DRAFT REMEDIAL ACTION PROPOSAL FOR ACID BROOK DELTA SEDIMENTS POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY

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EXECUTIVE SUMMARY

Sediment in the Acid Brook Delta (the Delta) has been impacted by mercury associated with historic manufacturing activities at the DuPont Pompton Lakes Works. Compared to a reference location, total mercury and methylmercury levels in the Delta in the sediments, surface water, and biota are elevated. To support a remedial action, DuPont has conducted additional investigations of the following:

- Surface water mercury and methylmercury concentrations
- Surficial sediment mercury and methylmercury concentrations
- Deep sediment cores
- Methylmercury flux chamber measurements
- Methylmercury production in sediment-water microcosms
- Biological tissue measurements in benthic community analyses

The results of these investigations indicate that sediment total mercury concentrations do not correlate well with methylmercury concentrations in sediments or surface water and that mercury found deep in the sediment is unlikely to be involved in active mercury cycling in surficial sediments. Additionally, benthic flux chamber and microcosm studies suggest that methylmercury production in the Delta sediments may be low relative to other mercury contaminated environments.

Using the results of these investigations, DuPont proposes a sediment excavation that will result in the removal of 78,000 cubic yards of mercury-impacted nearshore materials (i.e., sediment and peat). This removal action will result in an approximate 83% removal of the mercury mass in Delta sediments and approximately 99% of the mercury mass from the nearshore environment. Sediments from the nearshore environment have been shown to be most involved in methylmercury production. By removing these sediments, the potential risk posed by methylmercury to benthic communities in the Delta should be significantly decreased. In addition, the proposed remedial action is conservative in that it will also result in the removal of sediment-associated mercury not expected to be a source of methylmercury (mercury found deep in the sediment).

1.0 INTRODUCTION

The elevated mercury levels found in the Acid Brook Delta (Delta) sediments are associated with historic manufacturing processes at the Pompton Lakes Works site located on the upstream portion of Acid Brook. The plant started operations in the Acid Brook Valley in 1926, ceased operations in 1994, and was demolished in 1995.

Between 1991 and 1997, Acid Brook was the subject of remedial efforts that included streambed cleaning and excavation of floodplain soils. In conjunction with these activities, the Delta and its upland were the subject of investigation between 1990 and 1993 [DuPont Environmental Remediation Services (DERS), 1994]. In 1997, portions of the Delta uplands were remediated (DERS, 1996).

Between 1995 and 1998, an ecological investigation was conducted in Pompton Lake and the Delta to evaluate the potential for adverse effects to ecological receptors (PTI, 1997 and Exponent and The Academy of Natural Sciences, 1999). DuPont submitted the ecological investigation report to the New Jersey Department of Environmental Protection in 1999. In 2002, the NJDEP provided comments on the report and requested a remedial action. DuPont submitted a revised report addressing NJDEP’s comments (Exponent, 2003) and a work plan [DuPont Corporate Remediation Group (CRG), 2003] outlining additional activities to be conducted in support of a remedial action.

This report outlines DuPont efforts in selecting and designing a remedial action to address elevated levels of mercury in Delta sediments. The NJDEP has been kept informed of these efforts through regular electronic mail messages and team meetings in Trenton, New Jersey.

2.0 BACKGROUND

The Delta can generally be defined as an anthropogenic environment, measuring approximately 37.5 acres in size. The Delta was created by the discharge of water and suspended sediments from Acid Brook into Pompton Lake (a reservoir established by a dam constructed in the Ramapo River). Figure 1 shows the location of the Delta with respect to Pompton Lake and the Ramapo River. Materials located at the bottom of the Delta consist largely of fine sands and silt, underlain by a dense layer of peat. These are deposited on top of a glacial till (gravelly sand or silty/clayey sand). Sediment thicknesses within the Delta range from approximately 0 to 4.5 feet, while the total approximate sediment and peat thickness (combined) ranges from approximately 0 to 7.6 feet (DuPont CRG, 2006).

The primary environmental issue at the Delta is the presence of mercury-impacted sediments. DuPont has performed investigations of the following to evaluate the magnitude and extent of impacts of mercury in Delta sediments:

- Surface water mercury and methylmercury concentrations
- Surficial sediment mercury and methylmercury concentrations
- Deep sediment cores
- Methylmercury flux chamber measurements
- Methylmercury production in sediment-water microcosms
- Biological tissue measurements in benthic community analyses

The primary objectives of the investigations were as follows:

- Determine the presence and extent of mercury in sediments.
- Develop a remedial action that maximizes the benefits to the Delta and surrounding areas while minimizing potential impacts associated with large-scale sediment excavation.

Based on these investigations and consistent with these objectives, DuPont is proposing a remedial action that involves removing mercury-impacted sediments from select areas within the Delta. This proposal has been shared previously with the NJDEP at a meeting with the DuPont team members on December 7, 2005.

This report describes the methods used to develop the proposed remedial action (see Section 3.0), all of which are based on the previous investigation data summarized in Section 4.0. Complete reports detailing the previous investigations are provided in Appendices A through E.

3.0 DEVELOPMENT OF THE REMEDIAL ACTION

As presented previously to the NJDEP, the main component of the remedial action proposed is the removal of mercury-impacted sediments from the Delta, with backfill of clean materials to promote the re-establishment of benthic communities. The removal and reuse of the sediment on-site with some off-site disposal of these impacted sediments would decrease the total mass of mercury in the Delta and reduce potential future impacts to the Delta and surrounding lake aquatic communities.

3.1 Approach

DuPont has conducted several investigations to further understand the physical properties and characteristics of Delta sediments and the magnitude and extent of mercury impacts. A summary of the findings of these investigations is provided in Section 4.0 and associated appendices.

As part of these investigations and including recent sediment core collection activities performed at the request of NJDEP following the December 2005 meeting, sediment cores were collected within the Delta study area. These cores resulted in a data set consisting of samples from 382 surface locations (mercury analysis of the top 6 inches of sediment) and 251 subsurface locations (mercury analysis of materials from a variety of depth increments below 6 inches). Data resulting from the surficial and deep core sediment investigations and analysis of mercury species in the surface water were used to develop the remedial action. The complete report detailing the sediment Delta investigation is provided in Appendix B.

3.2 Evaluations

To facilitate the development of the remedial action, volume-weighted spatial averaging evaluations were employed to further characterize the extent of mercury concentrations throughout the study area—under existing conditions and the predicted post-remediation conditions. For the purpose of this evaluation, the study area was defined by the 2 milligrams per kilogram (mg/kg) of mercury in the surface sediment delineation program as it existed in October 2006. Spatial averaging is a geostatistical data evaluation technique used to distribute discrete data over large areas, thereby attributing data to the entire study area rather than just to sample locations. This method was also used to quantify the mass of mercury to be removed and the average concentration of sediment mercury at the surface and at depth in areas outside of the excavation area.

3.2.1 Volume-Weighted Spatial Averaging Evaluations

Prior to initiating spatial averaging evaluations, two detailed site maps were developed. These maps included the site boundary and sample locations within the boundary. One map was developed to represent surface sampling activities, and a second map was developed to represent subsurface sampling activities. For the purposes of these evaluations, the surface depth increment represented the top 6 inches of sediment and the subsurface depth increment represented materials located below a depth of 6 inches.

Using the detailed site maps, Thiessen polygons were drawn about each sample location for both the surface and subsurface depth increments such that the entire study area was divided among the collection of sample-location-specific polygons. The creation of Thiessen polygons involves the use of computer software to draw perpendicular bisector lines between adjacent sample locations. The intersections of the perpendicular bisector lines create two-dimensional, sample-location-specific polygon areas about each sample location. Thiessen polygon mapping for surface and subsurface depth increments is shown in Figure 3.

Once developed, the area of each polygon was calculated. Each polygon is associated with a specific sample location and corresponding mercury concentration. For the surface depth increment, the mercury analytical result from the 0- to 6-inch depth increment at each sample location was assigned to its corresponding polygon. For the subsurface depth increment, an arithmetic average of the mercury analytical results from sediments collected below a depth of 6 inches at each sample location was assigned to its corresponding polygon. Thiessen polygon mapping for surface and subsurface depth increments, including polygon identification numbers and approximate polygon size, are shown in Figures 2 and 3, respectively.

Once the maps were developed, polygon areas calculated, and analytical data processed, the following steps were conducted to produce a volume-weighted spatial average mercury concentration:

1. For each polygon within the surface depth increment, corresponding volumes were calculated by multiplying the polygon area by a thickness of 6 inches. For each polygon within the subsurface depth increment, corresponding volumes were calculated by multiplying the polygon area by the sediment thickness observed at that sample location minus the top 6 inches.
2. The sediment volume associated with each polygon was then multiplied by the mercury result associated with that polygon. As indicated above, mercury results used in subsurface evaluations are arithmetic averages of subsurface analytical results observed at each location.
3. The product of each of the polygon sediment volume and the related mercury concentration was then summed across the entire study area for both the surface and subsurface depth increments.
4. The two sums (surface and subsurface) are then added and divided by the total estimated sediment volume within the study area.

By performing the evaluation steps described above, a volume-weighted spatial average mercury concentration was derived for the entire study area (incorporating both surface and subsurface sediments). This approach was first applied to the entire data set to establish baseline or existing conditions against which results from various conceptual remedial alternatives could be compared.

3.2.2 Existing Condition Evaluation

A volume-weighted spatial average mercury concentration was calculated using the procedures discussed above to estimate the existing condition in the Delta sediments (i.e., extent and magnitude of mercury impacts in the study area). The surface and subsurface polygons used in evaluating existing conditions are again shown in Figure 4. Figure 4 also uses a color-coded gradient to illustrate the distribution of mercury concentrations found in surface and volume-weighted average mercury concentrations in subsurface sediments. As seen in this figure, the majority of the existing highest mercury concentrations are found in sediments in the nearshore areas.

The resultant estimated study area volume-weighted spatial average mercury concentrations in the surface and subsurface increments are approximately 81 and 61 mg/kg, respectively. The overall volume-weighted spatial average mercury concentration in existing sediments within the study area is approximately 69 mg/kg (surface and subsurface combined). A summary of all the evaluation results is included in Table 1.

3.2.3 Remedial Action Evaluation

As discussed above, DuPont proposes the removal of mercury-impacted, nearshore sediments from the Delta and the backfill of clean materials to promote benthic community re-establishment. Conceptually, removal activities would be accomplished via mechanical methods and would be performed in a manner to optimize the mass of mercury removed relative to the total material removal volume.

Figure 5 shows the proposed limits of removal by shading those polygons where sediment removal would occur as part of the remedial action being considered, as well as the location of the approximate 5-foot water depth line. Polygons subject to removal were selected using the above-referenced evaluations with additional consideration given to constructability and the objectives of removal discussed above. For comparative purposes, Figure 5 also includes a representation of the original conceptual remedial scenario first presented to the NJDEP in November 2004.

To evaluate the remedial action, those polygons containing elevated levels of mercury in sediment were targeted for removal. The corresponding removal and subsequent backfilling activities were then considered during the development of post-remediation evaluations (described below). Based on these evaluations, the remedial action would consist of the removal of sediments from approximately 16 acres (see Figure 5), including the removal of an estimated 78,000 cubic yards of sediment and peat. Note that peat materials (i.e., nonsediment materials residing beneath surface and subsurface sediments) have not been included in the evaluation of mercury concentrations following implementation of the remedial action. However, based on constructability issues (e.g., the ability to segregate sediment and peat materials), peat materials have been conservatively included in total removal volumes. If, during the course of construction, it appears that peat materials are clearly identifiable and can be segregated from overlying sediments, DuPont may elect to leave such materials in place and limit further excavation.

Based on the removal volumes discussed above, it is assumed that an estimated two to three construction seasons would be required to complete these remedial activities. These removal activities are anticipated to require a minimum of 6,100 truck loads for transport of removed materials for appropriate disposal. Depending on the final design and the extent of berms and backfill in the excavated area, an estimated 2,000 to 7,500 truck loads of material may be required.

3.2.4 Post-Remediation Condition Evaluation

The evaluation of the study area under post-remediation conditions considered the sediment removal volume, the corresponding mercury concentrations removed, and the placement of clean backfill material. To compute the post-remediation volume-weighted spatial average, the evaluations used for the existing conditions were modified to account for removal activities. Specifically, mercury concentrations associated with polygons subject to removal were replaced with mercury concentrations of 0.25 mg/kg (approximately half of the mercury detection limit observed during investigations). The remedial action being evaluated and the replacement of existing mercury concentrations with 0.25 mg/kg assumes that sediment removed from those areas illustrated in Figure 5 would be replaced with clean backfill. Note that for the purposes of the sediment mercury concentration evaluations, it has been assumed that, following material removal, clean backfill would be placed in the excavated area to the approximate existing grades. At this time, the extent of backfill to be placed within this area has not been fully determined. At a minimum, DuPont anticipates the placement of 12 inches of clean backfill materials to provide an environment conducive to benthic community re-establishment. Final backfill grades will be determined during the final remedial design phase.

Following the procedures discussed above, a volume-weighted spatial average mercury concentration was produced to estimate the post-remediation conditions in the study area. The estimated post-remediation volume-weighted spatial average mercury concentration in surface and subsurface sediments is approximately 6.4 mg/kg and 15.2 mg/kg, respectively. Following removal, the overall post-remediation volume-weighted spatial average mercury concentration in study area sediments would be approximately 11.6 mg/kg (surface and subsurface combined)—an approximate 83% reduction in the mass of mercury within the study area. A summary of evaluation results is included in Table 1.

To further understand post-remediation conditions, a volume-weighted spatial average was also calculated for the portion of the study area not subject to removal actions. Figure 6 illustrates the distribution of remaining mercury concentrations and associated polygons not subject to removal actions.

The estimated volume-weighted spatial average mercury concentrations for the surface and subsurface increments not subject to removal would be approximately 11 mg/kg and 34 mg/kg, respectively. The overall post-remediation volume-weighted spatial average mercury concentration in study area sediments not subject to removal actions would be approximately 23 mg/kg. Note that DuPont has previously presented conceptual removal discussions targeting post-remediation volume-weighted spatial average mercury concentrations in the vicinity of 20 mg/kg. Following the most recent investigative activities, it appears that constructability issues make this target difficult to achieve. For example, in those areas where additional removal would need to be performed in order to achieve the 20 mg/kg target, water depths exceed 5 feet (as shown in Figure 6). These water depths may alter the anticipated removal approach (i.e., mechanical removal in the dry vs. hydraulic dredging). Additionally, in these areas, mercury concentrations in surface sediments are generally already lower than 20 mg/kg.

To illustrate the efficacy of the remedial action, a theoretical performance curve was derived that represents the possible ratios of percent mercury removed to various sediment removal volumes. This performance curve is shown in Figure 7. This theoretical performance curve was derived based on the removal of select polygons with the greatest mercury concentrations without any regard for constructability. As such, this performance curve does not represent realistic considerations. Nonetheless, the performance of the remedial action evaluated herein approaches the curve, an indication that it would perform well in optimizing the mercury removal relative to total material removal. Further, as illustrated in Figure 7, the remedial action performs better than the original conceptual one first presented to the NJDEP in November 2004 and the 500-foot ring scenarios previously discussed with the NJDEP.

3.3 Summary

DuPont has performed multiple investigations to evaluate the magnitude and extent of mercury impacts in sediments within the Delta. Using the results of these investigations, a volume-weighted spatial average mercury concentration was developed to further understand the existing conditions in study area sediments. Further, the volume-weighted spatial averages were used to develop the remedial action, which consists of the removal of mercury-containing sediments from approximately 16 acres of the study area. An evaluation of the potential post-remediation conditions was performed and a post-remediation volume-weighted spatial average mercury concentration was produced. Table 2 shows that the remedial action effectively improves overall sediment conditions within the study area, removing the clear majority of impacts.

Additionally, as illustrated in Figure 7, the remedial action evaluated herein is an efficient means of remediation. It minimizes the total impact to the Delta and surrounding communities by maximizing the mercury removal relative to total sediment removal. The following items summarize the details of the remedial action:

- ❑ Removal of approximately 78,000 cubic yards of materials (in situ sediment and peat volume)
  - Construction preliminarily estimated to take as many as two to three construction seasons
  - Construction expected to require a minimum of 6,100 truck loads for the transport of removed materials and as many as 2,000 to 7,500 additional truck loads for construction and backfill activities through residential neighborhoods for project completion
- ❑ Removal area focused on nearshore littoral habitat areas

- ❑ Approximately 83% of mercury removed in overall study area
    - Approximately 99% of mercury removed in nearshore areas
    - Approximately 92% of mercury removed in overall surface sediments
- ❑ Volume-weighted spatial average mercury concentration reduced by over 80%

4.0 TECHNICAL EVIDENCE SUPPORTING THE REMEDIAL ACTION

Identifying the areas of Delta sediments that are most important in the production of methylmercury will allow removal efforts to be focused on areas that most impact water quality in this portion of Pompton Lake while minimizing impacts on the rest of the lake. DuPont developed the remedial action for the Delta sediments based on results from the following sources of data:

- Surface water mercury and methylmercury concentrations
- Surficial sediment mercury and methylmercury concentrations
- Deep sediment cores
- Methylmercury flux chamber measurements
- Methylmercury production in sediment-water microcosms
- Biological tissue measurements in benthic community analyses

Each data set is summarized in the following subsections. Detailed information about the surface water, sediment, flux chamber, and biota studies are provided in Appendices A through D. A surface water circulation study was also conducted; detailed results are provided in Appendix E.

4.1 Surface Water Mercury and Methylmercury Concentrations

Surface water samples were collected in May and August 2004 and January and April 2005. Although the Delta has been treated conceptually as a single unit with a homogeneous mercury concentration profile, mercury and methylmercury sampling results in surface water suggest that this is an inaccurate characterization. Results showed that Delta nearshore areas consistently had higher dissolved mercury and methylmercury concentrations when compared to portions of the Delta further from the shore and the rest of Pompton Lake. The portions of the Delta furthest from the shore typically had dissolved methylmercury concentrations that were comparable with, if not less than, those observed in the non-Delta portions of the lake (see Appendix A).

In addition, there is little evidence that portions of the lake downstream of the Delta are influenced by methylmercury from the Delta. Dissolved methylmercury concentrations at these points in the lake were comparable to dissolved methylmercury values measured at points upstream of the Delta (see Appendix A). If it is accepted that surface water methylmercury concentrations represent an integration of methylmercury produced by the underlying sediments, these data clearly show that the nearshore sediments are the most important site of mercury methylation in the Delta system. Moreover, an analysis of this data set indicated that, at sediment total mercury concentrations below 50 micrograms per gram dry weight (µg/g dry wt), surface water methylmercury concentrations were comparable to those collected in the upstream reference site and sites not impacted by Pompton Lakes Works.

These data taken together suggest that environmental factors such as nearshore vs. profundal location are more important in determining surface water methylmercury concentrations than the total mercury concentration of underlying sediments. Sediments in areas of the Delta that have elevated dissolved methylmercury concentrations in surface water (relative to the rest of the lake) are currently slated for removal.

A more detailed description of the surface water sampling and analysis is provided in Appendix A.

4.2 Surficial Sediment Mercury and Methylmercury Concentrations

Surficial [top 1 centimeter (cm)] sediment samples were collected in August 2004 and January 2005. It has been observed in the Everglades that sediment methylmercury concentrations are proportional to sediment mercury methylation rates (Gilmour, et al., 1998). Therefore, DuPont sampled surficial sediments in the Delta for total mercury and methylmercury to help determine current mercury inputs to the sediment column and identify sites of extant methylmercury production.

Total mercury concentrations observed in the surficial centimeter of the sediments were generally lower than deeper (6 inches or 15 cm) sediments (see Appendix B). However, surficial Delta sediment sampling results were elevated for total mercury relative to reference sediments collected upstream of the Delta in 1998. The surficial sediment results are consistent with the surface water results in that they show that nearshore surficial sediments have higher total mercury and methylmercury concentrations and typically higher organic carbon [as measured by loss on ignition (LOI)] than sediments found at deeper sites in the Delta. Total organic carbon and methylmercury concentrations correlated positively in surficial sediments. However, similar to the surface water results, sediment total mercury and sediment methylmercury concentrations were not strongly correlated (see Appendix B).

These results are consistent with the results from the surface water sampling events. Both sampling event results suggest that proximity to shore may be a better predictor of methylmercury production than total sediment mercury.

A more detailed description of the surficial sediment sampling and analysis is provided in Appendix B.

4.3 Deep Sediment Cores

Deep sediment core samples were collected in August 2004 and January 2005. Five deep (35 to 55 cm) sediment cores were collected in the center and more distal portions of the Delta and analyzed for total mercury. Two of these cores were dated using radioisotope techniques to determine sediment deposition histories. The cores have distinct mercury profiles with maxima at comparable depths consistent with the known history of mercury use at the Pompton Lakes site (see Appendix B). These maxima represent the period of active mercury input, followed by significant decreases in mercury inputs to the sediment. The preservation of the clear maxima in the sediment cores is indicative of a stable sediment environment with little or no large-scale mixing. These profiles suggest that mercury found at depth in the sediments is stable and unlikely to be involved in the highly bioactive zone in the top centimeter of sediments where mercury methylation is assumed to be most active. The sequestration of deep mercury in sediments is supportive of a remedial action focused on surficial sediment mercury concentrations that are more likely to be in contact with benthic biota, active in methylmercury production, and at risk for disturbance and transport within the Delta.

A more detailed description of the deep core sediment sampling and analysis is provided in Appendix B.

4.4 Methylmercury Flux Chamber Measurements

Flux chamber measurements of methylmercury efflux were collected during two sampling events in April and August 2005. The results of this work were expected to correlate with observations of methylmercury in the surface water. However, the methylmercury flux measured in the Delta was found to be highly variable (see Appendix C). Some flux chambers that were deployed side-by-side in pairs resulted in measurements of positive flux in one chamber and negative flux in the other. Flux chamber results were not well correlated with either sediment total mercury or proximity to shore, although it should be noted that the highest methylmercury fluxes for each sampling event were measured at a nearshore site (corresponding to SW 15) in the southwestern portion of the Delta that is slated for excavation (see Appendix C).

When positive, the Delta sediment methylmercury fluxes measured by the flux chambers in April 2005 were 50 to 32 times higher (at the reference and Delta sites, respectively) than those calculated from porewater methylmercury gradients with estimated diffusion coefficients during the Phase II ecological investigation (Exponent and The Academy of Natural Sciences, 1999). During this sampling event, the methylmercury fluxes observed from reference site sediments (outside of the Delta) were comparable to those measured in the Delta and were elevated relative to calculated values from 1999. However, it should be noted that this was the only benthic flux chamber measurement collected from the reference site. Given the observed high variability in benthic fluxes of methylmercury in the Delta, it is likely that the reference site fluxes would show similar variability and result in some cases of lower or even negative methylmercury fluxes. In August 2005, methylmercury flux in the Delta, when positive, was four times higher than the fluxes calculated in the 1999 Phase II report (see Appendix C).

