.12	<0.13	<0.14	<0.13	<0.15	<0.12	<0.094	<0.085	<0.19	<0.051
n-Propylbenzene	103-65-1	mg/kg	EPA 8260C				-	<0.17	<0.13	<0.14	<0.16	<0.15	<0.17	<0.13	<0.11	<0.095	<0.21	<0.057
o-Xylene	95-47-6	mg/kg	EPA 8260C	0.025	0.0375	0.05	-	<0.14	<0.11	<0.12	<0.13	<0.12	<0.14	<0.11	<0.087	<0.078	<0.17	<0.047
p-Isopropyltoluene	99-87-6	mg/kg	EPA 8260C				-	<0.13	<0.099	<0.11	<0.12	<0.11	<0.13	<0.10	<0.080	<0.072	<0.16	<0.044
sec-Butylbenzene	135-98-8	mg/kg	EPA 8260C				-	<0.17	<0.13	<0.14	<0.15	<0.14	<0.17	<0.13	<0.10	<0.091	<0.20	<0.055
Styrene	100-42-5	mg/kg	EPA 8260C				-	<0.17	<0.13	<0.14	<0.16	<0.15	<0.17	<0.13	<0.11	<0.095	<0.21	<0.057
tert-Butylbenzene	98-06-6	mg/kg	EPA 8260C				-	<0.15	<0.11	<0.12	<0.14	<0.13	<0.15	<0.11	<0.091	<0.082	<0.18	<0.049
Tetrachloroethene	127-18-4	mg/kg	EPA 8260C				-	<0.078	<0.058	<0.063	<0.071	<0.067	<0.077	<0.059	<0.047	<0.042	<0.094	<0.026
Tetrahydrofuran	109-99-9	mg/kg	EPA 8260C				-	<0.84	<0.63	<0.68	<0.76	<0.72	<0.83	<0.64	<0.51	<0.46	<1.0	<0.28
Toluene	108-88-3	mg/kg	EPA 8260C	0.89	1.345	1.8	-	<0.078	<0.058	<0.063	<0.071	<0.067	<0.077	<0.059	<0.047	<0.042	<0.094	<0.026
trans-1,2-Dichloroethene	156-60-5	mg/kg	EPA 8260C				-	<0.060	<0.045	<0.048	<0.055	<0.051	<0.059	<0.046	<0.036	<0.033	<0.072	<0.020
trans-1,3-Dichloropropene	10061-02-6	mg/kg	EPA 8260C				-	<0.14	<0.10	<0.11	<0.13	<0.12	<0.14	<0.10	<0.083	<0.075	<0.17	<0.045
Trichloroethene	79-01-6	mg/kg	EPA 8260C				-	<0.090	<0.067	<0.073	<0.082	<0.077	<0.089	<0.068	<0.054	<0.049	<0.11	<0.030
Trichlorofluoromethane	75-69-4	mg/kg	EPA 8260C				-	<0.24	<0.18	<0.19	<0.22	<0.21	<0.24	<0.18	<0.15	<0.13	<0.29	<0.079
Vinyl acetate	108-05-4	mg/kg	EPA 8260C				-	<0.72	<0.54	<0.58	<0.65	<0.62	<0.71	<0.55	<0.44	<0.39	<0.87	<0.24
Vinyl chloride	75-01-4	mg/kg	EPA 8260C				-	<0.060	<0.045	<0.048	<0.055	<0.051	<0.059	<0.046	<0.036	<0.033	<0.072	<0.020
PAHs																		
1-Methylnaphthalene	90-12-0	ug/kg	EPA 8270D-				-	63.1	15.4	26.2	9.40	82.3	32.8	76.8	23.9	29.7	11.9	23.7
2-Methylnaphthalene	91-57-6	ug/kg	EPA 8270D-	20.2	111	201	-	111	25.4	44.9	19.6	215	67.4	161	38.1	48.2	19.7	29.2
Acenaphthene	83-32-9	ug/kg	EPA 8270D-	6.7	48	89	-	76.2	17.6	30.5	4.29	55.7	43.9	64.8	23.9	18.9	13.3	74.6
Acenaphthylene	208-96-8	ug/kg	EPA 8270D-	5.9	67	128	-	225	58.0	96.8	17.2	358	106	362	140	178	18.7	47.7
Anthracene	120-12-7	ug/kg	EPA 8270D-	57.2	451	845	-	155	81.9	180	26.7	305	266	404	122	157	49.0	283
Benzo(a)anthracene	56-55-3	ug/kg	EPA 8270D-	108	579	1050	-	425	422	714	73.4	1500	1020	1810	545	770	352	1590
Benzo(a)pyrene	50-32-8	ug/kg	EPA 8270D-	150	800	1450	-	321	268	563	48.9	1100	817	1370	468	640	404	1410
Benzo(b)fluoranthene	205-99-2	ug/kg	EPA 8270D-	240	6820	13400	-	518	678	936	195	1990	1360	2440	766	1160	693	2570
Benzo(g,h,i)perylene	191-24-2	ug/kg	EPA 8270D-	170	1685	3200	-	290	300	426	43.4	836	528	933	329	492	324	1190
Benzo(k)fluoranthene	207-08-9	ug/kg	EPA 8270D-	240	6820	13400	-	131	168	210	23.2	547	322	644	206	215	183	510
Benzo(e)pyrene	50-32-8	ug/kg	EPA 8270D-				-	319	308	416	69.1	920	600	1080	376	541	334	1100
Chrysene	218-01-9	ug/kg	EPA 8270D-	166	728	1290	-	435	390	616	132	1350	801	1540	550	727	363	1350
Dibenzo(a,h)anthracene	53-70-3	ug/kg	EPA 8270D-	33	84	135	-	61.0	63.9	84.9	6.5	188	83.1	220	71.9	115	23.0	213
Fluoranthene	206-44-0	ug/kg	EPA 8270D-	423	1327	2230	-	998	1030	1660	325	2930	2110	3520	1140	1510	914	3800
Fluorene	86-73-7	ug/kg	EPA 8270D-	77.4	307	536	-	180	72.6	114	26.3	207	175	228	72.7	73.5	36.9	127
Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	EPA 8270D-	200	1700	3200	-	286	320	446	67.9	851	568	952	347	500	342	1160
Naphthalene	91-20-3	ug/kg	EPA 8270D-	176	369	561	-	551	42.3	98.1	38.5	352	123	231	95.8	74.6	27.7	40.6
Phenanthrene	85-01-8	ug/kg	EPA 8270D-	204	687	1170	-	890	597	976	156	1800	1100	2230	645	806	310	1630
Pyrene	129-00-0	ug/kg	EPA 8270D-	195	858	1520	-	920	795	1250	161	2560	1590	2980	1020	1370	713	2940
TOTAL PAH		ug/kg					-	6955	5653	8888	1443	18147	11713	21247	6980	9426	5132	20089
Insecticides																		

Constituent	CAS Number	Units	Method	WI CBSQG (TEC)	WI CBSQG (MEC)	WI CBSQG (PEC)	Background Threshold Value (BTV)	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10	S-11	US-1
4,4'-DDD	72-54-8	mg/kg	EPA 8081B	0.0049	0.0165	0.028	-	<0.0018	<0.0013	<0.0014	<0.0015	<0.0015	<0.0018	<0.0013	<0.0011	<0.00098	**0.0816** [P]	**0.0487** [P]
4,4'-DDE	72-55-9	mg/kg	EPA 8081B	0.0032	0.0106	0.018	-	<0.0014	**0.00671** [P]	**0.00385** [P]	<0.0012	<0.0012	**0.0245** [P]	<0.0010	<0.00083	**0.015** [P]	**0.0788** [P]	**0.00782** [P]
4,4'-DDT	50-29-3	mg/kg	EPA 8081B	0.0042	0.0336	0.063	-	<0.036	**0.0313**	<0.029	<0.031	<0.030	**0.0657**	**0.0445**	**0.0288**	**0.0554** [P]	**0.107**	<0.012
Aldrin	309-00-2	mg/kg	EPA 8081B	0.002	0.041	0.08	-	**0.0374** [P]	**0.0188** [P]	**0.0187** [P]	<0.0026	**0.0254** [P]	<0.0030	**0.0191** [P]	**0.0165** [P]	<0.0016	<0.0036	<0.00098
alpha-BHC	319-84-6	mg/kg	EPA 8081B	0.003	0.062	0.12	-	**0.159** [P]	**0.0729**	**0.0471**	**0.0429** [P]	<0.0051	**0.109** [P]	**0.150**	**0.109**	**0.0584** [P]	**0.102** [P]	**0.0264** [P]
alpha-Chlordane	12789-03-6	mg/kg	EPA 8081B				-	<0.0013	<0.00098	<0.0011	**0.0179** [P]	<0.0011	<0.0013	<0.00098	**0.00396**	<0.00072	**0.0551**	<0.00043
beta-BHC	319-85-7	mg/kg	EPA 8081B	0.005	0.108	0.21	-	**0.136**	**0.0591** [P]	**0.0769** [P]	<0.0041	**0.0685** [P]	**0.0896** [P]	**0.0983**	**0.0784**	**0.0434** [P]	<0.0057	**0.00801** [P]
Chlordane (Technical)	12789-03-6	mg/kg	EPA 8081B	0.0032	0.0106	0.018	-	<0.024	<0.018	<0.019	<0.020	<0.020	<0.024	<0.018	<0.014	<0.013	<0.029	<0.0078
delta-BHC	319-86-8	mg/kg	EPA 8081B				-	<0.016	<0.012	<0.013	**0.0613** [P,Z]	<0.014	**0.167** [P,Z]	<0.012	<0.0097	**0.143** [P,Z]	**0.358** [P,Z]	<0.0053
Dieldrin	309-00-2	mg/kg	EPA 8081B	0.0019	0.032	0.062	-	**0.00543** [P]	**0.00179** [P]	<0.0012	<0.0013	<0.0013	**0.0107** [P]	**0.00756** [P]	**0.00432** [P]	**0.0088** [P]	**0.0165** [P]	**0.00352** [P]
Endosulfan I	115-29-7	mg/kg	EPA 8081B				-	**0.00362** [P]	<0.00094	<0.0010	<0.0011	**0.00152** [P]	<0.0013	**0.00178** [P]	**0.00432**	<0.00068	<0.0015	**0.00919** [P]
Endosulfan II	33213-65-9	mg/kg	EPA 8081B				-	**0.00483**	<0.0014	**0.0024** [P]	<0.0016	**0.00457** [P]	<0.0019	**0.00445**	**0.00324**	<0.0010	<0.0023	**0.00235**
Endosulfan sulfate	1031-07-8	mg/kg	EPA 8081B				-	<0.0030	<0.0022	<0.0024	<0.0025	<0.0025	<0.0029	<0.0022	<0.0018	<0.0016	<0.0035	<0.00096
Endrin	72-20-8	mg/kg	EPA 8081B	0.0022	0.1046	0.207	-	<0.024	<0.018	<0.019	<0.020	<0.020	<0.024	<0.018	<0.014	<0.013	<0.029	<0.0078
Endrin aldehyde	72-20-8	mg/kg	EPA 8081B				-	<0.0030	<0.0022	<0.0024	**0.0107**	<0.0025	**0.00836**	**0.00311**	<0.0018	<0.0016	<0.0036	<0.00098
Endrin ketone	53494-70-5	mg/kg	EPA 8081B				-	<0.0030	<0.0022	<0.0024	<0.0026	**0.00406**	<0.0030	**0.0089** [P]	**0.00540**	**0.00424**	<0.0036	**0.00489**
gamma-Chlordane	5566-34-7	mg/kg	EPA 8081B				-	<0.0024	<0.0018	<0.0019	**0.0123** [P]	<0.0020	<0.0024	<0.0018	<0.0014	<0.0013	<0.0029	<0.00078