Flux measurements of methylmercury directly measured with chambers were elevated relative to earlier calculated fluxes. However, the literature suggests that flux chambers will typically result in higher measured fluxes in comparison to fluxes calculated from gradients (Gill, 2004). Fluxes of mercury from Delta sediments were found to be low (4 to 30 times lower) when compared to similar measurements in other mercury-impacted sites, including a riverine system (Virginia) where the same flux chambers used in this study were deployed (Gill, et al., 1999; Gill, 2004; Landis, unpublished results).

A high variability, including negative values, in methylmercury fluxes has been reported by other researchers. Measurements of methylmercury efflux from sediment cores collected at Lahontan Reservoir showed that intra-site variability obscured inter-site variability (Kuwabara, et al., 2002). A similarly high variability in methylmercury fluxes was observed in marine sediments in Lavaca Bay (Gill, et al., 1999). Although some of the variability in the Lavaca Bay methylmercury flux measurements is attributable to diurnal effects, similar studies in the Delta suggest that diurnal effects are not a major controller of methylmercury efflux.

The methylmercury flux results from the Delta sediments appear highly variable and did correlate to the surface water measurements of methylmercury. However, these data indicate that a single measurement of Delta sediments is not predictive of the behavior of the entire Delta. The extrapolation of calculated methylmercury fluxes from two sediment cores to generate a total methylmercury production rate for Delta sediments in the Phase II ecological investigation was likely an overestimate because it did not take into account the inherent variability of the system (Exponent and The Academy of Natural Sciences, 2003).

A more detailed description of the benthic flux chamber study is provided in Appendix C.

4.5 Methylmercury Production in Sediment-Water Microcosms

Sediment methylmercury production was modeled in small anoxic sediment-water batch systems prepared from surficial sediments collected from the Delta and reference site and surface water collected from the reference site. In these experiments, the ability of Delta or reference site sediments to methylate mercury was tested under well-mixed anoxic conditions (i.e., conditions that should be stimulative of methylmercury production). Similar to the results of sediment methylmercury efflux measured by benthic flux chambers, the sediments in the microcosms did not consistently show net production of methylmercury. Methylmercury was produced only when mercury was added in the highly bioavailable form of an aqueous solution of mercuric chloride ($HgCl_2$) or when present as sediment-associated mercury from Delta sediments collected near the shoreline. A small amount of mercury was methylated in some sediments that were amended with readily bioavailable organic carbon, but this response was not observed in all cases where organic carbon was added. Overall, these preliminary studies suggest that mercury associated with Delta sediments is largely unavailable for mercury methylation, even when subjected to conditions that should be highly favorable for methylmercury production.

A more detailed description of the microcosm study is provided in Appendix C.

4.6 Biological Tissue Measurements in Benthic Community Analyses

The results of the 2005 biological investigation of the Delta generally support the conclusions of the Phase II ecological investigation conducted in 1998 (Exponent and The Academy of Natural Sciences, 1999). In 1998 and 2005, mercury and methylmercury concentrations in benthic invertebrates, young of the year (YOY) fish, and algal mats were greater in samples collected from the Delta relative to samples collected from background stations. Although tissue concentrations in the Delta were elevated relative to background samples, food-web modeling conducted in the 1998 investigation indicated that these tissue concentrations did not pose an unacceptable risk to five avian wildlife receptors. In general, tissue concentrations measured in the Delta in 2005 did not indicate an increased accumulation of mercury by chironomids and YOY fish tissue relative to 1998 tissue concentrations.

The results of the 2005 benthic invertebrate community analyses support the conclusion of the 1998 investigation that benthic invertebrate community structure in the Delta has not been altered by mercury concentrations in sediment. Based on community metrics and hierarchical cluster analysis, benthic community structure was similar in 1998 and 2005 for Delta and background sampling stations and did not correspond with spatial patterns of mercury concentrations in sediments. In general, benthic community characteristics appear to be influenced by proximity to the shoreline or water depth and sediment characteristics. The absence of impacts to the benthic community is supported by the results of sediment toxicity studies conducted in 1998, which demonstrated that elevated mercury levels in Delta sediments were not associated with increased toxicity to benthic organisms.

The proposed sediment removal action will further augment the conclusions of the 1998 and 2005 investigations regarding the health and condition of aquatic communities in the Delta by substantially reducing exposure to mercury concentrations in sediment. The substantial reduction in mercury exposure associated with the proposed action will support the protection of aquatic communities in the Delta.

A more detailed description of the biological investigation is provided in Appendix D.

4.7 Summary

The Delta exhibits elevated mercury and methylmercury concentrations in the sediments, surface water, and biota when compared to non-Delta sites in the lake. However, the data presented here indicate that the contribution of the Delta to the overall methylmercury budget of the lake may be dependent on processes localized to very specific nearshore portions of the Delta. To address these local sites of mercury methylation, DuPont proposes to remove sediments from the nearshore portions of the Delta, resulting in a removal of 83% of the sediment mercury mass, including 92% of the surface sediment mercury mass and 99% removal of mercury from the nearshore environment. This action will have the advantage of removing sediments suspected to be important potential sites of mercury methylation as well as providing a clean substrate for benthic biota.

The studies outlined in this section support the conclusion that Delta sediments are not uniformly important sites of methylmercury production. Mercury at depth appears to be sequestered from the surficial sediments where mercury methylation is expected to be active and the potential for contact with benthic biota is high. Mercury associated with surficial sediments may be methylated only when specific environmental conditions are met. As a result, the large-scale removal of the entire sediment column proposed herein is expected to be a conservative remedial approach in that it removes elevated levels of mercury associated with sediments regardless of whether that mercury is likely to be available for methylation.

The benefits of this extensive sediment removal action will be localized to the Delta environment. Most of the mercury mass proposed to be removed is believed to be sequestered in the sediments and not actively involved in biogeochemical cycling or available for bioaccumulation. Additionally, there are external sources of mercury to Pompton Lake that are not associated with historic manufacturing processes at the DuPont plant; these areas will not be addressed by the sediment removal action.

Specifically, an analysis of the mass balance of mercury in Pompton Lake showed that Ramapo River water represented the largest source of mercury to the Pompton Lakes system (Exponent and The Academy of Natural Sciences, 1999). This mercury is likely to be highly mobile, easily transported throughout the lake, and may be associated with the methylmercury fluxes observed at the reference area site upstream of the Delta. Regardless of the source of the Ramapo River mercury, it will continue throughout and after the proposed sediment removal action in the Delta. Because of the continued inputs of mercury from this source and others (e.g., atmospheric deposition and nonspecific watershed runoff), it is unlikely that the Pompton Lake biota as a whole will display decreased methylmercury as a result of removal of sediments from the Delta.

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TABLES

TABLE 1A
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-1	31	576	0	-	0.5	188.00	10.66	2,004.77
537-10	32	755	0	-	0.5	24.90	13.97	347.91
537-100	33	1,149	0	-	0.5	224.00	21.28	4,766.39
537-101	34	1,111	0	-	0.5	0.74	20.57	15.22
537-102	35	1,693	0	-	0.5	72.90	31.35	2,285.55
537-103	36	1,796	0	-	0.5	201.00	33.25	6,683.48
537-104	37	2,395	0	-	0.5	761.00	44.35	33,747.30
537-105	38	623	0	-	0.5	51.10	11.53	589.31
537-105a	39	2,874	0	-	0.5	147.00	53.23	7,824.62
537-106	40	2,826	0	-	0.5	814.00	52.34	42,606.66
537-107	41	3,009	0	-	0.5	2.60	55.72	144.87
537-107a	42	1,060	0	-	0.5	3.90	19.63	76.57
537-108	43	2,461	0	-	0.5	16.90	45.57	770.21
537-108a	44	835	0	-	0.5	26.30	15.47	406.89
537-109	45	3,654	0	-	0.5	119.00	67.67	8,052.29
537-11	46	1,379	0	-	0.5	21.80	25.54	556.68
537-110	47	917	0	-	0.5	0.21	16.99	3.57
537-111	48	1,309	0	-	0.5	0.60	24.25	14.55
537-112	49	1,617	0	-	0.5	571.00	29.95	17,100.88
537-113	50	2,559	0	-	0.5	657.00	47.39	31,136.21
537-114	51	1,612	0	-	0.5	792.00	29.86	23,646.68
537-115	52	5,713	0	-	0.5	132.00	105.80	13,966.19
537-116	53	2,100	0	-	0.5	174.00	38.89	6,767.28
537-117	54	3,952	0	-	0.5	1.60	73.18	117.09
537-118	55	2,205	0	-	0.5	0.23	40.84	9.39
537-119	56	2,700	0	-	0.5	147.00	49.99	7,348.65
537-120	57	4,459	0	-	0.5	1.90	82.58	156.90
537-121	58	2,598	0	-	0.5	0.15	48.11	7.22
537-122	59	3,203	0	-	0.5	0.58	59.32	34.41
537-123	60	2,687	0	-	0.5	590.00	49.76	29,358.95
537-124	61	1,735	0	-	0.5	298.00	32.12	9,572.41
537-125	62	2,806	0	-	0.5	257.00	51.97	13,356.41
537-126	63	3,488	0	-	0.5	0.19	64.60	12.27
537-127	64	4,648	0	-	0.5	40.20	86.08	3,460.45
537-128	65	1,934	0	-	0.5	0.70	35.81	25.07
537-129	66	2,402	0	-	0.5	1.20	44.48	53.38
537-130	67	2,994	0	-	0.5	462.00	55.45	25,615.74
537-131	68	1,774	0	-	0.5	130.00	32.85	4,270.47
537-132	69	2,939	0	-	0.5	306.00	54.43	16,656.18
537-133	70	2,071	0	-	0.5	7.20	38.35	276.09
537-14	71	485	0	-	0.5	33.70	8.97	302.38
537-140	72	320	0	-	0.5	148.00	5.93	877.66
537-144	73	561	0	-	0.5	8.07	10.38	83.77
537-145	74	2,119	0	-	0.5	133.50	39.24	5,238.09
537-146	75	3,620	0	-	0.5	1.80	67.03	120.65
537-147	76	1,271	0	-	0.5	207.40	23.54	4,881.93
537-148	77	1,235	0	-	0.5	279.30	22.87	6,388.25
537-149	78	1,210	0	-	0.5	91.70	22.41	2,055.01

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Existing Surface Conditions - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-15	79	1,284	0	-	0.5	1.30	23.77	30.91
537-150	80	1,727	0	-	0.5	97.70	31.97	3,123.84
537-151	81	995	0	-	0.5	247.80	18.43	4,566.70
537-152	82	1,125	0	-	0.5	166.70	20.84	3,473.57
537-153	83	1,568	0	-	0.5	75.40	29.03	2,189.08
537-154	84	1,790	0	-	0.5	66.60	33.15	2,207.47
537-155	85	2,688	0	-	0.5	183.70	49.78	9,144.02
537-156	86	1,567	0	-	0.5	159.10	29.02	4,616.78
537-157	87	1,589	0	-	0.5	426.00	29.43	12,536.16
537-158	88	1,265	0	-	0.5	24.00	23.43	562.22
537-159	89	1,267	0	-	0.5	87.10	23.46	2,042.94
537-16	90	599	0	-	0.5	4,520.00	11.10	50,162.51
537-160	91	855	0	-	0.5	117.90	15.82	1,865.73
537-161	92	1,118	0	-	0.5	118.10	20.70	2,445.13
537-162	93	966	0	-	0.5	9.00	17.88	160.94
537-164	94	737	0	-	0.5	61.60	13.65	840.92
537-165	95	836	0	-	0.5	24.50	15.48	379.24
537-166	96	1,188	0	-	0.5	49.70	22.00	1,093.44
537-167	97	2,417	0	-	0.5	25.60	44.76	1,145.89
537-168	98	2,362	0	-	0.5	111.40	43.74	4,872.82
537-169	99	907	0	-	0.5	72.10	16.80	1,210.97
537-17	100	1,441	0	-	0.5	200.00	26.68	5,336.93
537-170	101	731	0	-	0.5	86.00	13.53	1,163.45
537-171	102	1,683	0	-	0.5	388.40	31.16	12,102.28
537-172	103	1,385	0	-	0.5	281.90	25.64	7,228.01
537-173	104	636	0	-	0.5	79.90	11.78	941.41
537-174	105	1,235	0	-	0.5	126.00	22.87	2,882.24
537-175	106	1,487	0	-	0.5	93.10	27.55	2,564.45
537-176	107	1,152	0	-	0.5	94.90	21.34	2,025.21
537-177	108	996	0	-	0.5	121.60	18.45	2,243.79
537-178	109	1,653	0	-	0.5	228.00	30.62	6,980.82
537-179	110	951	0	-	0.5	80.80	17.61	1,422.91
537-18	111	1,147	0	-	0.5	18.20	21.25	386.67
537-184	112	773	0	-	0.5	158.00	14.32	2,262.70
537-186	113	1,473	0	-	0.5	135.50	27.28	3,697.07
537-187	114	1,194	0	-	0.5	114.20	22.11	2,525.46
537-188	115	1,144	0	-	0.5	135.20	21.18	2,863.42
537-189	116	333	0	-	0.5	10.00	6.17	61.68
537-190	117	534	0	-	0.5	16.30	9.89	161.23
37-193/537-16	118	632	0	-	0.5	81.55	11.70	954.10
537-194	119	1,983	0	-	0.5	127.40	36.72	4,678.44
537-195	120	731	0	-	0.5	13.80	13.54	186.81
537-196	121	3,235	0	-	0.5	57.80	59.91	3,462.85
537-197	122	2,072	0	-	0.5	27.80	38.36	1,066.49
537-198	123	2,419	0	-	0.5	51.90	44.79	2,324.69
537-199	124	2,875	0	-	0.5	78.90	53.25	4,201.36
537-2	125	870	0	-	0.5	123.00	16.12	1,982.53
537-201	127	1,441	0	-	0.5	49.80	26.68	1,328.72

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Existing Surface Conditions - Removal from Shoreline to 2 ppm Surface Line
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0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-202	128	1,595	0	-	0.5	63.80	29.53	1,883.99
537-203	129	5,505	0	-	0.5	52.70	101.94	5,372.12
537-204	130	1,465	0	-	0.5	157.00	27.14	4,260.27
537-205	131	1,978	0	-	0.5	697.00	36.63	25,532.03
537-206	132	861	0	-	0.5	237.00	15.94	3,777.71
537-207	133	1,308	0	-	0.5	84.00	24.22	2,034.19
537-208	134	2,467	0	-	0.5	1,486.00	45.68	67,885.15
537-209	135	2,003	0	-	0.5	103.00	37.10	3,821.16
537-210	136	1,971	0	-	0.5	331.00	36.50	12,082.10
537-211	137	467	0	-	0.5	71.00	8.65	614.12
537-212	138	2,328	0	-	0.5	189.00	43.11	8,147.09
537-213	139	361	0	-	0.5	91.00	6.68	607.51
537-214	140	1,287	0	-	0.5	358.00	23.84	8,534.23
537-215	141	1,512	0	-	0.5	211.00	28.00	5,907.90
537-216	142	2,185	0	-	0.5	361.00	40.46	14,605.30
537-217	143	1,431	0	-	0.5	55.00	26.51	1,457.93
537-218	144	584	0	-	0.5	132.00	10.82	1,428.27
537-219	145	963	0	-	0.5	103.00	17.83	1,836.71
537-22	146	1,698	0	-	0.5	666.00	31.45	20,944.66
537-220	147	921	0	-	0.5	121.00	17.05	2,063.65
537-221	148	1,767	0	-	0.5	112.00	32.73	3,665.24
537-222	149	2,027	0	-	0.5	496.00	37.53	18,617.03
537-223	150	1,321	0	-	0.5	82.00	24.47	2,006.65
537-224	151	341	0	-	0.5	9.00	6.32	56.90
537-225	152	2,049	0	-	0.5	64.00	37.95	2,428.78
537-226	153	1,342	0	-	0.5	128.00	24.86	3,181.65
537-227	154	884	0	-	0.5	4.00	16.37	65.47
537-228	155	1,087	0	-	0.5	600.00	20.13	12,075.43
537-229	156	1,988	0	-	0.5	73.00	36.82	2,687.52
537-23	157	1,091	0	-	0.5	668.00	20.20	13,492.84
537-230	158	2,742	0	-	0.5	62.00	50.78	3,148.42
537-231	159	2,022	0	-	0.5	61.00	37.45	2,284.67
537-232	160	1,583	0	-	0.5	115.00	29.32	3,371.86
537-233	161	3,307	0	-	0.5	57.00	61.24	3,490.93
537-234	162	2,185	0	-	0.5	0.25	40.46	10.12
537-235	163	9,857	0	-	0.5	16.00	182.54	2,920.64
537-236	164	1,645	0	-	0.5	74.00	30.46	2,254.06
537-237	165	9,792	0	-	0.5	43.00	181.34	7,797.44
537-239	167	10,482	0	-	0.5	1.00	194.11	194.11
537-24	168	1,317	0	-	0.5	14.00	24.39	341.43
537-241	170	10,785	0	-	0.5	8.00	199.72	1,597.76
537-242	171	1,815	0	-	0.5	109.00	33.61	3,662.97
537-243	172	258	0	-	0.5	12.00	4.78	57.33
537-244	173	1,175	0	-	0.5	110.00	21.76	2,393.99
537-246	175	2,041	0	-	0.5	121.00	37.79	4,573.03
537-248	177	1,179	0	-	0.5	176.00	21.84	3,843.51
537-250	179	9,273	0	-	0.5	670.00	171.71	115,048.77
537-259	188	2,654	0	-	0.5	24.00	49.15	1,179.49

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EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-26	189	1,385	0	-	0.5	155.00	25.66	3,976.80
537-261	191	11,339	0	-	0.5	13.00	209.99	2,729.81
537-263	193	7,772	0	-	0.5	60.00	143.92	8,635.09
537-265	195	10,598	0	-	0.5	133.00	196.26	26,102.54
537-266	196	11,728	0	-	0.5	0.25	217.19	54.30
537-267	197	14,699	0	-	0.5	168.00	272.21	45,730.45
537-268	198	9,191	0	-	0.5	40.00	170.20	6,808.19
537-269	199	15,523	0	-	0.5	62.00	287.47	17,822.86
537-270	200	7,669	0	-	0.5	48.00	142.01	6,816.70
537-271	201	13,499	0	-	0.5	36.00	249.98	8,999.26
537-272	202	2,850	0	-	0.5	49.10	52.77	2,590.94
537-273	203	2,291	0	-	0.5	35.80	42.43	1,519.14
537-274	204	6,042	0	-	0.5	41.10	111.89	4,598.67
537-28	210	1,838	0	-	0.5	431.00	34.04	14,671.84
537-283	214	2,463	0	-	0.5	13.50	45.61	615.72
537-284	215	1,278	0	-	0.5	42.20	23.66	998.54
537-285	216	2,893	0	-	0.5	23.40	53.57	1,253.44
537-286	217	2,249	0	-	0.5	19.40	41.65	808.03
537-29	221	1,131	0	-	0.5	0.35	20.95	7.33
537-297	228	4,489	0	-	0.5	66.70	83.13	5,544.72
537-298	229	2,396	0	-	0.5	17.30	44.37	767.65
537-299	230	3,560	0	-	0.5	17.00	65.93	1,120.88
537-3	231	596	0	-	0.5	118.00	11.03	1,301.96
537-30	232	6,728	0	-	0.5	0.50	124.60	62.30
537-308	240	130	0	-	0.5	2.33	2.41	5.62
537-31	241	987	0	-	0.5	20.00	18.27	365.46
537-310	242	771	0	-	0.5	13.30	14.28	189.88
537-311	243	6,980	0	-	0.5	3.22	129.25	416.19
537-312	244	3,652	0	-	0.5	11.40	67.63	770.96
537-32	252	1,454	0	-	0.5	22.40	26.92	603.00
537-321	254	0	0	-	0.5	15.20	0.01	0.14
537-322	255	3,641	0	-	0.5	15.90	67.43	1,072.21
537-33	263	1,116	0	-	0.5	20.80	20.67	429.97
537-331	265	4,243	0	-	0.5	16.50	78.58	1,296.52
537-339	273	3,572	0	-	0.5	367.00	66.14	24,273.38
537-35	281	733	0	-	0.5	62.80	13.57	851.95
537-36	282	664	0	-	0.5	1,450.00	12.30	17,842.22
537-37	283	427	0	-	0.5	17.00	7.90	134.38
537-371	284	5,748	0	-	0.5	19.00	106.44	2,022.33
537-38	292	479	0	-	0.5	38.20	8.87	338.93
537-381	293	3,856	0	-	0.5	18.10	71.40	1,292.39
537-382	294	10	0	-	0.5	8.10	0.19	1.50
537-39	299	1,776	0	-	0.5	8,060.00	32.89	265,108.53
537-4	300	792	0	-	0.5	63.20	14.66	926.43
537-40	301	637	0	-	0.5	127.00	11.79	1,497.36
537-41	302	704	0	-	0.5	211.00	13.05	2,752.51
537-42	303	667	0	-	0.5	175.00	12.35	2,162.11
537-43	304	536	0	-	0.5	120.00	9.93	1,191.10

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Existing Surface Conditions - Removal from Shoreline to 2 ppm Surface Line
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0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-44	305	456	0	-	0.5	11.10	8.44	93.65
537-45	306	979	0	-	0.5	511.00	18.14	9,267.86
537-46	307	3,141	0	-	0.5	663.00	58.16	38,558.70
537-47	308	1,645	0	-	0.5	517.00	30.47	15,753.28
537-5	309	600	0	-	0.5	59.80	11.12	664.95
537-51/537-183	310	1,304	0	-	0.5	11.60	24.15	280.09
537-52	311	677	0	-	0.5	10.80	12.54	135.47
537-53	312	2,791	0	-	0.5	3.40	51.69	175.74
537-54	313	2,363	0	-	0.5	2,790.00	43.76	122,096.56
537-55	314	2,374	0	-	0.5	0.28	43.97	12.31
537-56	315	2,660	0	-	0.5	378.00	49.26	18,622.14
537-57	316	2,901	0	-	0.5	288.00	53.72	15,470.75
537-58	317	1,821	0	-	0.5	43.70	33.72	1,473.40
537-59	318	3,812	0	-	0.5	42.50	70.59	2,999.93
537-6	319	589	0	-	0.5	98.30	10.91	1,071.98
537-60	320	2,008	0	-	0.5	164.00	37.18	6,098.01
537-61	321	1,495	0	-	0.5	1.20	27.69	33.23
537-62	322	2,226	0	-	0.5	172.00	41.23	7,091.18
537-63	323	2,476	0	-	0.5	1,900.00	45.85	87,115.55
537-64	324	2,498	0	-	0.5	42.30	46.25	1,956.50
537-65	325	2,359	0	-	0.5	1,200.00	43.69	52,432.71
537-66	326	3,986	0	-	0.5	3.20	73.82	236.23
537-67	327	2,462	0	-	0.5	5,060.00	45.60	230,711.30
537-68	328	3,166	0	-	0.5	2.00	58.62	117.25
537-69	329	2,245	0	-	0.5	38.90	41.58	1,617.47
537-7	330	364	0	-	0.5	97.10	6.74	654.26
537-70	331	2,982	0	-	0.5	42.70	55.22	2,358.01
537-71	332	664	0	-	0.5	25.50	12.29	313.47
537-72	333	2,167	0	-	0.5	0.14	40.12	5.62
537-73	334	2,494	0	-	0.5	56.50	46.19	2,609.90
537-74	335	3,170	0	-	0.5	55.60	58.71	3,264.32
537-75	336	2,251	0	-	0.5	1.10	41.69	45.86
537-76	337	1,904	0	-	0.5	283.00	35.27	9,980.93
537-77	338	2,474	0	-	0.5	0.59	45.82	27.04
537-78	339	3,605	0	-	0.5	15.00	66.76	1,001.46
537-79	340	2,393	0	-	0.5	90.10	44.31	3,992.39
537-8	341	1,971	0	-	0.5	147.00	36.49	5,364.24
537-80	342	2,762	0	-	0.5	266.00	51.14	13,603.47
537-81	343	1,880	0	-	0.5	113.00	34.82	3,934.88
537-82	344	2,691	0	-	0.5	17.80	49.82	886.88
537-83	345	2,594	0	-	0.5	1.70	48.04	81.67
537-84	346	1,062	0	-	0.5	3.00	19.67	59.02
537-85	347	3,537	0	-	0.5	8.10	65.50	530.58
537-86	348	2,094	0	-	0.5	330.00	38.78	12,798.80
537-87	349	3,165	0	-	0.5	321.00	58.62	18,815.75
537-88	350	1,874	0	-	0.5	28.00	34.71	971.88
537-89	351	2,930	0	-	0.5	22.40	54.26	1,215.32
537-9	352	1,474	0	-	0.5	13.10	27.31	357.70

TABLE 1A
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions - Removal from Shoreline to 2 ppm Surface Line
DupPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-90	353	2,990	0	-	0.5	25.30	55.37	1,400.98
537-91	354	2,866	0	-	0.5	630.00	53.07	33,431.48
537-92	355	2,888	0	-	0.5	5.20	53.48	278.11
537-93	356	2,129	0	-	0.5	42.70	39.43	1,683.66
537-94	357	2,819	0	-	0.5	88.80	52.20	4,635.74
537-95	358	2,121	0	-	0.5	632.00	39.28	24,825.47
537-96	359	2,044	0	-	0.5	72.30	37.85	2,736.50
537-97	360	2,142	0	-	0.5	39.60	39.66	1,570.54
537-98	361	2,285	0	-	0.5	424.00	42.31	17,938.22
537-99	362	1,432	0	-	0.5	41.00	26.52	1,087.16
TR-1	363	919	0	-	0.5	14.00	17.02	238.29
TR-11	365	1,850	0	-	0.5	64.00	34.25	2,192.06
TR-13	367	4,335	0	-	0.5	40.00	80.27	3,210.96
TR-14	368	683	0	-	0.5	84.00	12.64	1,061.74
TR-15	369	754	0	-	0.5	186.00	13.95	2,595.49
TR-16	370	45	0	-	0.5	30.00	0.83	24.95
TR-17	371	7,519	0	-	0.5	51.00	139.25	7,101.55
TR-18	372	601	0	-	0.5	95.00	11.12	1,056.81
TR-19	373	1,147	0	-	0.5	65.00	21.25	1,381.14
TR-2	374	5,057	0	-	0.5	34.00	93.66	3,184.31
TR-20	375	5,491	0	-	0.5	43.00	101.69	4,372.65
TR-21	376	9,839	0	-	0.5	15.00	182.20	2,732.95
TR-22	377	1,124	0	-	0.5	83.00	20.81	1,727.12
TR-3	378	535	0	-	0.5	12.00	9.91	118.93
TR-4	379	8,377	0	-	0.5	56.00	155.12	8,686.80
TR-5	380	7,335	0	-	0.5	61.00	135.84	8,285.96
TR-8	383	1,117	0	-	0.5	80.00	20.68	1,654.67
537-402	385	11,759	0	-	0.5	13.40	217.76	2,917.94
537-403	386	30	0	-	0.5	8.76	0.55	4.82
537-410	391	17,166	0	-	0.5	16.00	317.90	5,086.36
537-411	392	15	0	-	0.5	6.73	0.28	1.90
537-415	396	2,753	0	-	0.5	7.54	50.97	384.34
537-110	47a	4,280	0	-	0.5	0.21	79.26	16.64
537-120	57a	767	0	-	0.5	1.90	14.20	26.98
537-121	58a	2,313	0	-	0.5	0.15	42.83	6.42
537-200	126	9,844	0	-	0.5	21.80	182.29	3,973.97
537-234	162a	7,218	0	-	0.5	0.25	133.67	33.42
537-238	166	13,790	0	-	0.5	20.00	255.37	5,107.40
537-239	167a	5,359	0	-	0.5	1.00	99.24	99.24
537-240	169	13,170	0	-	0.5	12.00	243.89	2,926.64
537-243	172a	12,148	0	-	0.5	12.00	224.97	2,699.60
537-245	174	12,028	0	-	0.5	5.00	222.74	1,113.68
537-247	176	8,646	0	-	0.5	8.00	160.11	1,280.89
537-249	178	14,118	0	-	0.5	9.00	261.45	2,353.06
537-251	180	11,821	0	-	0.5	0.25	218.92	54.73
537-252	181	14,412	0	-	0.5	91.00	266.88	24,286.40
537-253	182	14,552	0	-	0.5	16.00	269.48	4,311.63
537-254	183	14,039	0	-	0.5	40.00	259.98	10,399.31

TABLE 1A
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-255	184	12,324	0	-	0.5	27.00	228.22	6,161.81
537-256	185	11,424	0	-	0.5	21.00	211.56	4,442.83
537-257	186	8,488	0	-	0.5	17.00	157.18	2,672.08
537-258	187	15,899	0	-	0.5	13.00	294.43	3,827.64
537-259	188a	13,317	0	-	0.5	24.00	246.62	5,918.80
537-260	190	10,131	0	-	0.5	9.00	187.61	1,688.51
537-262	192	11,583	0	-	0.5	3.00	214.49	643.47
537-264	194	8,731	0	-	0.5	17.00	161.68	2,748.51
537-274	204a	1,115	0	-	0.5	41.10	20.64	848.44
537-275	205	4,327	0	-	0.5	16.50	80.12	1,322.03
537-276	206	4,279	0	-	0.5	9.09	79.24	720.28
537-277	207	4,009	0	-	0.5	7.52	74.24	558.29
537-278	208	3,696	0	-	0.5	6.26	68.44	428.41
537-279	209	4,089	0	-	0.5	7.61	75.73	576.29
537-280	211	4,083	0	-	0.5	15.20	75.61	1,149.29
537-281	212	5,808	0	-	0.5	2.81	107.55	302.23
537-282	213	2,482	0	-	0.5	6.46	45.96	296.89
537-283	214a	89	0	-	0.5	13.50	1.65	22.26
537-286	217a	645	0	-	0.5	19.40	11.94	231.65
537-287	218	3,842	0	-	0.5	12.30	71.15	875.18
537-288	219	4,694	0	-	0.5	59.90	86.93	5,207.23
537-289	220	4,064	0	-	0.5	5.71	75.25	429.69
537-29	221a	3,815	0	-	0.5	0.35	70.64	24.73
537-290	222	4,407	0	-	0.5	4.29	81.60	350.08
537-291	223	3,747	0	-	0.5	4.75	69.39	329.60
537-292	224	4,287	0	-	0.5	4.00	79.39	317.58
537-293	225	3,643	0	-	0.5	2.28	67.47	153.82
537-294	226	4,502	0	-	0.5	5.29	83.36	440.99
537-295	227	2,790	0	-	0.5	0.92	51.67	47.54
537-299	230a	62	0	-	0.5	17.00	1.15	19.58
537-300	233	3,981	0	-	0.5	9.29	73.71	684.80
537-301	234	4,703	0	-	0.5	6.07	87.09	528.64
537-302	235	3,778	0	-	0.5	5.75	69.97	402.30
537-303	236	3,726	0	-	0.5	3.98	69.01	274.65
537-304	237	4,072	0	-	0.5	4.32	75.41	325.76
537-305	238	3,922	0	-	0.5	3.21	72.62	233.12
537-307	239	3,057	0	-	0.5	3.74	56.61	211.72
537-308	240a	253	0	-	0.5	2.33	4.69	10.94
537-312	244a	1	0	-	0.5	11.40	0.02	0.26
537-313	245	3,392	0	-	0.5	7.06	62.81	443.47
537-314	246	4,839	0	-	0.5	6.39	89.61	572.61
537-315	247	3,886	0	-	0.5	17.40	71.95	1,252.00
537-316	248	4,299	0	-	0.5	4.54	79.61	361.44
537-317	249	3,390	0	-	0.5	3.07	62.78	192.73
537-318	250	4,795	0	-	0.5	3.42	88.80	303.70
537-319	251	661	0	-	0.5	3.53	12.23	43.18
537-320	253	4,600	0	-	0.5	13.30	85.18	1,132.93
537-321	254a	771	0	-	0.5	15.20	14.27	216.89

TABLE 1A
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-323	256	4,954	0	-	0.5	9.76	91.74	895.37
537-324	257	4,646	0	-	0.5	7.65	86.04	658.18
537-325	258	4,756	0	-	0.5	6.36	88.08	560.18
537-326	259	4,786	0	-	0.5	4.25	88.62	376.65
537-327	260	2,469	0	-	0.5	1.07	45.72	48.92
537-328	261	5,108	0	-	0.5	7.14	94.59	675.34
537-329	262	792	0	-	0.5	1.80	14.66	26.38
537-330	264	4,828	0	-	0.5	4.58	89.41	409.51
537-332	266	3,805	0	-	0.5	9.73	70.46	685.56
537-333	267	4,879	0	-	0.5	6.57	90.36	593.65
537-334	268	4,361	0	-	0.5	7.19	80.75	580.61
537-335	269	5,150	0	-	0.5	3.73	95.37	355.73
537-336	270	1,916	0	-	0.5	3.91	35.49	138.76
537-337	271	4,513	0	-	0.5	4.05	83.56	338.44
537-338	272	4,368	0	-	0.5	2.92	80.88	236.18
537-339	273a	3	0	-	0.5	367.00	0.05	18.85
537-340	274	3,973	0	-	0.5	8.21	73.58	604.09
537-341	275	4,899	0	-	0.5	5.40	90.72	489.88
537-342	276	3,568	0	-	0.5	21.20	66.07	1,400.75
537-343	277	3,972	0	-	0.5	3.14	73.55	230.96
537-344	278	1,268	0	-	0.5	3.39	23.49	79.62
537-345	279	5,421	0	-	0.5	4.77	100.39	478.86
537-346	280	4,540	0	-	0.5	4.57	84.08	384.25
537-372	285	5,488	0	-	0.5	9.85	101.62	1,000.97
537-373	286	4,219	0	-	0.5	7.43	78.13	580.54
537-374	287	26,874	0	-	0.5	0.55	497.67	273.72
537-375	288	4,589	0	-	0.5	2.90	84.98	246.45
537-376	289	16,173	0	-	0.5	0.15	299.49	44.92
537-377	290	4,963	0	-	0.5	3.28	91.90	301.44
537-378	291	2,004	0	-	0.5	2.94	37.11	109.12
537-382	294a	3,736	0	-	0.5	8.10	69.18	560.38
537-383	295	5,206	0	-	0.5	4.30	96.42	414.59
537-384	296	4,551	0	-	0.5	1.01	84.28	85.12
537-385	297	3,809	0	-	0.5	2.43	70.54	171.41
537-386	298	4,702	0	-	0.5	4.27	87.07	371.79
537-72	333a	3,767	0	-	0.5	0.14	69.76	9.77
537-78	339a	133	0	-	0.5	15.00	2.47	37.08
537-85	347a	48	0	-	0.5	8.10	0.89	7.24
TR-1	363a	7,690	0	-	0.5	14.00	142.40	1,993.61
TR-10	364	7,795	0	-	0.5	50.00	144.35	7,217.27
TR-12	366	11,003	0	-	0.5	23.00	203.76	4,686.52
TR-13	367a	2,798	0	-	0.5	40.00	51.81	2,072.43
TR-16	370a	9,781	0	-	0.5	30.00	181.13	5,433.92
TR-3	378a	11,137	0	-	0.5	12.00	206.23	2,474.82
TR-6	381	11,704	0	-	0.5	18.00	216.74	3,901.28
TR-7	382	9,889	0	-	0.5	43.00	183.13	7,874.78
TR-9	384	11,092	0	-	0.5	18.00	205.40	3,697.26
537-403	386a	12,248	0	-	0.5	8.76	226.81	1,986.88

TABLE 1A
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-404	387	8,455	0	-	0.5	7.07	156.58	1,106.99
537-405	388	2,326	0	-	0.5	2.09	43.08	90.04
537-406	389	4,004	0	-	0.5	2.55	74.16	189.10
537-407	390	770	0	-	0.5	1.35	14.27	19.26
537-410	391a	16	0	-	0.5	16.00	0.29	4.60
537-411	392a	20,758	0	-	0.5	6.73	384.41	2,587.10
537-412	393	12,867	0	-	0.5	4.84	238.27	1,153.23
537-413	394	1,906	0	-	0.5	1.37	35.30	48.36
537-414	395	818	0	-	0.5	1.78	15.16	26.98
537-415	396a	9,500	0	-	0.5	7.54	175.92	1,326.43
537-416	397	22,459	0	-	0.5	2.75	415.90	1,143.73
537-417	398	19,335	0	-	0.5	5.48	358.06	1,962.14
537-418	399	1,253	0	-	0.5	1.60	23.20	37.12
537-420	400	1,175	0	-	0.5	2.41	21.75	52.42
537-422	401	14,518	0	-	0.5	10.00	268.86	2,688.60
537-424	402	62,784	0	-	0.5	6.06	1,162.67	7,045.79
537-426	403	22,856	0	-	0.5	5.03	423.27	2,129.03
537-428	404	271	0	-	0.5	1.96	5.01	9.82
537-430	405	20,005	0	-	0.5	8.11	370.47	3,004.50
537-431	406	10,714	0	-	0.5	2.57	198.40	509.88
537-432	407	17,585	0	-	0.5	1.92	325.65	625.25
537-435	408	20,427	0	-	0.5	3.40	378.27	1,286.13
537-438	409	8,034	0	-	0.5	1.54	148.79	229.13
537-306	414	441	0	-	0.5	1.68	8.17	13.73
537-306	415	177	0	-	0.5	1.68	3.28	5.51
Totals:		1,635,710		--		--	30,290.93	2,454,147.33
						Volume Weighted Average:		**81.0**

Notes:

1. Non-detectable mercury concentrations are included as one-half the detection limit in calculations and shown in bold.
2. All calculations and rounding are performed by the computer software. Therefore, certain quantities in above table are displayed as rounded numbers for clarity.

TABLE 1B
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions (> 0.5 foot) - Removal from Shoreline to 2 ppm Surface Line
Dupont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-1	34	576	0.5	-	1.30	121.93	17.06	2,080.35
537-10	35	1,133	0.5	-	1.71	402.01	50.69	20,379.25
537-100	36	1,551	0.5	-	1.26	0.58	43.59	25.28
537-101	37	1,293	0.5	-	1.60	0.45	52.66	23.70
537-102	38	2,895	0.5	-	1.16	1.30	70.82	92.07
537-103	39	2,327	0.5	-	3.80	15.10	284.46	4,295.33
537-105	40	644	0.5	-	2.80	7.50	54.85	411.38
537-105a	41	5,163	0.5	-	1.98	45.88	283.03	12,985.31
537-107	42	4,723	0.5	-	1.00	0.06	87.46	5.25
537-107a	43	1,303	0.5	-	1.52	25.81	49.23	1,270.63
537-108	44	3,834	0.5	-	1.10	0.06	85.19	5.11
537-108a	45	840	0.5	-	1.20	2.67	21.78	58.15
537-109	46	3,904	0.5	-	1.08	0.21	83.68	17.57
537-11	47	915	0.5	-	1.97	6.00	49.93	299.59
537-110	48	2,106	0.5	-	0.69	0.06	15.18	0.91
537-111	49	3,371	0.5	-	1.08	0.63	72.42	45.63
537-112	50	3,708	0.5	-	1.30	0.21	109.86	23.07
537-113	51	3,376	0.5	-	1.13	0.57	78.78	44.90
537-114	52	3,026	0.5	-	0.84	0.07	38.11	2.67
537-115	53	24,760	0.5	-	0.54	0.06	36.68	2.20
537-116	54	3,439	0.5	-	1.32	0.32	104.44	33.42
537-117	55	8,053	0.5	-	1.17	0.06	199.83	11.99
537-118	56	3,058	0.5	-	1.38	0.06	99.67	5.98
537-119	57	3,814	0.5	-	1.00	0.71	70.62	50.14
537-12	58	1,174	0.5	-	2.80	4.63	100.00	463.00
537-120	59	4,951	0.5	-	1.06	0.06	102.68	6.16
537-121	60	2,635	0.5	-	1.12	0.06	60.51	3.63
537-122	61	3,793	0.5	-	1.01	0.07	71.65	5.02
537-123	62	3,724	0.5	-	0.92	0.19	57.92	11.01
537-124	63	4,171	0.5	-	1.22	0.07	111.22	7.79
537-125	64	6,482	0.5	-	0.70	0.14	48.02	6.72
537-126	65	10,702	0.5	-	0.94	0.39	174.40	68.02
537-127	66	7,298	0.5	-	1.17	0.13	181.10	23.54
537-128	67	4,320	0.5	-	1.22	0.06	115.19	6.91
537-129	68	2,402	0.5	-	1.11	0.06	54.27	3.26
537-13	69	1,045	0.5	-	2.37	22.70	72.39	1,643.28
537-130	70	5,120	0.5	-	2.49	0.74	377.37	279.26
537-131	71	3,494	0.5	-	1.33	19.99	107.41	2,147.11
537-132	72	4,576	0.5	-	2.45	394.00	330.52	130,226.54
537-133	73	3,841	0.5	-	2.05	0.06	220.49	13.23
537-136	74	372	0.5	-	2.10	1.27	22.02	27.97
537-139	75	259	0.5	-	2.00	161.00	14.38	2,314.62
537-14	76	798	0.5	-	2.11	24.34	47.59	1,158.39
537-140	77	312	0.5	-	2.59	31.83	24.14	768.31
537-142	78	485	0.5	-	3.23	3.84	49.06	188.37
537-143	79	291	0.5	-	1.43	101.35	10.04	1,017.47
537-145	80	2,619	0.5	-	1.20	1.87	67.89	126.96
537-146	81	7,559	0.5	-	2.00	1.41	419.96	592.14

TABLE 1B
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions (> 0.5 foot) - Removal from Shoreline to 2 ppm Surface Line
DupPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-147	82	1,960	0.5	-	2.36	69.73	135.01	9,414.54
537-148	83	2,242	0.5	-	1.50	62.73	83.04	5,208.85
537-149	84	1,173	0.5	-	2.02	43.71	66.02	2,885.83
537-15	85	250	0.5	-	2.16	31.83	15.38	489.48
537-150	86	2,109	0.5	-	1.21	2.06	55.46	114.24
537-151	87	1,522	0.5	-	1.50	1.95	56.39	109.96
537-152	88	2,001	0.5	-	1.49	12.45	73.36	913.27
537-153	89	1,903	0.5	-	1.51	141.78	71.20	10,094.97
537-154	90	5,394	0.5	-	1.19	221.13	137.85	30,483.29
537-155	91	4,853	0.5	-	1.49	1.68	177.95	298.95
537-156	92	1,723	0.5	-	1.49	2.03	63.17	128.24
537-157	93	3,110	0.5	-	1.49	0.69	114.04	78.69
537-158	94	1,979	0.5	-	0.78	0.30	20.52	6.16
537-159	95	1,670	0.5	-	1.26	11.57	47.01	543.90
537-16	96	1,240	0.5	-	1.75	33.23	57.42	1,907.99
537-17	97	1,177	0.5	-	1.68	60.41	51.43	3,107.16
537-18	98	1,066	0.5	-	1.76	0.28	49.73	13.92
537-182	99	581	0.5	-	1.56	6.68	22.81	152.39
537-185	100	506	0.5	-	2.13	153.40	30.55	4,685.99
537-19	101	1,142	0.5	-	1.48	34.66	41.44	1,436.32
537-191	102	763	0.5	-	2.76	109.40	63.83	6,983.32
537-192	103	862	0.5	-	1.89	199.50	44.37	8,851.97
537-196	104	30,853	0.5	-	1.05	2.95	628.49	1,854.05
537-197	105	2,181	0.5	-	0.77	0.80	21.81	17.45
537-198	106	2,912	0.5	-	1.12	1.25	66.87	83.59
537-199	107	19,170	0.5	-	1.03	1.50	376.30	564.46
537-2	108	870	0.5	-	2.00	114.27	48.35	5,525.47
537-20	109	1,554	0.5	-	2.23	0.88	99.56	87.61
537-200	110	13	0.5	-	1.53	2.80	0.50	1.40
537-201	111	2,274	0.5	-	1.21	0.90	59.81	53.83
537-21	112	1,525	0.5	-	1.14	56.04	36.15	2,026.08
537-22	113	1,661	0.5	-	1.46	0.10	59.05	5.91
537-23	114	2,061	0.5	-	1.61	0.74	84.74	62.71
537-24	115	1,556	0.5	-	1.63	1.06	65.14	69.05
537-25	116	1,136	0.5	-	1.69	5.58	50.05	279.28
537-26	117	1,562	0.5	-	1.54	51.30	60.18	3,087.10
537-272	118	32,424	0.5	-	2.25	185.76	2,101.58	390,389.09
537-273	119	19,090	0.5	-	1.75	356.00	883.80	314,633.40
537-274	120	10,092	0.5	-	0.75	57.50	93.44	5,372.87
537-28	126	2,324	0.5	-	2.18	36.37	144.58	5,258.52
537-282	128	4	0.5	-	1.00	15.90	0.08	1.23
537-283	129	30,219	0.5	-	2.00	49.60	1,678.83	83,270.18
537-284	130	1,257	0.5	-	1.50	0.41	46.56	19.09
537-285	131	3,661	0.5	-	1.60	510.00	149.14	76,060.96
537-286	132	2,249	0.5	-	0.75	80.60	20.83	1,678.53
537-29	136	1,131	0.5	-	1.10	0.18	25.14	4.53
537-296	141	601	0.5	-	1.88	188.00	30.62	5,756.44
537-297	142	5,005	0.5	-	2.00	509.00	278.04	141,522.17