Heptachlor	76-44-8	mg/kg	EPA 8081B				-	<0.019	<0.014	<0.015	<0.016	<0.016	<0.019	<0.014	<0.011	<0.010	<0.022	<0.0061
Heptachlor epoxide	1024-57-3	mg/kg	EPA 8081B	0.0025	0.0093	0.016	-	<0.0013	<0.00098	<0.0011	**0.0204**	<0.0011	<0.0013	<0.00098	<0.00079	<0.00072	<0.0016	<0.00043
Lindane	58-89-9	mg/kg	EPA 8081B	0.003	0.004	0.005	-	<0.015	<0.011	<0.012	<0.013	<0.013	<0.015	**0.0445** [P]	<0.0090	<0.0082	<0.018	**0.00977** [P]
Methoxychlor	72-43-5	mg/kg	EPA 8081B				-	<0.085	<0.063	<0.067	<0.071	<0.071	<0.084	<0.062	<0.050	<0.046	<0.10	<0.027
Toxaphene	8001-35-2	mg/kg	EPA 8081B	0.001	0.0015	0.002	-	<0.024	<0.018	<0.019	<0.020	<0.020	<0.024	<0.018	<0.014	<0.013	<0.029	<0.0078
Pesticides																		
2,4-D	94-75-7	ug/kg	EPA 8151A				-	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14	<1.14
2,4-DB	94-82-6	ug/kg	EPA 8151A				-	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
2,4,5-TP (Silvex)	93-72-1	ug/kg	EPA 8151A				-	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
2,4,5-T	93-76-5	ug/kg	EPA 8151A				-	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29
Dalapon	75-99-0	ug/kg	EPA 8151A				-	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11
Dicamba	1918-00-9	ug/kg	EPA 8151A				-	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22
Dichloroprop	88-85-7	ug/kg	EPA 8151A				-	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04	<1.04
Dinoseb	88-85-7	ug/kg	EPA 8151A				-	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45
Pentachlorophenol	87-86-5	ug/kg	EPA 8151A	150	175	200	-	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24
Picloram	1918021	ug/kg	EPA 8151A				-	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29
Bentazon	25057-89-0	ug/kg	EPA 8151A				-	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
Acifluorfen	62476-59-9	ug/kg	EPA 8151A				-	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27
Grain Size																		
#4 Sieve	4.75mm	%Passing	ASTM C136-				-	**99.7**	**99.7**	**100**	**98.3**	**99.6**	**100**	**100**	**100**	**96.7**	**100**	**92.3**
#10 Sieve	2.0mm	%Passing	ASTM C136-				-	**90.1**	**83.3**	**93.8**	**84.1**	**93.2**	**99.7**	**99.9**	**99.7**	**87.0**	**99.0**	**81.4**
#20 Sieve	0.850mm	%Passing	ASTM C136-				-	**58.5**	**44.9**	**53.4**	**47.9**	**62.5**	**93.1**	**96.5**	**91.8**	**76.2**	**87.1**	**68.9**
#40 Sieve	0.425mm	%Passing	ASTM C136-				-	**41.8**	**29.6**	**34.9**	**34.4**	**46.7**	**69.6**	**78.3**	**71.1**	**58.8**	**70.3**	**47.0**
#60 Sieve	0.250mm	%Passing	ASTM C136-				-	**32.0**	**21.5**	**25.9**	**27.6**	**38.2**	**57.0**	**66.4**	**55.7**	**48.9**	**58.4**	**22.9**
#80 Sieve	0.180mm	%Passing	ASTM C136-				-	**26.4**	**17.5**	**21.4**	**23.6**	**32.7**	**49.4**	**56.8**	**46.0**	**39.6**	**49.8**	**14.5**
#100 Sieve	0.150mm	%Passing	ASTM C136-				-	**24.2**	**16.0**	**19.4**	**22.1**	**30.0**	**46.1**	**51.8**	**42.3**	**36.5**	**45.9**	**12.1**