TABLE 1B
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions (> 0.5 foot) - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-298	143	7,857	0.5	-	1.55	330.00	305.53	100,825.94
537-299	144	3,701	0.5	-	1.25	215.00	102.81	22,103.59
537-3	145	617	0.5	-	2.43	21.50	44.09	947.91
537-30	146	31,600	0.5	-	0.87	0.50	433.03	216.52
537-309	154	197	0.5	-	1.88	6.19	10.05	62.19
537-31	155	1,556	0.5	-	0.75	0.06	14.41	0.86
537-312	156	3,811	0.5	-	1.25	608.00	105.86	64,363.23
537-32	162	2,019	0.5	-	0.77	0.13	20.19	2.62
537-321	163	38	0.5	-	1.50	19.10	1.40	26.66
537-322	164	4,018	0.5	-	1.35	754.00	126.50	95,381.92
537-33	170	844	0.5	-	1.00	126.89	15.63	1,983.86
537-331	172	4,638	0.5	-	1.35	179.00	146.02	26,137.30
537-339	178	3,572	0.5	-	1.35	24.90	112.45	2,800.07
537-34	179	598	0.5	-	1.00	174.00	11.08	1,928.21
537-35	184	249	0.5	-	1.00	34.15	4.61	157.34
537-36	185	648	0.5	-	1.75	42.61	30.02	1,278.95
537-37	186	427	0.5	-	1.80	63.66	20.55	1,308.40
537-371	187	5,385	0.5	-	1.40	257.00	179.51	46,133.99
537-372	188	0	0.5	-	1.40	135.00	0.00	0.49
537-38	192	1,148	0.5	-	2.73	339.95	94.83	32,235.89
537-381	193	4,321	0.5	-	1.40	264.50	144.02	38,092.85
537-39	198	4,372	0.5	-	3.29	0.85	451.78	384.02
537-4	199	1,446	0.5	-	2.34	62.47	98.53	6,155.27
537-40	200	582	0.5	-	2.58	736.67	44.80	33,002.81
537-41	201	683	0.5	-	2.62	104.49	53.60	5,600.91
537-42	202	623	0.5	-	2.42	133.00	44.33	5,896.20
537-43	203	700	0.5	-	2.26	198.63	45.64	9,064.58
537-44	204	722	0.5	-	2.56	205.44	55.09	11,317.28
537-45	205	811	0.5	-	2.28	267.33	53.47	14,293.30
537-46	206	3,414	0.5	-	2.14	140.88	207.36	29,212.89
537-47	207	1,584	0.5	-	2.02	25.01	89.15	2,229.59
537-48	208	634	0.5	-	3.20	125.85	63.41	7,980.23
537-49	209	1,167	0.5	-	2.49	95.50	86.02	8,215.19
537-5	210	1,671	0.5	-	2.21	13.18	105.82	1,394.70
537-50	211	2,181	0.5	-	0.98	94.70	38.77	3,671.48
537-51	212	520	0.5	-	1.41	23.63	17.53	414.17
537-52	213	1,040	0.5	-	2.01	57.45	58.14	3,339.89
537-53	214	2,744	0.5	-	2.14	5.35	166.69	891.81
537-54	215	2,368	0.5	-	1.50	0.57	87.71	50.00
537-55	216	3,074	0.5	-	2.07	1.70	178.76	303.89
537-56	217	4,817	0.5	-	2.65	0.53	383.61	203.31
537-57	218	3,228	0.5	-	2.58	3.58	248.68	890.28
537-58	219	3,079	0.5	-	1.51	0.55	115.19	63.36
537-59	220	3,936	0.5	-	2.08	0.30	230.31	69.09
537-6	221	1,559	0.5	-	1.20	32.87	40.42	1,328.47
537-60	222	3,722	0.5	-	2.43	0.55	266.05	146.33
537-61	223	2,854	0.5	-	1.68	1.17	124.71	145.92
537-62	224	3,184	0.5	-	1.87	3.50	161.56	565.46

TABLE 1B
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions (> 0.5 foot) - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-63	225	3,823	0.5	-	2.01	0.53	213.83	113.33
537-64	226	3,594	0.5	-	1.56	0.06	141.09	8.47
537-65	227	4,266	0.5	-	2.46	0.07	309.68	21.68
537-66	228	8,085	0.5	-	1.96	0.07	437.20	30.60
537-67	229	4,395	0.5	-	1.19	0.56	112.30	62.89
537-68	230	3,694	0.5	-	0.82	0.06	43.78	2.63
537-69	231	3,693	0.5	-	1.09	1.50	80.69	121.04
537-7	232	1,231	0.5	-	1.80	2.96	59.27	175.42
537-70	233	3,530	0.5	-	1.14	0.06	83.68	5.02
537-71	234	664	0.5	-	0.76	0.06	6.39	0.38
537-72	235	2,670	0.5	-	2.00	0.06	148.35	8.90
537-73	236	3,478	0.5	-	1.10	0.16	77.28	12.37
537-74	237	3,946	0.5	-	0.86	0.98	52.61	51.56
537-75	238	3,138	0.5	-	1.12	0.06	72.07	4.32
537-76	239	2,127	0.5	-	1.24	0.06	58.30	3.50
537-77	240	3,420	0.5	-	1.03	0.06	67.13	4.03
537-78	241	4,044	0.5	-	0.92	2.20	62.91	138.39
537-79	242	2,637	0.5	-	1.04	0.27	52.74	14.24
537-8	243	714	0.5	-	1.23	0.45	19.32	8.69
537-80	244	3,029	0.5	-	0.96	0.68	51.61	35.10
537-81	245	2,632	0.5	-	1.40	0.37	87.72	32.46
537-82	246	3,327	0.5	-	1.97	0.20	181.12	36.22
537-83	247	3,368	0.5	-	2.13	0.06	203.31	12.20
537-84	248	2,522	0.5	-	0.85	0.06	32.69	1.96
537-85	249	18,398	0.5	-	2.00	0.06	1,022.11	61.33
537-86	250	4,042	0.5	-	1.37	0.20	130.23	26.05
537-87	251	3,643	0.5	-	1.52	0.30	137.63	41.29
537-88	252	2,399	0.5	-	0.80	0.06	26.66	1.60
537-89	253	3,793	0.5	-	0.97	0.25	66.03	16.51
537-9	254	1,511	0.5	-	1.93	115.93	80.05	9,279.74
537-90	255	3,054	0.5	-	1.40	1.90	101.81	193.44
537-91	256	3,614	0.5	-	1.20	1.10	93.69	103.06
537-92	257	3,424	0.5	-	1.01	0.36	64.68	23.28
537-93	258	3,013	0.5	-	0.95	4.20	50.21	210.89
537-94	259	3,287	0.5	-	1.23	0.06	88.88	5.33
537-95	260	2,608	0.5	-	1.11	3.40	58.91	200.31
537-96	261	2,191	0.5	-	1.37	0.24	70.60	16.94
537-97	262	3,161	0.5	-	1.65	1.50	134.64	201.96
537-98	263	2,291	0.5	-	1.90	155.00	118.78	18,410.35
537-99	264	1,963	0.5	-	1.24	3.10	53.80	166.78
537-402	265	11,687	0.5	-	1.00	230.00	216.43	49,777.99
537-403	266	35	0.5	-	1.00	110.00	0.65	71.17
537-410	270	14,456	0.5	-	0.60	19.80	53.54	1,060.09
537-411	271	4	0.5	-	1.10	83.92	0.08	7.02
537-423	279	5,475	0.5	-	0.55	110.00	10.14	1,115.22
537-110	48a	3,659	0.5	-	0.69	0.06	26.37	1.58
537-121	60a	6,569	0.5	-	1.12	0.06	150.85	9.05
537-200	110a	1,209	0.5	-	1.53	2.80	46.10	129.09

TABLE 1B
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions (> 0.5 foot) - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-275	121	4,327	0.5	-	1.00	35.74	80.12	2,863.59
537-276	122	13,885	0.5	-	1.05	58.10	282.84	16,433.20
537-277	123	25,510	0.5	-	2.00	37.90	1,417.22	53,712.74
537-278	124	31,671	0.5	-	1.15	47.70	762.45	36,368.97
537-279	125	29,271	0.5	-	0.50	5.65	0.00	0.00
537-280	127	47,330	0.5	-	0.85	21.50	613.54	13,191.09
537-282	128a	28,287	0.5	-	1.00	15.90	523.83	8,328.83
537-283	129a	187	0.5	-	2.00	49.60	10.39	515.59
537-287	133	3,842	0.5	-	1.00	39.70	71.15	2,824.78
537-288	134	4,694	0.5	-	0.95	8.78	78.24	686.94
537-289	135	4,064	0.5	-	1.25	38.80	112.88	4,379.71
537-29	136a	4,032	0.5	-	1.10	0.18	89.59	16.13
537-290	137	4,407	0.5	-	0.75	21.90	40.80	893.55
537-291	138	3,747	0.5	-	0.75	28.50	34.70	988.81
537-292	139	8,532	0.5	-	1.00	23.20	158.00	3,665.62
537-294	140	7,548	0.5	-	1.00	14.40	139.78	2,012.81
537-299	144a	62	0.5	-	1.25	215.00	1.73	371.42
537-300	147	3,981	0.5	-	1.30	81.90	117.94	9,659.42
537-301	148	4,707	0.5	-	1.00	37.40	87.17	3,260.24
537-302	149	6,046	0.5	-	1.00	57.10	111.97	6,393.46
537-303	150	3,726	0.5	-	1.00	33.80	69.01	2,332.51
537-304	151	4,072	0.5	-	1.00	22.30	75.41	1,681.59
537-305	152	4,033	0.5	-	1.25	21.40	112.04	2,397.67
537-307	153	5,754	0.5	-	1.00	13.00	106.55	1,385.14
537-312	156a	1	0.5	-	1.25	608.00	0.03	21.00
537-313	157	3,392	0.5	-	1.30	72.80	100.50	7,316.68
537-314	158	4,839	0.5	-	0.85	43.10	62.73	2,703.52
537-316	159	4,330	0.5	-	0.75	34.40	40.09	1,379.14
537-317	160	22,837	0.5	-	0.75	18.40	211.45	3,890.77
537-318	161	4,947	0.5	-	1.25	35.80	137.42	4,919.79
537-321	163a	3,432	0.5	-	1.50	19.10	127.10	2,427.61
537-323	165	4,954	0.5	-	1.30	13.90	146.78	2,040.28
537-324	166	4,652	0.5	-	0.65	56.00	25.84	1,447.24
537-325	167	30,189	0.5	-	0.70	19.60	223.62	4,383.03
537-326	168	4,843	0.5	-	1.00	11.00	89.68	986.50
537-328	169	5,216	0.5	-	1.25	17.00	144.89	2,463.15
537-330	171	7,049	0.5	-	0.70	8.36	52.22	436.52
537-332	173	3,805	0.5	-	1.35	81.20	119.78	9,726.07
537-333	174	4,880	0.5	-	0.75	62.50	45.18	2,823.92
537-335	175	5,777	0.5	-	1.10	17.52	128.37	2,249.04
537-337	176	4,547	0.5	-	0.90	11.90	67.37	801.69
537-338	177	11,683	0.5	-	0.65	8.20	64.90	532.20
537-339	178a	3	0.5	-	1.35	24.90	0.09	2.22
537-340	180	3,976	0.5	-	1.35	71.70	125.17	8,974.76
537-341	181	5,088	0.5	-	0.75	71.20	47.11	3,354.01
537-343	182	4,220	0.5	-	1.10	14.10	93.78	1,322.28
537-345	183	6,003	0.5	-	0.80	12.00	66.70	800.42
537-372	188a	5,049	0.5	-	1.40	135.00	168.29	22,718.68

TABLE 1B
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions (> 0.5 foot) - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-373	189	4,677	0.5	-	0.75	78.30	43.31	3,391.18
537-375	190	5,123	0.5	-	1.10	9.46	113.85	1,076.97
537-377	191	4,639	0.5	-	0.80	13.20	51.54	680.32
537-381	193a	0	0.5	-	1.40	264.50	0.00	0.01
537-382	194	4,270	0.5	-	1.40	52.63	142.33	7,490.66
537-383	195	5,561	0.5	-	0.75	3.07	51.49	158.07
537-385	196	4,558	0.5	-	3.50	3.50	506.42	1,772.48
537-386	197	6,458	0.5	-	0.75	11.50	59.79	687.63
537-72	235a	8,766	0.5	-	2.00	0.06	486.97	29.22
537-78	241a	1,268	0.5	-	0.92	2.20	19.72	43.39
537-85	249a	12,117	0.5	-	2.00	0.06	673.16	40.39
537-403	266a	12,157	0.5	-	1.00	110.00	225.13	24,764.73
537-404	267	9,507	0.5	-	0.70	41.10	70.42	2,894.47
537-405	268	3,944	0.5	-	1.15	10.15	94.94	963.63
537-406	269	4,599	0.5	-	0.55	5.31	8.52	45.23
537-410	270a	16	0.5	-	0.60	19.80	0.06	1.14
537-411	271a	20,749	0.5	-	1.10	83.92	461.10	38,695.37
537-412	272	15,900	0.5	-	0.85	11.30	206.11	2,329.03
537-413	273	3,956	0.5	-	0.80	7.17	43.96	315.16
537-414	274	1,133	0.5	-	0.50	3.74	0.00	0.00
537-415	275	36,406	0.5	-	1.20	1.53	943.86	1,444.10
537-416	276	36,283	0.5	-	1.00	273.50	671.90	183,764.60
537-417	277	32,465	0.5	-	0.50	3.77	0.00	0.00
537-419	278	2,072	0.5	-	1.00	8.39	38.37	321.92
537-423	279a	73	0.5	-	0.55	110.00	0.13	14.81
537-425	280	64,986	0.5	-	0.85	99.80	842.41	84,072.88
537-427	281	2,264	0.5	-	1.25	13.65	62.88	858.27
537-431	282	16,990	0.5	-	0.85	15.00	220.25	3,303.70
537-432	283	10,962	0.5	-	0.75	7.54	101.50	765.33
537-435	284	32,329	0.5	-	1.24	2.77	886.06	2,454.40
537-110	48b	18,087	0.5	-	0.69	0.06	130.35	7.82
537-117	55a	820	0.5	-	1.17	0.06	20.34	1.22
537-120	59a	1,297	0.5	-	1.06	0.06	26.90	1.61
537-121	60b	19,300	0.5	-	1.12	0.06	443.19	26.59
537-126	65a	91	0.5	-	0.94	0.39	1.49	0.58
537-128	67a	657	0.5	-	1.22	0.06	17.52	1.05
537-199	107a	2,423	0.5	-	1.03	1.50	47.56	71.34
537-200	110b	49,044	0.5	-	1.53	2.80	1,870.95	5,238.67
537-201	111a	1,434	0.5	-	1.21	0.90	37.72	33.95
537-273	119a	17	0.5		1.75	356.00	0.80	284.95
537-274	120a	9,414	0.5		0.75	57.50	87.17	5,012.19
537-275	121a	11,596	0.5		1.00	35.74	214.74	7,674.97
537-276	122a	5,340	0.5		1.05	58.10	108.78	6,319.86

TABLE 1B
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Existing Surface Conditions (> 0.5 foot) - Removal from Shoreline to 2 ppm Surface Line
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-286	132a	664	0.5		0.75	80.60	6.15	495.40
537-29	136b	21,563	0.5		1.10	0.18	479.18	86.25
537-72	235b	13,856	0.5		2.00	0.06	769.78	46.19
537-78	241b	133	0.5		0.92	2.20	2.08	4.57
Totals:		1,635,710	--			--	43,062.92	2,623,498.32
						Volume Weighted Average:		**60.9**

Notes:

1. Non-detectable mercury concentrations are included as one-half the detection limit in calculations in subsurface areas
2. All calculations and rounding are performed by the computer software. Therefore, certain quantities in above table are displayed as rounded numbers for clarity.
3. Average subsurface mercury conc. shown herein represent the average mercury concentration for soil samples collected below a depth of approximately 6 inches. These values were provided to BBL by DuPont electronically on October 18, 2005 and September 2006.
4. X = the approximate depth of sediment observed for each sample location. These values have been estimated based on field data collected at select locations.

TABLE 1C
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Surface Conditions - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-1	31	576	0	-	0.5	***0.25***	10.66	2.67
537-10	32	755	0	-	0.5	***0.25***	13.97	3.49
537-100	33	1,149	0	-	0.5	***0.25***	21.28	5.32
537-101	34	1,111	0	-	0.5	***0.25***	20.57	5.14
537-102	35	1,693	0	-	0.5	***0.25***	31.35	7.84
537-103	36	1,796	0	-	0.5	***0.25***	33.25	8.31
537-104	37	2,395	0	-	0.5	***0.25***	44.35	11.09
537-105	38	623	0	-	0.5	***0.25***	11.53	2.88
537-105a	39	2,874	0	-	0.5	***0.25***	53.23	13.31
537-106	40	2,826	0	-	0.5	***0.25***	52.34	13.09
537-107	41	3,009	0	-	0.5	***0.25***	55.72	13.93
537-107a	42	1,060	0	-	0.5	***0.25***	19.63	4.91
537-108	43	2,461	0	-	0.5	***0.25***	45.57	11.39
537-108a	44	835	0	-	0.5	***0.25***	15.47	3.87
537-109	45	3,654	0	-	0.5	***0.25***	67.67	16.92
537-11	46	1,379	0	-	0.5	***0.25***	25.54	6.38
537-110	47	917	0	-	0.5	***0.25***	16.99	4.25
537-111	48	1,309	0	-	0.5	***0.25***	24.25	6.06
537-112	49	1,617	0	-	0.5	***0.25***	29.95	7.49
537-113	50	2,559	0	-	0.5	***0.25***	47.39	11.85
537-114	51	1,612	0	-	0.5	***0.25***	29.86	7.46
537-115	52	5,713	0	-	0.5	***0.25***	105.80	26.45
537-116	53	2,100	0	-	0.5	***0.25***	38.89	9.72
537-117	54	3,952	0	-	0.5	***0.25***	73.18	18.30
537-118	55	2,205	0	-	0.5	***0.25***	40.84	10.21
537-119	56	2,700	0	-	0.5	***0.25***	49.99	12.50
537-120	57	4,459	0	-	0.5	***0.25***	82.58	20.64
537-121	58	2,598	0	-	0.5	***0.25***	48.11	12.03
537-122	59	3,203	0	-	0.5	***0.25***	59.32	14.83
537-123	60	2,687	0	-	0.5	***0.25***	49.76	12.44
537-124	61	1,735	0	-	0.5	***0.25***	32.12	8.03
537-125	62	2,806	0	-	0.5	***0.25***	51.97	12.99
537-126	63	3,488	0	-	0.5	***0.25***	64.60	16.15
537-127	64	4,648	0	-	0.5	***0.25***	86.08	21.52
537-128	65	1,934	0	-	0.5	***0.25***	35.81	8.95
537-129	66	2,402	0	-	0.5	***0.25***	44.48	11.12
537-130	67	2,994	0	-	0.5	***0.25***	55.45	13.86
537-131	68	1,774	0	-	0.5	***0.25***	32.85	8.21
537-132	69	2,939	0	-	0.5	***0.25***	54.43	13.61
537-133	70	2,071	0	-	0.5	***0.25***	38.35	9.59
537-14	71	485	0	-	0.5	***0.25***	8.97	2.24
537-140	72	320	0	-	0.5	***0.25***	5.93	1.48
537-144	73	561	0	-	0.5	***0.25***	10.38	2.60
537-145	74	2,119	0	-	0.5	***0.25***	39.24	9.81
537-146	75	3,620	0	-	0.5	***0.25***	67.03	16.76
537-147	76	1,271	0	-	0.5	***0.25***	23.54	5.88
537-148	77	1,235	0	-	0.5	***0.25***	22.87	5.72
537-149	78	1,210	0	-	0.5	***0.25***	22.41	5.60
537-15	79	1,284	0	-	0.5	***0.25***	23.77	5.94

TABLE 1C
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Surface Conditions - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-150	80	1,727	0	-	0.5	***0.25***	31.97	7.99
537-151	81	995	0	-	0.5	***0.25***	18.43	4.61
537-152	82	1,125	0	-	0.5	***0.25***	20.84	5.21
537-153	83	1,568	0	-	0.5	***0.25***	29.03	7.26
537-154	84	1,790	0	-	0.5	***0.25***	33.15	8.29
537-155	85	2,688	0	-	0.5	***0.25***	49.78	12.44
537-156	86	1,567	0	-	0.5	***0.25***	29.02	7.25
537-157	87	1,589	0	-	0.5	***0.25***	29.43	7.36
537-158	88	1,265	0	-	0.5	***0.25***	23.43	5.86
537-159	89	1,267	0	-	0.5	***0.25***	23.46	5.86
537-16	90	599	0	-	0.5	***0.25***	11.10	2.77
537-160	91	855	0	-	0.5	***0.25***	15.82	3.96
537-161	92	1,118	0	-	0.5	***0.25***	20.70	5.18
537-162	93	966	0	-	0.5	***0.25***	17.88	4.47
537-164	94	737	0	-	0.5	***0.25***	13.65	3.41
537-165	95	836	0	-	0.5	***0.25***	15.48	3.87
537-166	96	1,188	0	-	0.5	***0.25***	22.00	5.50
537-167	97	2,417	0	-	0.5	***0.25***	44.76	11.19
537-168	98	2,362	0	-	0.5	***0.25***	43.74	10.94
537-169	99	907	0	-	0.5	***0.25***	16.80	4.20
537-17	100	1,441	0	-	0.5	***0.25***	26.68	6.67
537-170	101	731	0	-	0.5	***0.25***	13.53	3.38
537-171	102	1,683	0	-	0.5	***0.25***	31.16	7.79
537-172	103	1,385	0	-	0.5	***0.25***	25.64	6.41
537-173	104	636	0	-	0.5	***0.25***	11.78	2.95
537-174	105	1,235	0	-	0.5	***0.25***	22.87	5.72
537-175	106	1,487	0	-	0.5	***0.25***	27.55	6.89
537-176	107	1,152	0	-	0.5	***0.25***	21.34	5.34
537-177	108	996	0	-	0.5	***0.25***	18.45	4.61
537-178	109	1,653	0	-	0.5	***0.25***	30.62	7.65
537-179	110	951	0	-	0.5	***0.25***	17.61	4.40
537-18	111	1,147	0	-	0.5	***0.25***	21.25	5.31
537-184	112	773	0	-	0.5	***0.25***	14.32	3.58
537-186	113	1,473	0	-	0.5	***0.25***	27.28	6.82
537-187	114	1,194	0	-	0.5	***0.25***	22.11	5.53
537-188	115	1,144	0	-	0.5	***0.25***	21.18	5.29
537-189	116	333	0	-	0.5	***0.25***	6.17	1.54
537-190	117	534	0	-	0.5	***0.25***	9.89	2.47
537-193/537-163	118	632	0	-	0.5	***0.25***	11.70	2.92
537-194	119	1,983	0	-	0.5	***0.25***	36.72	9.18
537-195	120	731	0	-	0.5	***0.25***	13.54	3.38
537-196	121	3,235	0	-	0.5	***0.25***	59.91	14.98
537-197	122	2,072	0	-	0.5	***0.25***	38.36	9.59
537-198	123	2,419	0	-	0.5	***0.25***	44.79	11.20
537-199	124	2,875	0	-	0.5	***0.25***	53.25	13.31
537-2	125	870	0	-	0.5	***0.25***	16.12	4.03
537-201	127	1,441	0	-	0.5	***0.25***	26.68	6.67
537-202	128	1,595	0	-	0.5	***0.25***	29.53	7.38
537-203	129	5,505	0	-	0.5	***0.25***	101.94	25.48

TABLE 1C
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Surface Conditions - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-204	130	1,465	0	-	0.5	***0.25***	27.14	6.78
537-205	131	1,978	0	-	0.5	***0.25***	36.63	9.16
537-206	132	861	0	-	0.5	***0.25***	15.94	3.98
537-207	133	1,308	0	-	0.5	***0.25***	24.22	6.05
537-208	134	2,467	0	-	0.5	***0.25***	45.68	11.42
537-209	135	2,003	0	-	0.5	***0.25***	37.10	9.27
537-210	136	1,971	0	-	0.5	***0.25***	36.50	9.13
537-211	137	467	0	-	0.5	***0.25***	8.65	2.16
537-212	138	2,328	0	-	0.5	***0.25***	43.11	10.78
537-213	139	361	0	-	0.5	***0.25***	6.68	1.67
537-214	140	1,287	0	-	0.5	***0.25***	23.84	5.96
537-215	141	1,512	0	-	0.5	***0.25***	28.00	7.00
537-216	142	2,185	0	-	0.5	***0.25***	40.46	10.11
537-217	143	1,431	0	-	0.5	***0.25***	26.51	6.63
537-218	144	584	0	-	0.5	***0.25***	10.82	2.71
537-219	145	963	0	-	0.5	***0.25***	17.83	4.46
537-22	146	1,698	0	-	0.5	***0.25***	31.45	7.86
537-220	147	921	0	-	0.5	***0.25***	17.05	4.26
537-221	148	1,767	0	-	0.5	***0.25***	32.73	8.18
537-222	149	2,027	0	-	0.5	***0.25***	37.53	9.38
537-223	150	1,321	0	-	0.5	***0.25***	24.47	6.12
537-224	151	341	0	-	0.5	***0.25***	6.32	1.58
537-225	152	2,049	0	-	0.5	***0.25***	37.95	9.49
537-226	153	1,342	0	-	0.5	***0.25***	24.86	6.21
537-227	154	884	0	-	0.5	***0.25***	16.37	4.09
537-228	155	1,087	0	-	0.5	***0.25***	20.13	5.03
537-229	156	1,988	0	-	0.5	***0.25***	36.82	9.20
537-23	157	1,091	0	-	0.5	***0.25***	20.20	5.05
537-230	158	2,742	0	-	0.5	***0.25***	50.78	12.70
537-231	159	2,022	0	-	0.5	***0.25***	37.45	9.36
537-232	160	1,583	0	-	0.5	***0.25***	29.32	7.33
537-233	161	3,307	0	-	0.5	***0.25***	61.24	15.31
537-234	162	2,185	0	-	0.5	***0.25***	40.46	10.12
537-235	163	9,857	0	-	0.5	***0.25***	182.54	45.63
537-236	164	1,645	0	-	0.5	***0.25***	30.46	7.62
537-237	165	9,792	0	-	0.5	***0.25***	181.34	45.33
537-239	167	10,482	0	-	0.5	***0.25***	194.11	48.53
537-24	168	1,317	0	-	0.5	***0.25***	24.39	6.10
537-241	170	10,785	0	-	0.5	***0.25***	199.72	49.93
537-242	171	1,815	0	-	0.5	***0.25***	33.61	8.40
537-243	172	258	0	-	0.5	***0.25***	4.78	1.19
537-244	173	1,175	0	-	0.5	***0.25***	21.76	5.44
537-246	175	2,041	0	-	0.5	***0.25***	37.79	9.45
537-248	177	1,179	0	-	0.5	***0.25***	21.84	5.46
537-250	179	9,273	0	-	0.5	***0.25***	171.71	42.93
537-259	188	2,654	0	-	0.5	***0.25***	49.15	12.29
537-26	189	1,385	0	-	0.5	***0.25***	25.66	6.41
537-261	191	11,339	0	-	0.5	***0.25***	209.99	52.50
537-263	193	7,772	0	-	0.5	***0.25***	143.92	35.98

TABLE 1C
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Surface Conditions - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-265	195	10,598	0	-	0.5	***0.25***	196.26	49.06
537-266	196	11,728	0	-	0.5	***0.25***	217.19	54.30
537-267	197	14,699	0	-	0.5	***0.25***	272.21	68.05
537-268	198	9,191	0	-	0.5	***0.25***	170.20	42.55
537-269	199	15,523	0	-	0.5	***0.25***	287.47	71.87
537-270	200	7,669	0	-	0.5	***0.25***	142.01	35.50
537-271	201	13,499	0	-	0.5	***0.25***	249.98	62.49
537-272	202	2,850	0	-	0.5	***0.25***	52.77	13.19
537-273	203	2,291	0	-	0.5	***0.25***	42.43	10.61
537-274	204	6,042	0	-	0.5	***0.25***	111.89	27.97
537-28	210	1,838	0	-	0.5	***0.25***	34.04	8.51
537-283	214	2,463	0	-	0.5	***0.25***	45.61	11.40
537-284	215	1,278	0	-	0.5	***0.25***	23.66	5.92
537-285	216	2,893	0	-	0.5	***0.25***	53.57	13.39
537-286	217	2,249	0	-	0.5	***0.25***	41.65	10.41
537-29	221	1,131	0	-	0.5	***0.25***	20.95	5.24
537-297	228	4,489	0	-	0.5	***0.25***	83.13	20.78
537-298	229	2,396	0	-	0.5	***0.25***	44.37	11.09
537-299	230	3,560	0	-	0.5	***0.25***	65.93	16.48
537-3	231	596	0	-	0.5	***0.25***	11.03	2.76
537-30	232	6,728	0	-	0.5	***0.25***	124.60	31.15
537-308	240	130	0	-	0.5	***0.25***	2.41	0.60
537-31	241	987	0	-	0.5	***0.25***	18.27	4.57
537-310	242	771	0	-	0.5	***0.25***	14.28	3.57
537-311	243	6,980	0	-	0.5	***0.25***	129.25	32.31
537-312	244	3,652	0	-	0.5	***0.25***	67.63	16.91
537-32	252	1,454	0	-	0.5	***0.25***	26.92	6.73
537-321	254	0	0	-	0.5	***0.25***	0.01	0.00
537-322	255	3,641	0	-	0.5	***0.25***	67.43	16.86
537-33	263	1,116	0	-	0.5	***0.25***	20.67	5.17
537-331	265	4,243	0	-	0.5	***0.25***	78.58	19.64
537-339	273	3,572	0	-	0.5	***0.25***	66.14	16.54
537-35	281	733	0	-	0.5	***0.25***	13.57	3.39
537-36	282	664	0	-	0.5	***0.25***	12.30	3.08
537-37	283	427	0	-	0.5	***0.25***	7.90	1.98
537-371	284	5,748	0	-	0.5	***0.25***	106.44	26.61
537-38	292	479	0	-	0.5	***0.25***	8.87	2.22
537-381	293	3,856	0	-	0.5	***0.25***	71.40	17.85
537-382	294	10	0	-	0.5	***0.25***	0.19	0.05
537-39	299	1,776	0	-	0.5	***0.25***	32.89	8.22
537-4	300	792	0	-	0.5	***0.25***	14.66	3.66
537-40	301	637	0	-	0.5	***0.25***	11.79	2.95
537-41	302	704	0	-	0.5	***0.25***	13.05	3.26
537-42	303	667	0	-	0.5	***0.25***	12.35	3.09
537-43	304	536	0	-	0.5	***0.25***	9.93	2.48
537-44	305	456	0	-	0.5	***0.25***	8.44	2.11
537-45	306	979	0	-	0.5	***0.25***	18.14	4.53
537-46	307	3,141	0	-	0.5	***0.25***	58.16	14.54
537-47	308	1,645	0	-	0.5	***0.25***	30.47	7.62

TABLE 1C
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Surface Conditions - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-5	309	600	0	-	0.5	***0.25***	11.12	2.78
537-51/537-183	310	1,304	0	-	0.5	***0.25***	24.15	6.04
537-52	311	677	0	-	0.5	***0.25***	12.54	3.14
537-53	312	2,791	0	-	0.5	***0.25***	51.69	12.92
537-54	313	2,363	0	-	0.5	***0.25***	43.76	10.94
537-55	314	2,374	0	-	0.5	***0.25***	43.97	10.99
537-56	315	2,660	0	-	0.5	***0.25***	49.26	12.32
537-57	316	2,901	0	-	0.5	***0.25***	53.72	13.43
537-58	317	1,821	0	-	0.5	***0.25***	33.72	8.43
537-59	318	3,812	0	-	0.5	***0.25***	70.59	17.65
537-6	319	589	0	-	0.5	***0.25***	10.91	2.73
537-60	320	2,008	0	-	0.5	***0.25***	37.18	9.30
537-61	321	1,495	0	-	0.5	***0.25***	27.69	6.92
537-62	322	2,226	0	-	0.5	***0.25***	41.23	10.31
537-63	323	2,476	0	-	0.5	***0.25***	45.85	11.46
537-64	324	2,498	0	-	0.5	***0.25***	46.25	11.56
537-65	325	2,359	0	-	0.5	***0.25***	43.69	10.92
537-66	326	3,986	0	-	0.5	***0.25***	73.82	18.46
537-67	327	2,462	0	-	0.5	***0.25***	45.60	11.40
537-68	328	3,166	0	-	0.5	***0.25***	58.62	14.66
537-69	329	2,245	0	-	0.5	***0.25***	41.58	10.40
537-7	330	364	0	-	0.5	***0.25***	6.74	1.68
537-70	331	2,982	0	-	0.5	***0.25***	55.22	13.81
537-71	332	664	0	-	0.5	***0.25***	12.29	3.07
537-72	333	2,167	0	-	0.5	***0.25***	40.12	10.03
537-73	334	2,494	0	-	0.5	***0.25***	46.19	11.55
537-74	335	3,170	0	-	0.5	***0.25***	58.71	14.68
537-75	336	2,251	0	-	0.5	***0.25***	41.69	10.42
537-76	337	1,904	0	-	0.5	***0.25***	35.27	8.82
537-77	338	2,474	0	-	0.5	***0.25***	45.82	11.46
537-78	339	3,605	0	-	0.5	***0.25***	66.76	16.69
537-79	340	2,393	0	-	0.5	***0.25***	44.31	11.08
537-8	341	1,971	0	-	0.5	***0.25***	36.49	9.12
537-80	342	2,762	0	-	0.5	***0.25***	51.14	12.79
537-81	343	1,880	0	-	0.5	***0.25***	34.82	8.71
537-82	344	2,691	0	-	0.5	***0.25***	49.82	12.46
537-83	345	2,594	0	-	0.5	***0.25***	48.04	12.01
537-84	346	1,062	0	-	0.5	***0.25***	19.67	4.92
537-85	347	3,537	0	-	0.5	***0.25***	65.50	16.38
537-86	348	2,094	0	-	0.5	***0.25***	38.78	9.70
537-87	349	3,165	0	-	0.5	***0.25***	58.62	14.65
537-88	350	1,874	0	-	0.5	***0.25***	34.71	8.68
537-89	351	2,930	0	-	0.5	***0.25***	54.26	13.56
537-9	352	1,474	0	-	0.5	***0.25***	27.31	6.83
537-90	353	2,990	0	-	0.5	***0.25***	55.37	13.84
537-91	354	2,866	0	-	0.5	***0.25***	53.07	13.27
537-92	355	2,888	0	-	0.5	***0.25***	53.48	13.37
537-93	356	2,129	0	-	0.5	***0.25***	39.43	9.86
537-94	357	2,819	0	-	0.5	***0.25***	52.20	13.05

TABLE 1C
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Surface Conditions - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-95	358	2,121	0	-	0.5	***0.25***	39.28	9.82
537-96	359	2,044	0	-	0.5	***0.25***	37.85	9.46
537-97	360	2,142	0	-	0.5	***0.25***	39.66	9.92
537-98	361	2,285	0	-	0.5	***0.25***	42.31	10.58
537-99	362	1,432	0	-	0.5	***0.25***	26.52	6.63
TR-1	363	919	0	-	0.5	***0.25***	17.02	4.26
TR-11	365	1,850	0	-	0.5	***0.25***	34.25	8.56
TR-13	367	4,335	0	-	0.5	***0.25***	80.27	20.07
TR-14	368	683	0	-	0.5	***0.25***	12.64	3.16
TR-15	369	754	0	-	0.5	***0.25***	13.95	3.49
TR-16	370	45	0	-	0.5	***0.25***	0.83	0.21
TR-17	371	7,519	0	-	0.5	***0.25***	139.25	34.81
TR-18	372	601	0	-	0.5	***0.25***	11.12	2.78
TR-19	373	1,147	0	-	0.5	***0.25***	21.25	5.31
TR-2	374	5,057	0	-	0.5	***0.25***	93.66	23.41
TR-20	375	5,491	0	-	0.5	***0.25***	101.69	25.42
TR-21	376	9,839	0	-	0.5	***0.25***	182.20	45.55
TR-22	377	1,124	0	-	0.5	***0.25***	20.81	5.20
TR-3	378	535	0	-	0.5	***0.25***	9.91	2.48
TR-4	379	8,377	0	-	0.5	***0.25***	155.12	38.78
TR-5	380	7,335	0	-	0.5	***0.25***	135.84	33.96
TR-8	383	1,117	0	-	0.5	***0.25***	20.68	5.17
537-402	385	11,759	0	-	0.5	***0.25***	217.76	54.44
537-403	386	30	0	-	0.5	***0.25***	0.55	0.14
537-410	391	17,166	0	-	0.5	***0.25***	317.90	79.47
537-411	392	15	0	-	0.5	***0.25***	0.28	0.07
537-415	396	2,753	0	-	0.5	***0.25***	50.97	12.74
537-110	47a	4,280	0	-	0.5	0.21	79.26	16.64
537-120	57a	767	0	-	0.5	1.90	14.20	26.98
537-121	58a	2,313	0	-	0.5	0.15	42.83	6.42
537-200	126	9,844	0	-	0.5	21.80	182.29	3,973.97
537-234	162a	7,218	0	-	0.5	0.25	133.67	33.42
537-238	166	13,790	0	-	0.5	20.00	255.37	5,107.40
537-239	167a	5,359	0	-	0.5	1.00	99.24	99.24
537-240	169	13,170	0	-	0.5	12.00	243.89	2,926.64
537-243	172a	12,148	0	-	0.5	12.00	224.97	2,699.60
537-245	174	12,028	0	-	0.5	5.00	222.74	1,113.68
537-247	176	8,646	0	-	0.5	8.00	160.11	1,280.89
537-249	178	14,118	0	-	0.5	9.00	261.45	2,353.06
537-251	180	11,821	0	-	0.5	0.25	218.92	54.73
537-252	181	14,412	0	-	0.5	91.00	266.88	24,286.40
537-253	182	14,552	0	-	0.5	16.00	269.48	4,311.63
537-254	183	14,039	0	-	0.5	40.00	259.98	10,399.31
537-255	184	12,324	0	-	0.5	27.00	228.22	6,161.81
537-256	185	11,424	0	-	0.5	21.00	211.56	4,442.83
537-257	186	8,488	0	-	0.5	17.00	157.18	2,672.08
537-258	187	15,899	0	-	0.5	13.00	294.43	3,827.64
537-259	188a	13,317	0	-	0.5	24.00	246.62	5,918.80
537-260	190	10,131	0	-	0.5	9.00	187.61	1,688.51

TABLE 1C
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Surface Conditions - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-262	192	11,583	0	-	0.5	3.00	214.49	643.47
537-264	194	8,731	0	-	0.5	17.00	161.68	2,748.51
537-274	204a	1,115	0	-	0.5	41.10	20.64	848.44
537-275	205	4,327	0	-	0.5	16.50	80.12	1,322.03
537-276	206	4,279	0	-	0.5	9.09	79.24	720.28
537-277	207	4,009	0	-	0.5	7.52	74.24	558.29
537-278	208	3,696	0	-	0.5	6.26	68.44	428.41
537-279	209	4,089	0	-	0.5	7.61	75.73	576.29
537-280	211	4,083	0	-	0.5	15.20	75.61	1,149.29
537-281	212	5,808	0	-	0.5	2.81	107.55	302.23
537-282	213	2,482	0	-	0.5	6.46	45.96	296.89
537-283	214a	89	0	-	0.5	13.50	1.65	22.26
537-286	217a	645	0	-	0.5	19.40	11.94	231.65
537-287	218	3,842	0	-	0.5	12.30	71.15	875.18
537-288	219	4,694	0	-	0.5	59.90	86.93	5,207.23
537-289	220	4,064	0	-	0.5	5.71	75.25	429.69
537-29	221a	3,815	0	-	0.5	0.35	70.64	24.73
537-290	222	4,407	0	-	0.5	4.29	81.60	350.08
537-291	223	3,747	0	-	0.5	4.75	69.39	329.60
537-292	224	4,287	0	-	0.5	4.00	79.39	317.58
537-293	225	3,643	0	-	0.5	2.28	67.47	153.82
537-294	226	4,502	0	-	0.5	5.29	83.36	440.99
537-295	227	2,790	0	-	0.5	0.92	51.67	47.54
537-299	230a	62	0	-	0.5	17.00	1.15	19.58
537-300	233	3,981	0	-	0.5	9.29	73.71	684.80
537-301	234	4,703	0	-	0.5	6.07	87.09	528.64
537-302	235	3,778	0	-	0.5	5.75	69.97	402.30
537-303	236	3,726	0	-	0.5	3.98	69.01	274.65
537-304	237	4,072	0	-	0.5	4.32	75.41	325.76
537-305	238	3,922	0	-	0.5	3.21	72.62	233.12
537-307	239	3,057	0	-	0.5	3.74	56.61	211.72
537-308	240a	253	0	-	0.5	2.33	4.69	10.94
537-312	244a	1	0	-	0.5	11.40	0.02	0.26
537-313	245	3,392	0	-	0.5	7.06	62.81	443.47
537-314	246	4,839	0	-	0.5	6.39	89.61	572.61
537-315	247	3,886	0	-	0.5	17.40	71.95	1,252.00
537-316	248	4,299	0	-	0.5	4.54	79.61	361.44
537-317	249	3,390	0	-	0.5	3.07	62.78	192.73
537-318	250	4,795	0	-	0.5	3.42	88.80	303.70
537-319	251	661	0	-	0.5	3.53	12.23	43.18
537-320	253	4,600	0	-	0.5	13.30	85.18	1,132.93
537-321	254a	771	0	-	0.5	15.20	14.27	216.89
537-323	256	4,954	0	-	0.5	9.76	91.74	895.37
537-324	257	4,646	0	-	0.5	7.65	86.04	658.18
537-325	258	4,756	0	-	0.5	6.36	88.08	560.18
537-326	259	4,786	0	-	0.5	4.25	88.62	376.65
537-327	260	2,469	0	-	0.5	1.07	45.72	48.92
537-328	261	5,108	0	-	0.5	7.14	94.59	675.34
537-329	262	792	0	-	0.5	1.80	14.66	26.38

TABLE 1C
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Surface Conditions - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-330	264	4,828	0	-	0.5	4.58	89.41	409.51
537-332	266	3,805	0	-	0.5	9.73	70.46	685.56
537-333	267	4,879	0	-	0.5	6.57	90.36	593.65
537-334	268	4,361	0	-	0.5	7.19	80.75	580.61
537-335	269	5,150	0	-	0.5	3.73	95.37	355.73
537-336	270	1,916	0	-	0.5	3.91	35.49	138.76
537-337	271	4,513	0	-	0.5	4.05	83.56	338.44
537-338	272	4,368	0	-	0.5	2.92	80.88	236.18
537-339	273a	3	0	-	0.5	367.00	0.05	18.85
537-340	274	3,973	0	-	0.5	8.21	73.58	604.09
537-341	275	4,899	0	-	0.5	5.40	90.72	489.88
537-342	276	3,568	0	-	0.5	21.20	66.07	1,400.75
537-343	277	3,972	0	-	0.5	3.14	73.55	230.96
537-344	278	1,268	0	-	0.5	3.39	23.49	79.62
537-345	279	5,421	0	-	0.5	4.77	100.39	478.86
537-346	280	4,540	0	-	0.5	4.57	84.08	384.25
537-372	285	5,488	0	-	0.5	9.85	101.62	1,000.97
537-373	286	4,219	0	-	0.5	7.43	78.13	580.54
537-374	287	26,874	0	-	0.5	0.55	497.67	273.72
537-375	288	4,589	0	-	0.5	2.90	84.98	246.45
537-376	289	16,173	0	-	0.5	0.15	299.49	44.92
537-377	290	4,963	0	-	0.5	3.28	91.90	301.44
537-378	291	2,004	0	-	0.5	2.94	37.11	109.12
537-382	294a	3,736	0	-	0.5	8.10	69.18	560.38
537-383	295	5,206	0	-	0.5	4.30	96.42	414.59
537-384	296	4,551	0	-	0.5	1.01	84.28	85.12
537-385	297	3,809	0	-	0.5	2.43	70.54	171.41
537-386	298	4,702	0	-	0.5	4.27	87.07	371.79
537-72	333a	3,767	0	-	0.5	0.14	69.76	9.77
537-78	339a	133	0	-	0.5	15.00	2.47	37.08
537-85	347a	48	0	-	0.5	8.10	0.89	7.24
TR-1	363a	7,690	0	-	0.5	14.00	142.40	1,993.61
TR-10	364	7,795	0	-	0.5	50.00	144.35	7,217.27
TR-12	366	11,003	0	-	0.5	23.00	203.76	4,686.52
TR-13	367a	2,798	0	-	0.5	40.00	51.81	2,072.43
TR-16	370a	9,781	0	-	0.5	30.00	181.13	5,433.92
TR-3	378a	11,137	0	-	0.5	12.00	206.23	2,474.82
TR-6	381	11,704	0	-	0.5	18.00	216.74	3,901.28
TR-7	382	9,889	0	-	0.5	43.00	183.13	7,874.78
TR-9	384	11,092	0	-	0.5	18.00	205.40	3,697.26
537-403	386a	12,248	0	-	0.5	8.76	226.81	1,986.88
537-404	387	8,455	0	-	0.5	7.07	156.58	1,106.99
537-405	388	2,326	0	-	0.5	2.09	43.08	90.04
537-406	389	4,004	0	-	0.5	2.55	74.16	189.10
537-407	390	770	0	-	0.5	1.35	14.27	19.26
537-410	391a	16	0	-	0.5	16.00	0.29	4.60
537-411	392a	20,758	0	-	0.5	6.73	384.41	2,587.10
537-412	393	12,867	0	-	0.5	4.84	238.27	1,153.23
537-413	394	1,906	0	-	0.5	1.37	35.30	48.36

TABLE 1C
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Surface Conditions - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0- TO 0.5-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-414	395	818	0	-	0.5	1.78	15.16	26.98
537-415	396a	9,500	0	-	0.5	7.54	175.92	1,326.43
537-416	397	22,459	0	-	0.5	2.75	415.90	1,143.73
537-417	398	19,335	0	-	0.5	5.48	358.06	1,962.14
537-418	399	1,253	0	-	0.5	1.60	23.20	37.12
537-420	400	1,175	0	-	0.5	2.41	21.75	52.42
537-422	401	14,518	0	-	0.5	10.00	268.86	2,688.60
537-424	402	62,784	0	-	0.5	6.06	1,162.67	7,045.79
537-426	403	22,856	0	-	0.5	5.03	423.27	2,129.03
537-428	404	271	0	-	0.5	1.96	5.01	9.82
537-430	405	20,005	0	-	0.5	8.11	370.47	3,004.50
537-431	406	10,714	0	-	0.5	2.57	198.40	509.88
537-432	407	17,585	0	-	0.5	1.92	325.65	625.25
537-435	408	20,427	0	-	0.5	3.40	378.27	1,286.13
537-438	409	8,034	0	-	0.5	1.54	148.79	229.13
537-306	414	441	0	-	0.5	1.68	8.17	13.73
537-306	415	177	0	-	0.5	1.68	3.28	5.51
Totals:		1,635,710		--		--	30,290.93	194,968.82
						Volume Weighted Average:		**6.4**

OUTSIDE OF REMOVAL AREA

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)	Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
Totals:		940,827	--	--	17,422.73	191,751.77
				Volume Weighted Average:		**11**

Notes:
1. Non-detectable mercury concentrations are included as one-half the detection limit in calculations and shown in bold.
2. All calculations and rounding are performed by the computer software. Therefore, certain quantities in above table are displayed as rounded numbers for clarity.