Stoughton Millpond Sediment Sampling Results
Compared to WDNR CBSQGs

Constituent	*CAS Number*	*Units*	*Method*	*WI CBSQG (TEC)*	*WI CBSQG (MEC)*	*WI CBSQG (PEC)*	*Background Threshold Value (BTV)*	*S-2*	*S-3*	*S-4*	*S-5*	*S-6*	*S-7*	*S-8*	*S-9*	*S-10*	*S-11*	*US-1*
#200 Sieve	0.075mm	%Passing	ASTM C136-				-	**16.5**	**9.7**	**12.5**	**13.2**	**19.5**	**28.1**	**31.4**	**23.2**	**24.4**	**31.1**	**6.0**
#230 Sieve	0.063mm	%Passing	ASTM C136-				-	**13.9**	**8.0**	**10.9**	**10.8**	**18.3**	**20.8**	**27.8**	**17.6**	**19.8**	**25.4**	**4.9**
% Sand							-	**73.6**	**73.6**	**81.3**	**70.9**	**73.7**	**71.6**	**68.5**	**76.5**	**62.6**	**67.9**	**75.4**
% Silt and clay							-	**16.5**	**9.7**	**12.5**	**13.2**	**19.5**	**28.1**	**31.4**	**23.2**	**24.4**	**31.1**	**6.0**
% Pebbles							-	**9.9**	**16.7**	**6.2**	**15.9**	**6.8**	**0.3**	**0.1**	**0.3**	**13.0**	**1.0**	**18.6**

Notes:

<000	*Below Limit of Detection (detection limit shown)*
000	Result Exceeds WI Sediment Quality Guidelines - PEC
000	Result Exceeds WI Sediment Quality Guidelines - MEC
000	Result Exceeds WI Sediment Quality Guidelines - TEC

Code

B	Analyte (Phosphorus) detected in the associated Method Blank. Expected maximum contribution from blank is less than 10%.
J	Result is above limit of detection and below limit of quantitation. Result is an estimated concentration.
L	Significant peaks were detected outside the chromatographic window. Reported results (diesel range organics) not affected.
M	Matrix spike and/or Matrix Spike duplicate recovery outside acceptance limits. Results may be biased high or low.
P	Concentration of analyte differs more than 40% between primary and confirmation analysis. May indicate co-eluting compounds.
V	Sample matrix interference prevented lower sample dilution. Result not detectable at analyzed dilution.
Z	Specified calibration criteria not met due to matrix interference.