TABLE 1D
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Subsurface Conditions (> 0.5 foot) -Alternative 1 Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-1	34	576	0.5	-	1.30	***0.25***	17.06	4.27
537-10	35	1,133	0.5	-	1.71	***0.25***	50.69	12.67
537-100	36	1,551	0.5	-	1.26	***0.25***	43.59	10.90
537-101	37	1,293	0.5	-	1.60	***0.25***	52.66	13.16
537-102	38	2,895	0.5	-	1.16	***0.25***	70.82	17.71
537-103	39	2,327	0.5	-	3.80	***0.25***	284.46	71.11
537-105	40	644	0.5	-	2.80	***0.25***	54.85	13.71
537-105a	41	5,163	0.5	-	1.98	***0.25***	283.03	70.76
537-107	42	4,723	0.5	-	1.00	***0.25***	87.46	21.87
537-107a	43	1,303	0.5	-	1.52	***0.25***	49.23	12.31
537-108	44	3,834	0.5	-	1.10	***0.25***	85.19	21.30
537-108a	45	840	0.5	-	1.20	***0.25***	21.78	5.44
537-109	46	3,904	0.5	-	1.08	***0.25***	83.68	20.92
537-11	47	915	0.5	-	1.97	***0.25***	49.93	12.48
537-110	48	2,106	0.5	-	0.69	***0.25***	15.18	3.79
537-111	49	3,371	0.5	-	1.08	***0.25***	72.42	18.11
537-112	50	3,708	0.5	-	1.30	***0.25***	109.86	27.47
537-113	51	3,376	0.5	-	1.13	***0.25***	78.78	19.69
537-114	52	3,026	0.5	-	0.84	***0.25***	38.11	9.53
537-115	53	24,760	0.5	-	0.54	***0.25***	36.68	9.17
537-116	54	3,439	0.5	-	1.32	***0.25***	104.44	26.11
537-117	55	8,053	0.5	-	1.17	***0.25***	199.83	49.96
537-118	56	3,058	0.5	-	1.38	***0.25***	99.67	24.92
537-119	57	3,814	0.5	-	1.00	***0.25***	70.62	17.66
537-12	58	1,174	0.5	-	2.80	***0.25***	100.00	25.00
537-120	59	4,951	0.5	-	1.06	***0.25***	102.68	25.67
537-121	60	2,635	0.5	-	1.12	***0.25***	60.51	15.13
537-122	61	3,793	0.5	-	1.01	***0.25***	71.65	17.91
537-123	62	3,724	0.5	-	0.92	***0.25***	57.92	14.48
537-124	63	4,171	0.5	-	1.22	***0.25***	111.22	27.80
537-125	64	6,482	0.5	-	0.70	***0.25***	48.02	12.00
537-126	65	10,702	0.5	-	0.94	***0.25***	174.40	43.60
537-127	66	7,298	0.5	-	1.17	***0.25***	181.10	45.28
537-128	67	4,320	0.5	-	1.22	***0.25***	115.19	28.80
537-129	68	2,402	0.5	-	1.11	***0.25***	54.27	13.57
537-13	69	1,045	0.5	-	2.37	***0.25***	72.39	18.10
537-130	70	5,120	0.5	-	2.49	***0.25***	377.37	94.34
537-131	71	3,494	0.5	-	1.33	***0.25***	107.41	26.85

TABLE 1D
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Subsurface Conditions (> 0.5 foot) -Alternative 1 Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-132	72	4,576	0.5	-	2.45	***0.25***	330.52	82.63
537-133	73	3,841	0.5	-	2.05	***0.25***	220.49	55.12
537-136	74	372	0.5	-	2.10	***0.25***	22.02	5.51
537-139	75	259	0.5	-	2.00	***0.25***	14.38	3.59
537-14	76	798	0.5	-	2.11	***0.25***	47.59	11.90
537-140	77	312	0.5	-	2.59	***0.25***	24.14	6.03
537-142	78	485	0.5	-	3.23	***0.25***	49.06	12.26
537-143	79	291	0.5	-	1.43	***0.25***	10.04	2.51
537-145	80	2,619	0.5	-	1.20	***0.25***	67.89	16.97
537-146	81	7,559	0.5	-	2.00	***0.25***	419.96	104.99
537-147	82	1,960	0.5	-	2.36	***0.25***	135.01	33.75
537-148	83	2,242	0.5	-	1.50	***0.25***	83.04	20.76
537-149	84	1,173	0.5	-	2.02	***0.25***	66.02	16.51
537-15	85	250	0.5	-	2.16	***0.25***	15.38	3.84
537-150	86	2,109	0.5	-	1.21	***0.25***	55.46	13.86
537-151	87	1,522	0.5	-	1.50	***0.25***	56.39	14.10
537-152	88	2,001	0.5	-	1.49	***0.25***	73.36	18.34
537-153	89	1,903	0.5	-	1.51	***0.25***	71.20	17.80
537-154	90	5,394	0.5	-	1.19	***0.25***	137.85	34.46
537-155	91	4,853	0.5	-	1.49	***0.25***	177.95	44.49
537-156	92	1,723	0.5	-	1.49	***0.25***	63.17	15.79
537-157	93	3,110	0.5	-	1.49	***0.25***	114.04	28.51
537-158	94	1,979	0.5	-	0.78	***0.25***	20.52	5.13
537-159	95	1,670	0.5	-	1.26	***0.25***	47.01	11.75
537-16	96	1,240	0.5	-	1.75	***0.25***	57.42	14.35
537-17	97	1,177	0.5	-	1.68	***0.25***	51.43	12.86
537-18	98	1,066	0.5	-	1.76	***0.25***	49.73	12.43
537-182	99	581	0.5	-	1.56	***0.25***	22.81	5.70
537-185	100	506	0.5	-	2.13	***0.25***	30.55	7.64
537-19	101	1,142	0.5	-	1.48	***0.25***	41.44	10.36
537-191	102	763	0.5	-	2.76	***0.25***	63.83	15.96
537-192	103	862	0.5	-	1.89	***0.25***	44.37	11.09
537-196	104	30,853	0.5	-	1.05	***0.25***	628.49	157.12
537-197	105	2,181	0.5	-	0.77	***0.25***	21.81	5.45
537-198	106	2,912	0.5	-	1.12	***0.25***	66.87	16.72
537-199	107	19,170	0.5	-	1.03	***0.25***	376.30	94.08
537-2	108	870	0.5	-	2.00	***0.25***	48.35	12.09
537-20	109	1,554	0.5	-	2.23	***0.25***	99.56	24.89
537-200	110	13	0.5	-	1.53	***0.25***	0.50	0.12

TABLE 1D
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Subsurface Conditions (> 0.5 foot) -Alternative 1 Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-201	111	2,274	0.5	-	1.21	***0.25***	59.81	14.95
537-21	112	1,525	0.5	-	1.14	***0.25***	36.15	9.04
537-22	113	1,661	0.5	-	1.46	***0.25***	59.05	14.76
537-23	114	2,061	0.5	-	1.61	***0.25***	84.74	21.18
537-24	115	1,556	0.5	-	1.63	***0.25***	65.14	16.28
537-25	116	1,136	0.5	-	1.69	***0.25***	50.05	12.51
537-26	117	1,562	0.5	-	1.54	***0.25***	60.18	15.04
537-272	118	32,424	0.5	-	2.25	***0.25***	2,101.58	525.39
537-273	119	19,090	0.5	-	1.75	***0.25***	883.80	220.95
537-274	120	10,092	0.5	-	0.75	***0.25***	93.44	23.36
537-28	126	2,324	0.5	-	2.18	***0.25***	144.58	36.15
537-282	128	4	0.5	-	1.00	***0.25***	0.08	0.02
537-283	129	30,219	0.5	-	2.00	***0.25***	1,678.83	419.71
537-284	130	1,257	0.5	-	1.50	***0.25***	46.56	11.64
537-285	131	3,661	0.5	-	1.60	***0.25***	149.14	37.28
537-286	132	2,249	0.5	-	0.75	***0.25***	20.83	5.21
537-29	136	1,131	0.5	-	1.10	***0.25***	25.14	6.28
537-296	141	601	0.5	-	1.88	***0.25***	30.62	7.65
537-297	142	5,005	0.5	-	2.00	***0.25***	278.04	69.51
537-298	143	7,857	0.5	-	1.55	***0.25***	305.53	76.38
537-299	144	3,701	0.5	-	1.25	***0.25***	102.81	25.70
537-3	145	617	0.5	-	2.43	***0.25***	44.09	11.02
537-30	146	31,600	0.5	-	0.87	***0.25***	433.03	108.26
537-309	154	197	0.5	-	1.88	***0.25***	10.05	2.51
537-31	155	1,556	0.5	-	0.75	***0.25***	14.41	3.60
537-312	156	3,811	0.5	-	1.25	***0.25***	105.86	26.47
537-32	162	2,019	0.5	-	0.77	***0.25***	20.19	5.05
537-321	163	38	0.5	-	1.50	***0.25***	1.40	0.35
537-322	164	4,018	0.5	-	1.35	***0.25***	126.50	31.63
537-33	170	844	0.5	-	1.00	***0.25***	15.63	3.91
537-331	172	4,638	0.5	-	1.35	***0.25***	146.02	36.50
537-339	178	3,572	0.5	-	1.35	***0.25***	112.45	28.11
537-34	179	598	0.5	-	1.00	***0.25***	11.08	2.77
537-35	184	249	0.5	-	1.00	***0.25***	4.61	1.15
537-36	185	648	0.5	-	1.75	***0.25***	30.02	7.50
537-37	186	427	0.5	-	1.80	***0.25***	20.55	5.14
537-371	187	5,385	0.5	-	1.40	***0.25***	179.51	44.88
537-372	188	0	0.5	-	1.40	***0.25***	0.00	0.00
537-38	192	1,148	0.5	-	2.73	***0.25***	94.83	23.71

TABLE 1D
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Subsurface Conditions (> 0.5 foot) -Alternative 1 Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-381	193	4,321	0.5	-	1.40	***0.25***	144.02	36.00
537-39	198	4,372	0.5	-	3.29	***0.25***	451.78	112.95
537-4	199	1,446	0.5	-	2.34	***0.25***	98.53	24.63
537-40	200	582	0.5	-	2.58	***0.25***	44.80	11.20
537-41	201	683	0.5	-	2.62	***0.25***	53.60	13.40
537-42	202	623	0.5	-	2.42	***0.25***	44.33	11.08
537-43	203	700	0.5	-	2.26	***0.25***	45.64	11.41
537-44	204	722	0.5	-	2.56	***0.25***	55.09	13.77
537-45	205	811	0.5	-	2.28	***0.25***	53.47	13.37
537-46	206	3,414	0.5	-	2.14	***0.25***	207.36	51.84
537-47	207	1,584	0.5	-	2.02	***0.25***	89.15	22.29
537-48	208	634	0.5	-	3.20	***0.25***	63.41	15.85
537-49	209	1,167	0.5	-	2.49	***0.25***	86.02	21.51
537-5	210	1,671	0.5	-	2.21	***0.25***	105.82	26.45
537-50	211	2,181	0.5	-	0.98	***0.25***	38.77	9.69
537-51	212	520	0.5	-	1.41	***0.25***	17.53	4.38
537-52	213	1,040	0.5	-	2.01	***0.25***	58.14	14.53
537-53	214	2,744	0.5	-	2.14	***0.25***	166.69	41.67
537-54	215	2,368	0.5	-	1.50	***0.25***	87.71	21.93
537-55	216	3,074	0.5	-	2.07	***0.25***	178.76	44.69
537-56	217	4,817	0.5	-	2.65	***0.25***	383.61	95.90
537-57	218	3,228	0.5	-	2.58	***0.25***	248.68	62.17
537-58	219	3,079	0.5	-	1.51	***0.25***	115.19	28.80
537-59	220	3,936	0.5	-	2.08	***0.25***	230.31	57.58
537-6	221	1,559	0.5	-	1.20	***0.25***	40.42	10.10
537-60	222	3,722	0.5	-	2.43	***0.25***	266.05	66.51
537-61	223	2,854	0.5	-	1.68	***0.25***	124.71	31.18
537-62	224	3,184	0.5	-	1.87	***0.25***	161.56	40.39
537-63	225	3,823	0.5	-	2.01	***0.25***	213.83	53.46
537-64	226	3,594	0.5	-	1.56	***0.25***	141.09	35.27
537-65	227	4,266	0.5	-	2.46	***0.25***	309.68	77.42
537-66	228	8,085	0.5	-	1.96	***0.25***	437.20	109.30
537-67	229	4,395	0.5	-	1.19	***0.25***	112.30	28.08
537-68	230	3,694	0.5	-	0.82	***0.25***	43.78	10.95
537-69	231	3,693	0.5	-	1.09	***0.25***	80.69	20.17
537-7	232	1,231	0.5	-	1.80	***0.25***	59.27	14.82
537-70	233	3,530	0.5	-	1.14	***0.25***	83.68	20.92
537-71	234	664	0.5	-	0.76	***0.25***	6.39	1.60
537-72	235	2,670	0.5	-	2.00	***0.25***	148.35	37.09
537-73	236	3,478	0.5	-	1.10	***0.25***	77.28	19.32

TABLE 1D
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Subsurface Conditions (> 0.5 foot) -Alternative 1 Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-74	237	3,946	0.5	-	0.86	***0.25***	52.61	13.15
537-75	238	3,138	0.5	-	1.12	***0.25***	72.07	18.02
537-76	239	2,127	0.5	-	1.24	***0.25***	58.30	14.58
537-77	240	3,420	0.5	-	1.03	***0.25***	67.13	16.78
537-78	241	4,044	0.5	-	0.92	***0.25***	62.91	15.73
537-79	242	2,637	0.5	-	1.04	***0.25***	52.74	13.18
537-8	243	714	0.5	-	1.23	***0.25***	19.32	4.83
537-80	244	3,029	0.5	-	0.96	***0.25***	51.61	12.90
537-81	245	2,632	0.5	-	1.40	***0.25***	87.72	21.93
537-82	246	3,327	0.5	-	1.97	***0.25***	181.12	45.28
537-83	247	3,368	0.5	-	2.13	***0.25***	203.31	50.83
537-84	248	2,522	0.5	-	0.85	***0.25***	32.69	8.17
537-85	249	18,398	0.5	-	2.00	***0.25***	1,022.11	255.53
537-86	250	4,042	0.5	-	1.37	***0.25***	130.23	32.56
537-87	251	3,643	0.5	-	1.52	***0.25***	137.63	34.41
537-88	252	2,399	0.5	-	0.80	***0.25***	26.66	6.67
537-89	253	3,793	0.5	-	0.97	***0.25***	66.03	16.51
537-9	254	1,511	0.5	-	1.93	***0.25***	80.05	20.01
537-90	255	3,054	0.5	-	1.40	***0.25***	101.81	25.45
537-91	256	3,614	0.5	-	1.20	***0.25***	93.69	23.42
537-92	257	3,424	0.5	-	1.01	***0.25***	64.68	16.17
537-93	258	3,013	0.5	-	0.95	***0.25***	50.21	12.55
537-94	259	3,287	0.5	-	1.23	***0.25***	88.88	22.22
537-95	260	2,608	0.5	-	1.11	***0.25***	58.91	14.73
537-96	261	2,191	0.5	-	1.37	***0.25***	70.60	17.65
537-97	262	3,161	0.5	-	1.65	***0.25***	134.64	33.66
537-98	263	2,291	0.5	-	1.90	***0.25***	118.78	29.69
537-99	264	1,963	0.5	-	1.24	***0.25***	53.80	13.45
537-402	265	11,687	0.5	-	1.00	***0.25***	216.43	54.11
537-403	266	35	0.5	-	1.00	***0.25***	0.65	0.16
537-410	270	14,456	0.5	-	0.60	***0.25***	53.54	13.39
537-411	271	4	0.5	-	1.10	***0.25***	0.08	0.02
537-423	279	5,475	0.5	-	0.55	***0.25***	10.14	2.53
537-110	48a	3,659	0.5	-	0.69	0.06	26.37	1.58
537-121	60a	6,569	0.5	-	1.12	0.06	150.85	9.05
537-200	110a	1,209	0.5	-	1.53	2.80	46.10	129.09
537-275	121	4,327	0.5	-	1.00	35.74	80.12	2,863.59
537-276	122	13,885	0.5	-	1.05	58.10	282.84	16,433.20
537-277	123	25,510	0.5	-	2.00	37.90	1,417.22	53,712.74

TABLE 1D
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Subsurface Conditions (> 0.5 foot) -Alternative 1 Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-278	124	31,671	0.5	-	1.15	47.70	762.45	36,368.97
537-279	125	29,271	0.5	-	0.50	5.65	0.00	0.00
537-280	127	47,330	0.5	-	0.85	21.50	613.54	13,191.09
537-282	128a	28,287	0.5	-	1.00	15.90	523.83	8,328.83
537-283	129a	187	0.5	-	2.00	49.60	10.39	515.59
537-287	133	3,842	0.5	-	1.00	39.70	71.15	2,824.78
537-288	134	4,694	0.5	-	0.95	8.78	78.24	686.94
537-289	135	4,064	0.5	-	1.25	38.80	112.88	4,379.71
537-29	136a	4,032	0.5	-	1.10	0.18	89.59	16.13
537-290	137	4,407	0.5	-	0.75	21.90	40.80	893.55
537-291	138	3,747	0.5	-	0.75	28.50	34.70	988.81
537-292	139	8,532	0.5	-	1.00	23.20	158.00	3,665.62
537-294	140	7,548	0.5	-	1.00	14.40	139.78	2,012.81
537-299	144a	62	0.5	-	1.25	215.00	1.73	371.42
537-300	147	3,981	0.5	-	1.30	81.90	117.94	9,659.42
537-301	148	4,707	0.5	-	1.00	37.40	87.17	3,260.24
537-302	149	6,046	0.5	-	1.00	57.10	111.97	6,393.46
537-303	150	3,726	0.5	-	1.00	33.80	69.01	2,332.51
537-304	151	4,072	0.5	-	1.00	22.30	75.41	1,681.59
537-305	152	4,033	0.5	-	1.25	21.40	112.04	2,397.67
537-307	153	5,754	0.5	-	1.00	13.00	106.55	1,385.14
537-312	156a	1	0.5	-	1.25	608.00	0.03	21.00
537-313	157	3,392	0.5	-	1.30	72.80	100.50	7,316.68
537-314	158	4,839	0.5	-	0.85	43.10	62.73	2,703.52
537-316	159	4,330	0.5	-	0.75	34.40	40.09	1,379.14
537-317	160	22,837	0.5	-	0.75	18.40	211.45	3,890.77
537-318	161	4,947	0.5	-	1.25	35.80	137.42	4,919.79
537-321	163a	3,432	0.5	-	1.50	19.10	127.10	2,427.61
537-323	165	4,954	0.5	-	1.30	13.90	146.78	2,040.28
537-324	166	4,652	0.5	-	0.65	56.00	25.84	1,447.24
537-325	167	30,189	0.5	-	0.70	19.60	223.62	4,383.03
537-326	168	4,843	0.5	-	1.00	11.00	89.68	986.50
537-328	169	5,216	0.5	-	1.25	17.00	144.89	2,463.15
537-330	171	7,049	0.5	-	0.70	8.36	52.22	436.52
537-332	173	3,805	0.5	-	1.35	81.20	119.78	9,726.07
537-333	174	4,880	0.5	-	0.75	62.50	45.18	2,823.92
537-335	175	5,777	0.5	-	1.10	17.52	128.37	2,249.04
537-337	176	4,547	0.5	-	0.90	11.90	67.37	801.69
537-338	177	11,683	0.5	-	0.65	8.20	64.90	532.20

TABLE 1D
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Subsurface Conditions (> 0.5 foot) -Alternative 1 Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-339	178a	3	0.5	-	1.35	24.90	0.09	2.22
537-340	180	3,976	0.5	-	1.35	71.70	125.17	8,974.76
537-341	181	5,088	0.5	-	0.75	71.20	47.11	3,354.01
537-343	182	4,220	0.5	-	1.10	14.10	93.78	1,322.28
537-345	183	6,003	0.5	-	0.80	12.00	66.70	800.42
537-372	188a	5,049	0.5	-	1.40	135.00	168.29	22,718.68
537-373	189	4,677	0.5	-	0.75	78.30	43.31	3,391.18
537-375	190	5,123	0.5	-	1.10	9.46	113.85	1,076.97
537-377	191	4,639	0.5	-	0.80	13.20	51.54	680.32
537-381	193a	0	0.5	-	1.40	264.50	0.00	0.01
537-382	194	4,270	0.5	-	1.40	52.63	142.33	7,490.66
537-383	195	5,561	0.5	-	0.75	3.07	51.49	158.07
537-385	196	4,558	0.5	-	3.50	3.50	506.42	1,772.48
537-386	197	6,458	0.5	-	0.75	11.50	59.79	687.63
537-72	235a	8,766	0.5	-	2.00	0.06	486.97	29.22
537-78	241a	1,268	0.5	-	0.92	2.20	19.72	43.39
537-85	249a	12,117	0.5	-	2.00	0.06	673.16	40.39
537-403	266a	12,157	0.5	-	1.00	110.00	225.13	24,764.73
537-404	267	9,507	0.5	-	0.70	41.10	70.42	2,894.47
537-405	268	3,944	0.5	-	1.15	10.15	94.94	963.63
537-406	269	4,599	0.5	-	0.55	5.31	8.52	45.23
537-410	270a	16	0.5	-	0.60	19.80	0.06	1.14
537-411	271a	20,749	0.5	-	1.10	83.92	461.10	38,695.37
537-412	272	15,900	0.5	-	0.85	11.30	206.11	2,329.03
537-413	273	3,956	0.5	-	0.80	7.17	43.96	315.16
537-414	274	1,133	0.5	-	0.50	3.74	0.00	0.00
537-415	275	36,406	0.5	-	1.20	1.53	943.86	1,444.10
537-416	276	36,283	0.5	-	1.00	273.50	671.90	183,764.60
537-417	277	32,465	0.5	-	0.50	3.77	0.00	0.00
537-419	278	2,072	0.5	-	1.00	8.39	38.37	321.92
537-423	279a	73	0.5	-	0.55	110.00	0.13	14.81
537-425	280	64,986	0.5	-	0.85	99.80	842.41	84,072.88
537-427	281	2,264	0.5	-	1.25	13.65	62.88	858.27
537-431	282	16,990	0.5	-	0.85	15.00	220.25	3,303.70
537-432	283	10,962	0.5	-	0.75	7.54	101.50	765.33
537-435	284	32,329	0.5	-	1.24	2.77	886.06	2,454.40
537-110	48b	18,087	0.5	-	0.69	0.06	130.35	7.82
537-117	55a	820	0.5	-	1.17	0.06	20.34	1.22
537-120	59a	1,297	0.5	-	1.06	0.06	26.90	1.61

TABLE 1D
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Subsurface Conditions (> 0.5 foot) -Alternative 1 Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

0.5- TO X-FOOT DEPTH INCREMENT

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sediment Depth (ft.)			Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
537-121	60b	19,300	0.5	-	1.12	0.06	443.19	26.59
537-126	65a	91	0.5	-	0.94	0.39	1.49	0.58
537-128	67a	657	0.5	-	1.22	0.06	17.52	1.05
537-199	107a	2,423	0.5	-	1.03	1.50	47.56	71.34
537-200	110b	49,044	0.5	-	1.53	2.80	1,870.95	5,238.67
537-201	111a	1,434	0.5	-	1.21	0.90	37.72	33.95
537-273	119a	17	0.5		1.75	356.00	0.80	284.95
537-274	120a	9,414	0.5		0.75	57.50	87.17	5,012.19
537-275	121a	11,596	0.5		1.00	35.74	214.74	7,674.97
537-276	122a	5,340	0.5		1.05	58.10	108.78	6,319.86
537-286	132a	664	0.5		0.75	80.60	6.15	495.40
537-29	136b	21,563	0.5		1.10	0.18	479.18	86.25
537-72	235b	13,856	0.5		2.00	0.06	769.78	46.19
537-78	241b	133	0.5		0.92	2.20	2.08	4.57
Totals:		1,635,710	--			--	43,062.92	655,950.94
						Volume Weighted Average:		**15.2**

OUTSIDE OF REMOVAL AREA

Sample ID(s)	Polygon ID	Polygon Area (sq. ft.)	Sample Depth (ft.)	Mercury Conc. (ppm)	Volume (cumulative) (cy)	Average Mercury Conc. TIMES Total Volume
Totals:		940,827	--	--	18,900.69	649,910.38
				Volume Weighted Average:		**34**

Notes:

1. Non-detectable mercury concentrations are included as one-half the detection limit in calculations in subsurface areas
2. All calculations and rounding are performed by the computer software. Therefore, certain quantities in above table are displayed as rounded numbers for clarity.
3. Average subsurface mercury conc. shown herein represent the average mercury concentration for soil samples collected below a depth of approximately 6 inches. These values were provided to BBL by DuPont electronically on October 18, 2005 and September 2006.
4. X = the approximate depth of sediment observed for each sample location. These values have been estimated based on field data collected at select locations.

TABLE 1E
EXISTING AND POST-REMEDIATION SEDIMENT
MERCURY CONCENTRATION EVALUATIONS
Post-Remediation Conditions Summary - Alternative 1 - Removal As Proposed To NJDEP
DuPont Pompton Lakes - Acid Brook Delta Site

VOLUME WEIGHTED SPATIAL AVERAGE MERCURY CONCENTRATION SUMMARY (PPM)

OVERALL STUDY AREA	
0- TO 0.5- FOOT DEPTH INCREMENT:	6.4
COMBINED:	11.6

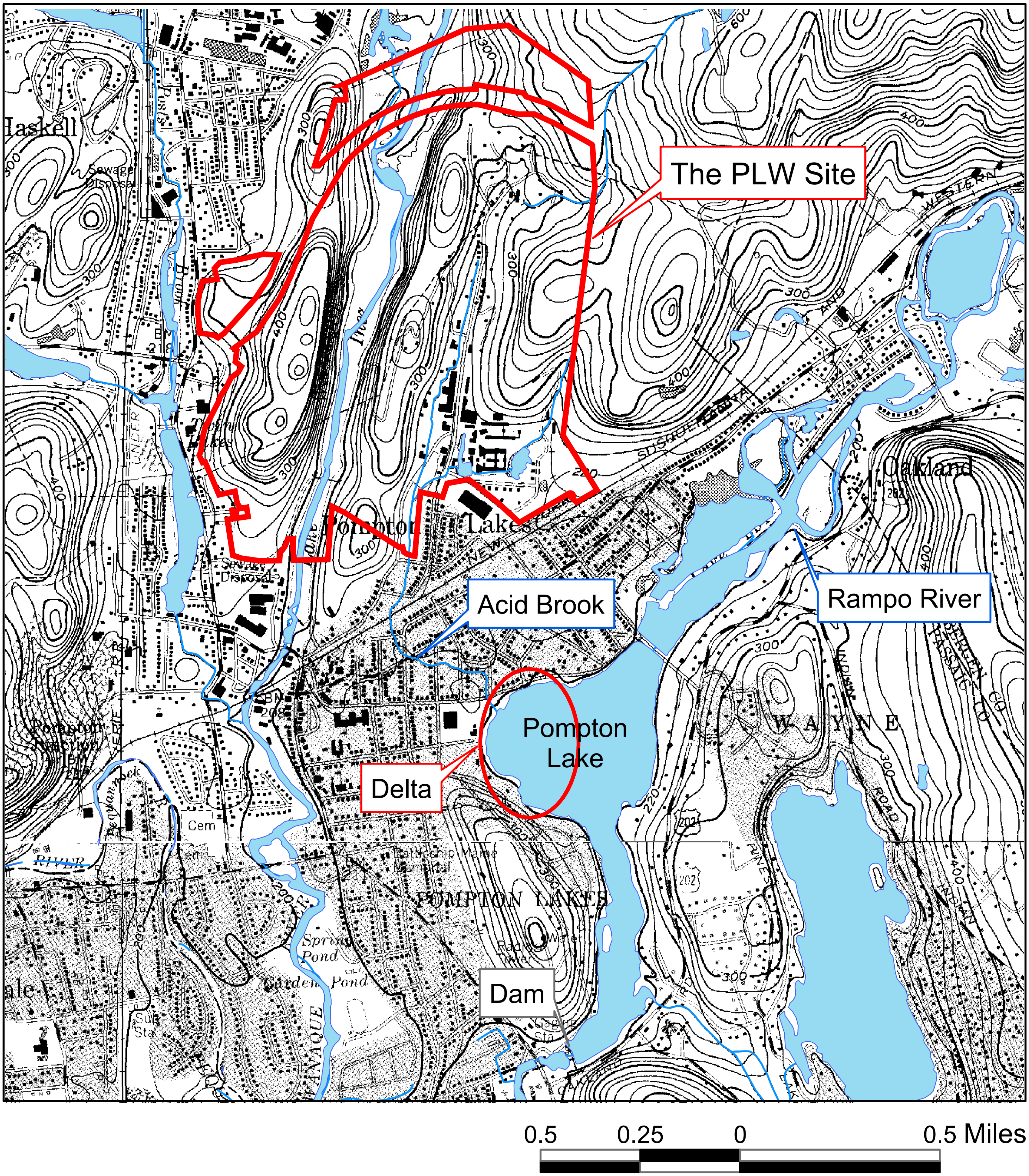
OUTSIDE OF REMOVAL AREA	
0- TO 0.5- FOOT DEPTH INCREMENT:	11
COMBINED:	23

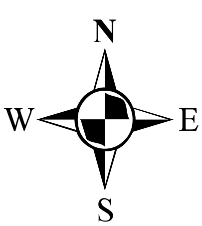
Table 2

Summary of Existing and Post-Remediation Conditions
DuPont Pompton Lakes - Acid Brook Delta Site

	Existing Conditions ABD Study Area	**Post-Remediation Conditions- Overall ABD Study Area**	**Post Remediation Conditions - Outside Excavation Limits**
Approximate Area	37.6 ac	16.0 ac - Excavated 21.6 ac –Undisturbed	21.6 ac Undisturbed
Remaining Volume-weighted Spatial Average Hg Concentration - Surface and Subsurface Combined	69 mg/kg	11.6 mg/kg	23 mg/kg
Remaining Volume-weighted Spatial Average Hg Concentration - Surface and Subsurface	81 mg/kg – Surface 61 mg/kg – Subsurface	6 mg/kg – Surface 15 mg/kg – Subsurface	11 mg/kg– Surface 34 mg/kg– Subsurface

FIGURES





Base is portions of the
USGS Wanaque QUAD and
USGS Pompton Plains QUAD.

DUPONT

Corporate Remediation Group

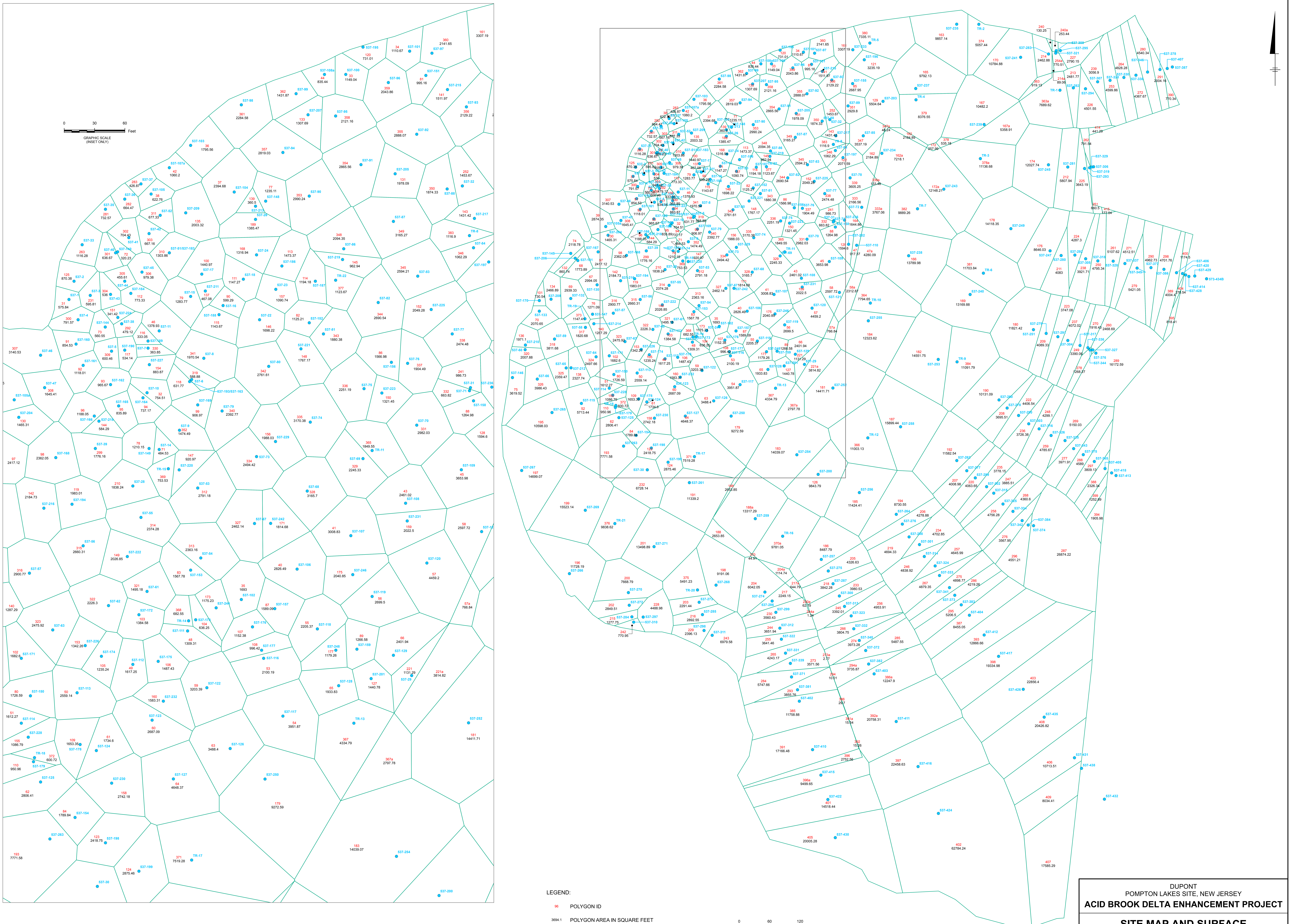
An Alliance between DuPont
and URS Diamond Group

2000 Cannonball Road
Pompton Lakes, New Jersey 07442

SITE LOCATION MAP

DuPont Pompton Lakes Works
Pompton Lakes, New Jersey

Figure 1



LEGEND:

- 96 POLYGON ID
- 3694.1 POLYGON AREA IN SQUARE FEET
- 537-53 BORING ID
- APPROXIMATE SURFACE SAMPLE LOCATION
- THIESSEN POLYGON

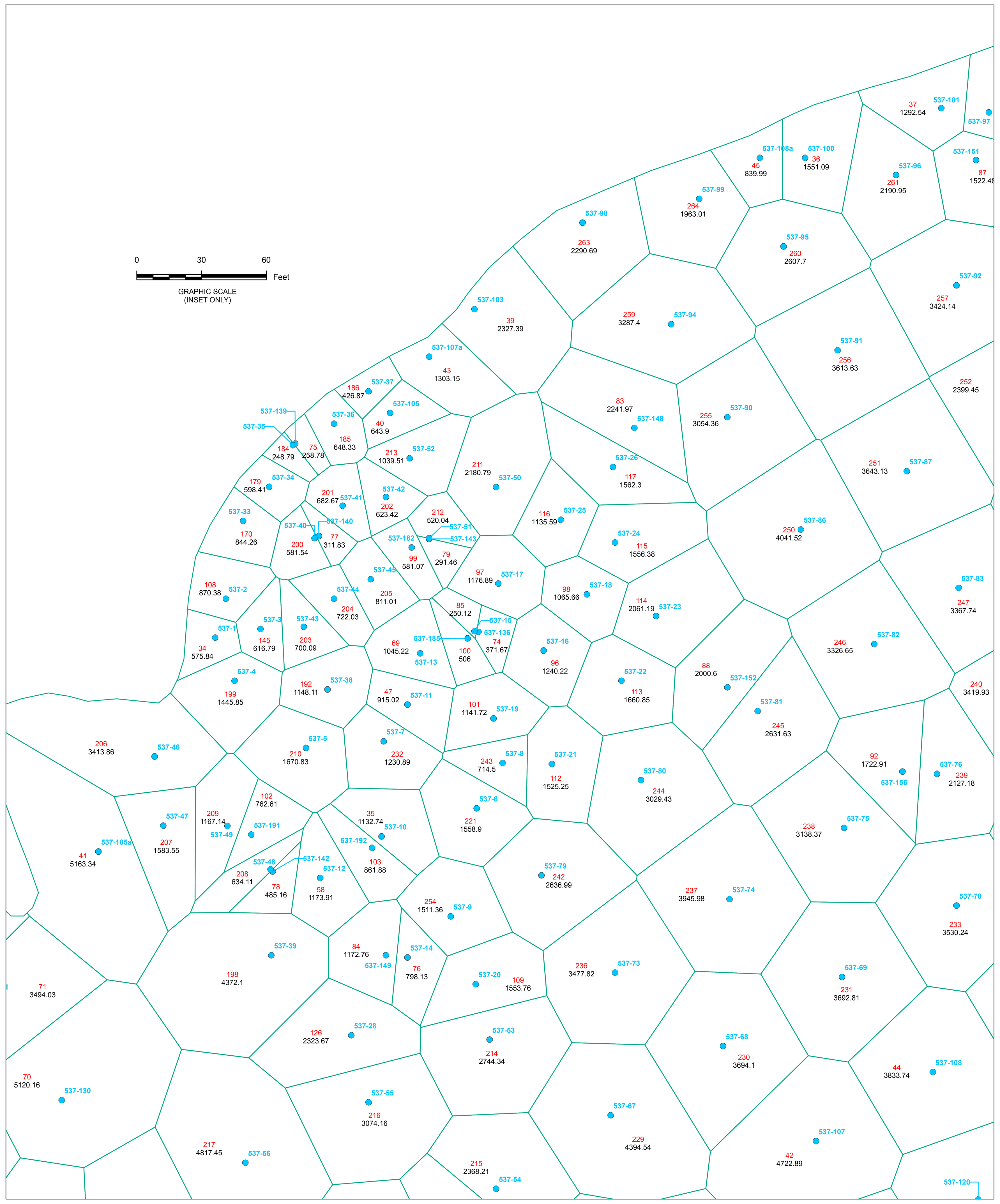
DUPONT
POMPTON LAKES SITE, NEW JERSEY
ACID BROOK DELTA ENHANCEMENT PROJECT

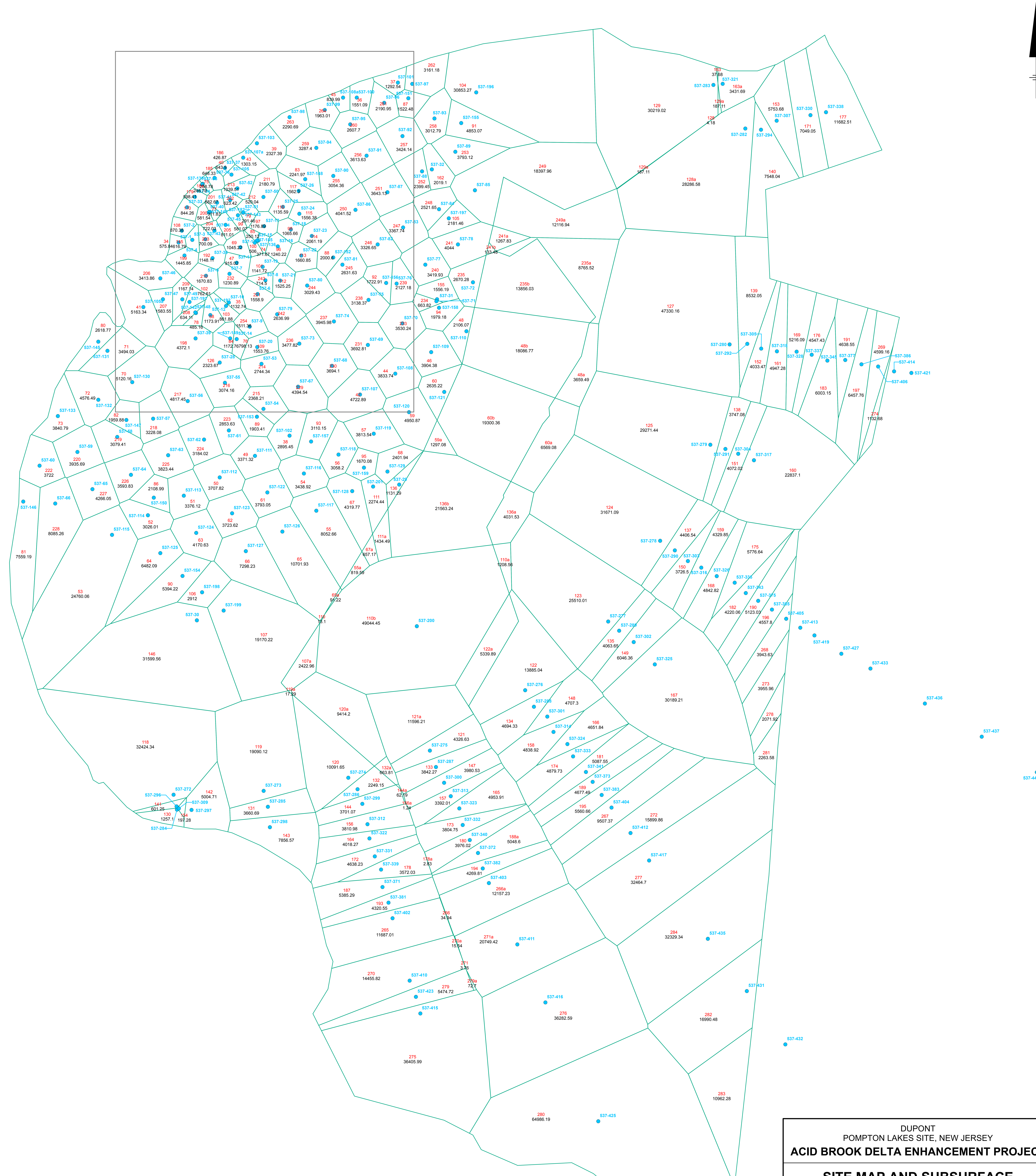
SITE MAP AND SURFACE SAMPLE LOCATIONS

BBL an ARCADIS company

FIGURE **2**

11/14/06 SYR-85 MTK
Dupont (42320.001)
Q:\Dupont\PomptonLake\RemediationCostAnalysis_09-25-06\mxd\Surface Report Map.mxd





LEGEND:

96 POLYGON ID

3694.1 POLYGON AREA IN SQUARE FEET

537-82 BORING ID

APPROXIMATE SUBSURFACE SAMPLE LOCATION

THIESSEN POLYGON

DUPONT
POMPTON LAKES SITE, NEW JERSEY

ACID BROOK DELTA ENHANCEMENT PROJECT

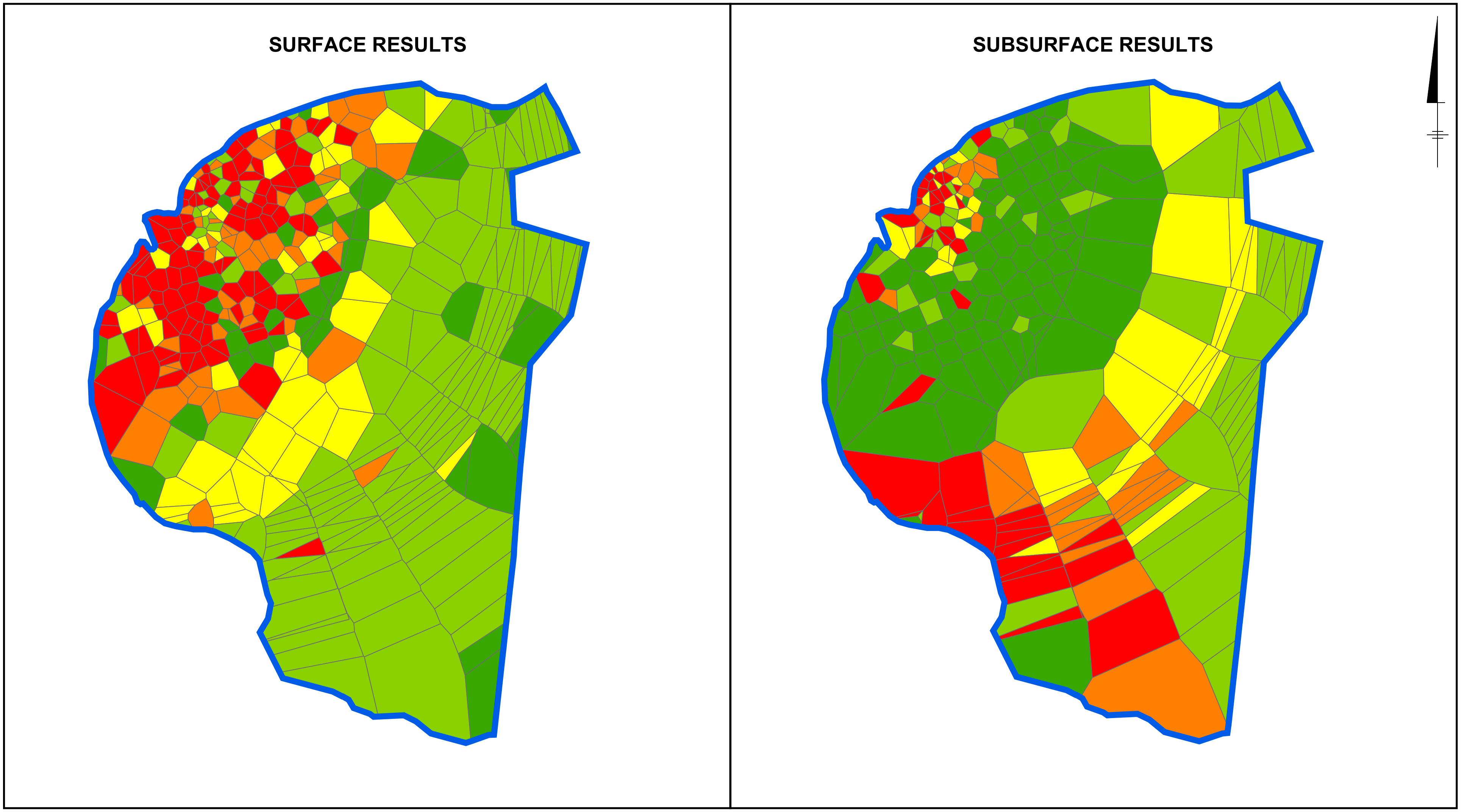
SITE MAP AND SUBSURFACE SAMPLE LOCATIONS

BBL an ARCADIS company

FIGURE **3**

11/14/06 SYR-85 MTK
Dupont (42320.001)
Q:\Dupont\PomptonLake\RemediationCostAnalysis_09-25-06\mxd\Subsurface Report Map.mxd

11/14/06 SYR-85 MTK
Dupont (42320.001) [SYR-85 MTK]
Q:\Dupont\PomptonLake\RemediationCostAnalysis_09-25-06\mxd\Existing Conditions.mxd



LEGEND:

ACID BROOK DELTA STUDY AREA

THIESSEN POLYGONS
MERCURY RESULTS (ppm):

- < 2
- 2 - 20
- 20 - 50
- 50 - 100
- > 100

0 400 800 Feet

GRAPHIC SCALE

DUPONT
POMPTON LAKES SITE, NEW JERSEY

ACID BROOK DELTA ENHANCEMENT PROJECT

EXISTING CONDITIONS

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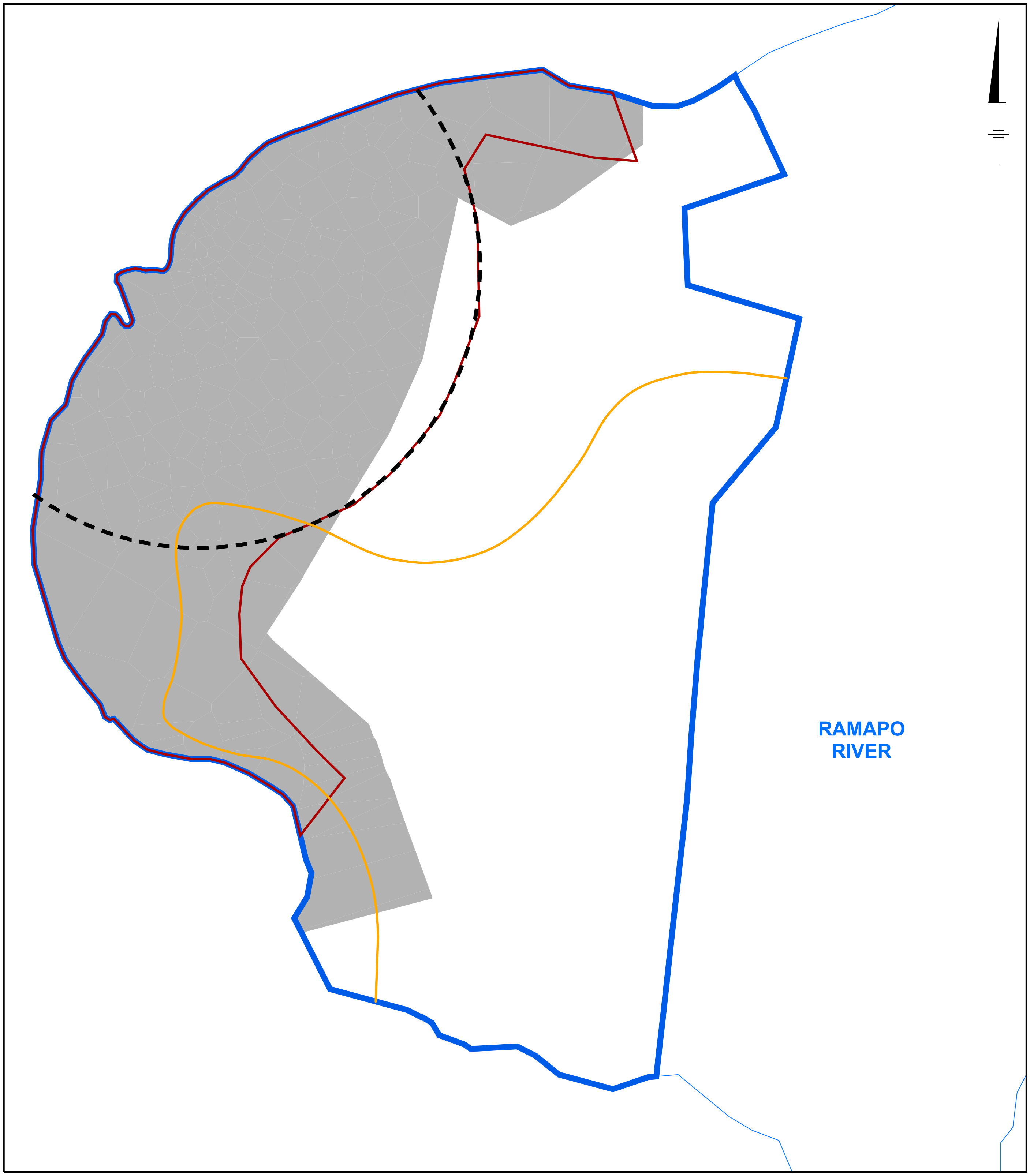
FIGURE
4



LEGEND:

- 5 ft WATER LINE
- 500 ft LINE
- ORIGINAL NOVEMBER 2004 SCENARIO
- ACID BROOK DELTA STUDY AREA
- AREA SUBJECT TO REMOVAL
- SHORELINE

0 250 500 Feet

GRAPHIC SCALE

DUPONT
POMPTON LAKES SITE, NEW JERSEY

ACID BROOK DELTA ENHANCEMENT PROJECT

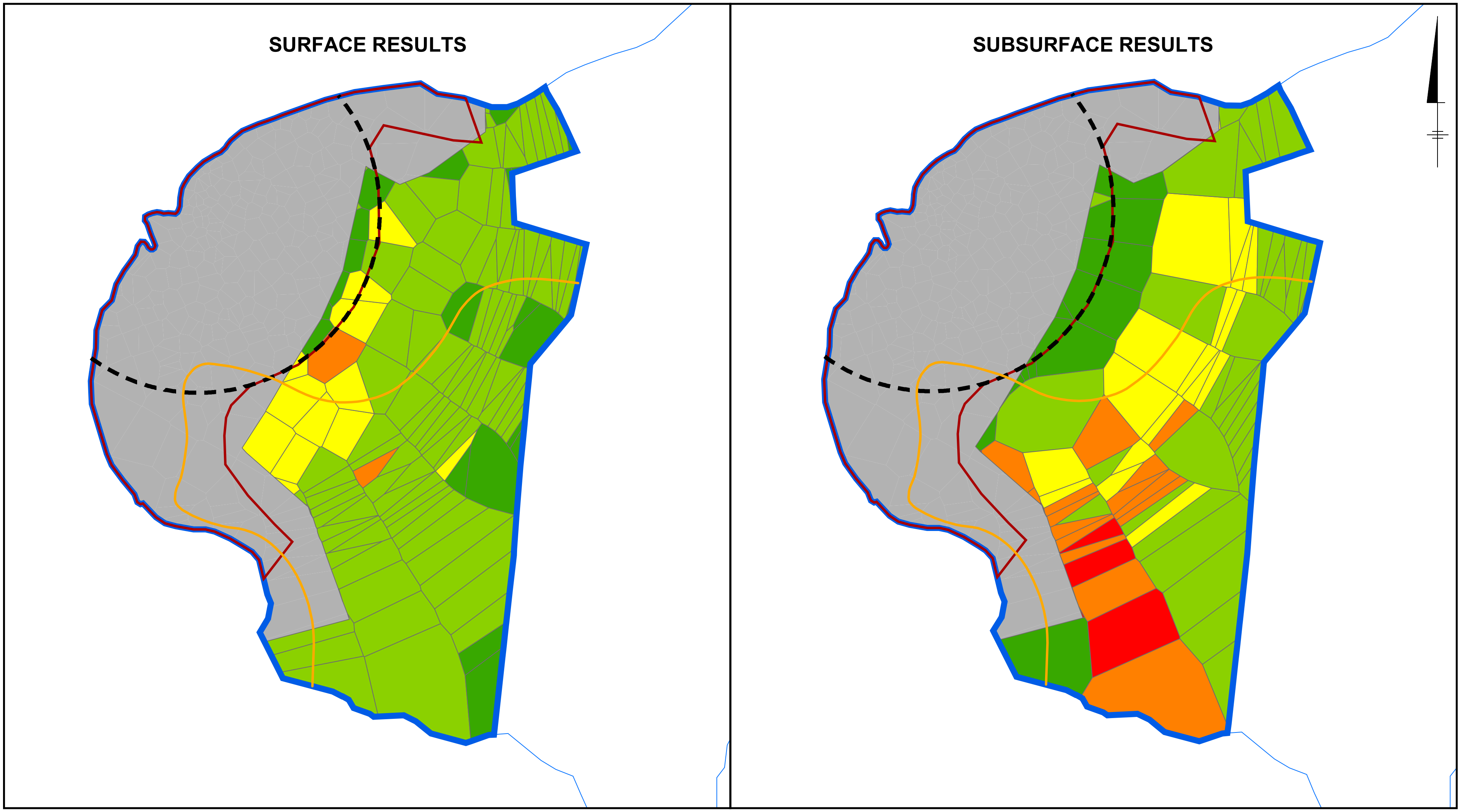
AREA SUBJECT TO REMOVAL AND 5 ft WATER LINE

BBL® an ARCADIS company

FIGURE 5

11/14/06 SYR-85 MTK
Dupont (42320.001) [SYR-85 MTK]
Q:\Dupont\PomptonLake\RemediationCostAnalysis 09-25-06\mxd\Removal Limits.mxd

11/14/06 SYR-85 MTK
Dupont (42320.001) [SYR-85 MTK]
Q:\Dupont\PomptonLake\RemediationCostAnalysis_09-25-06\mxd\PostRemediationConditions.mxd



LEGEND:

- 5 ft WATER LINE
- 500 ft LINE
- ORIGINAL NOVEMBER 2004 SCENARIO
- AREA SUBJECT TO REMOVAL
- ACID BROOK DELTA STUDY AREA
- SHORELINE

THIESSEN POLYGONS
MERCURY RESULTS (ppm):

- < 2
- 2 - 20
- 20 - 50
- 50 - 100
- > 100

0 400 800 Feet
GRAPHIC SCALE

DUPONT
POMPTON LAKES SITE, NEW JERSEY

ACID BROOK DELTA ENHANCEMENT PROJECT

POST-REMEDIATION CONDITIONS

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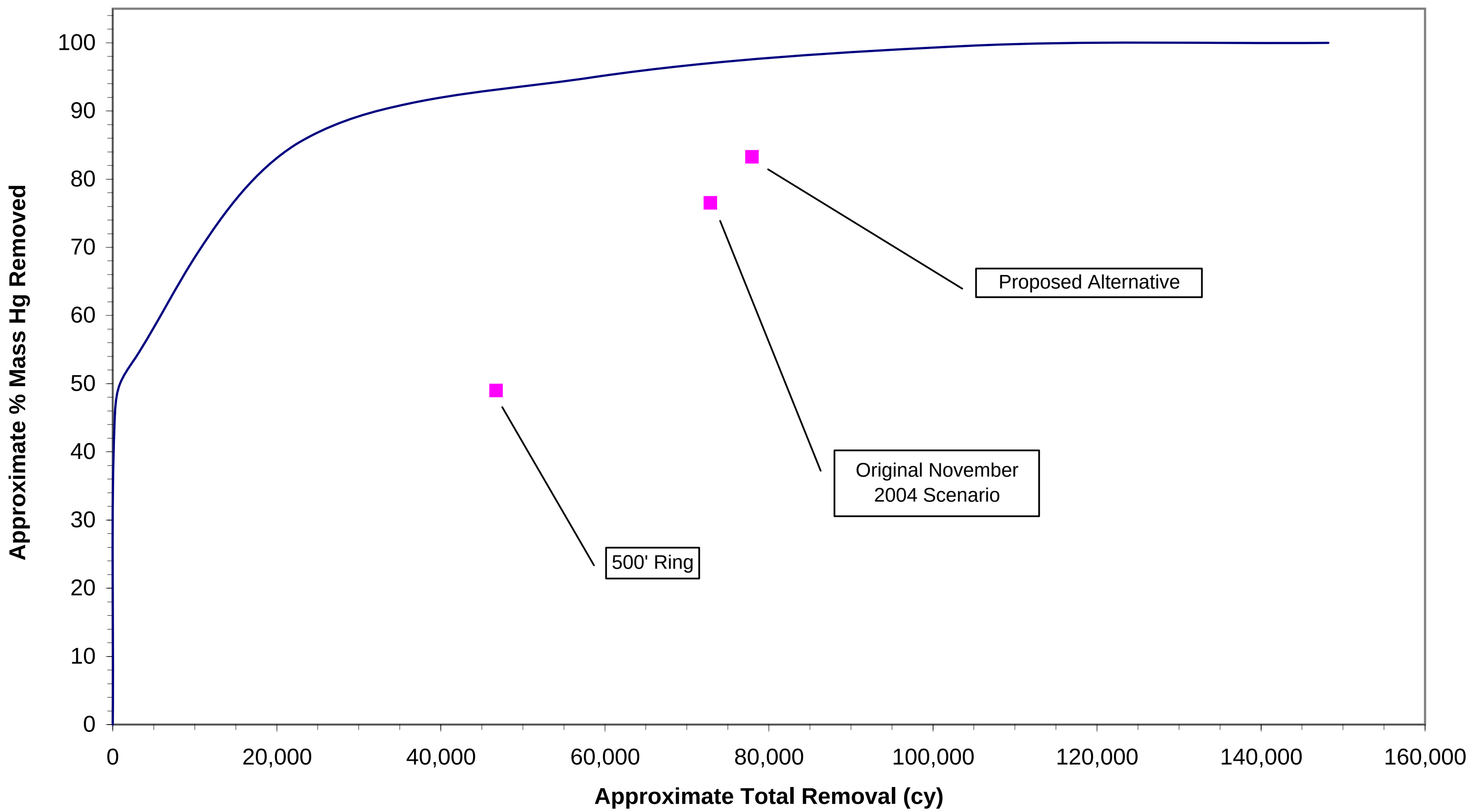
FIGURE
6



DUPONT

POMPTON LAKES, NEW JERSEY

ACID BROOK DELTA ENHANCEMENT PROJECT

THEORETICAL REMOVAL SCENARIO PERFORMANCE CURVE

BBL an ARCADIS company

FIGURE 7

APPENDICES

APPENDIX A
DELTA SURFACE WATER
SAMPLING AND ANALYSIS REPORT

Delta Surface Water Sampling and Analysis

Surface water concentrations of methylmercury and total mercury are routinely used to spatially characterize mercury contaminated aquatic systems (Choe and Gill, 2003a,b; Gill, 2004; Bloom, et al., 2004; Henry, et al., 1995). Conceptually, the water column is used as a flux chamber, capturing and integrating the evolution of mercury and methylmercury from the underlying sediments except that no rate data are collected. If water column concentrations of methylmercury are indicative of an integration of methylmercury efflux from sediments, these measurements represent a simple, noninvasive, and cost-effective method for monitoring the Acid Brook Delta (Delta). Additionally, water column measurements were used to focus costly and labor-intensive flux chamber studies. The data presented in this report are the results of four sampling events covering an entire annual cycle between 2004 and 2005.

Objectives

The surface water sampling and analysis efforts were designed to achieve the following:

- Identify potential site-to-site and/or temporal differences in methylmercury and mercury concentrations within the Delta water column.
- Determine the relationship between methylmercury concentrations in the Delta water column and methylmercury concentrations in the rest of the lake.
- Determine the relationship between water column methylmercury concentrations and sediment mercury concentrations.

Methods

The subsections below describe the sampling and analysis procedures as well as the sediment mercury estimation methods used in this study.

Sampling and Analysis Procedures

Surface water samples were collected in May and August 2004 and January and May 2005. Sampling locations are shown in Figure 1. Samples were not collected from all sampling locations during each sampling event. For example, the January 2005 sampling event focused on the Delta (see Figure 1). Sampling locations within the Delta were selected to include ranges of sediment mercury, proximity to shoreline, influence of Acid Brook, and water depth.

Water was collected just below the surface, and dissolved total mercury and methylmercury samples were obtained from samples that were filtered immediately after collection at 0.45 microns. Mercury and methylmercury measurements on these filtered samples are referred to as “dissolved.” However, it is acknowledged that these dissolved samples probably contain mercury associated with colloidal materials that are not truly dissolved. Unfiltered total mercury and methylmercury values were obtained from unfiltered sample analyses. In the May 2004 sampling event, all samples were collected and analyzed for unfiltered and dissolved total mercury and methylmercury and total suspended solids (TSS). In the August 2004 sampling event, all samples were analyzed for dissolved total mercury and methylmercury. Selected samples were also analyzed for unfiltered total mercury, methylmercury, and TSS. In the January and May 2005 sampling events, samples were analyzed only for dissolved total mercury and methylmercury.

All samples were analyzed by Frontier GeoSciences. Total mercury was measured using the method of Bloom and Fitzgerald (1988), and methylmercury was measured using the method of Horvat, et al. (1993). TSS was measured using a specialized method (developed by Studio Geochimica) that allows for low-level TSS detection [less than 2 parts per million (ppm)].

Sediment Mercury Estimations

Total sediment mercury values for the Delta were estimated from a comprehensive sediment sampling event in May 2003. These values represent surficial sediments to a depth of 6 inches and are shown in Table 1. In locations where sediment and surface water sampling sites did not coincide, the sediment total mercury value was estimated by averaging the values of the four sediment sampling sites surrounding the surface water sampling site. Total sediment values for the non-Delta portions of the lake were presumed to be similar to those measured at the reference site (identical to SW-2 in this study) during the Phase II ecological study (Exponent and The Academy of Natural Sciences, 1999). For this site, the ecological study reported total mercury values of 0.25 to 0.43 micrograms per gram (µg/g dry weight) in the top 8 centimeters at SW-2 in April and August 1998. The average of these six samples (0.4 µg/g dry weight) was used as a representative sediment total mercury value for non-Delta sites in this study.

Results

Unfiltered and dissolved total mercury and methylmercury and TSS results for all four sampling events are shown in Table 1. The August 2004 sampling event occurred after a significant rainfall that left the lake water level 6 inches higher than normal. During the January 2005 sampling event, temperatures were extremely low and some ice was present on the lake surface. Dissolved methylmercury values were lowest in the January 2005 sampling event.

TSS vs. Total Mercury and Methylmercury

Unfiltered and dissolved total mercury and methylmercury concentrations were compared to TSS values for the May and August 2004 sampling events (see Figures 2 and 3). In unfiltered samples, total mercury and methylmercury concentrations generally positively correlate with TSS.

Particle-associated total mercury or methylmercury is the difference between unfiltered and filtered concentrations divided by the amount of TSS. Unfiltered and filtered total mercury and methylmercury concentrations are only available for the May 2004 and selected locations for the August 2004 sampling events. In May 2004, the particle-associated total mercury correlated well with total sediment mercury for each site (see Figure 4). However, the correlation between the total sediment mercury and particle-associated methylmercury was poor during this sampling event (see Figure 4). Similarly in August 2004, the correlation between particle-associated mercury and total sediment mercury was also poor (see Figure 5). For the August sampling event, the poor correlation between total sediment mercury and particle-associated mercury may be the result of the incomplete unfiltered data set.

Lake and Delta Spatial Patterns for Dissolved Total Mercury and Methylmercury

All sampling results for dissolved total mercury and methylmercury are shown in Figures 6 through 9. As seen in these figures, results show a consistent spatial pattern to surface water total mercury and methylmercury concentrations in the Delta and Pompton Lake. Typically, concentrations of dissolved mercury and methylmercury in the Delta surface water are elevated relative to the rest of the lake only in the more nearshore or littoral parts of the Delta. At the more distal points of the Delta around 800 feet from the shore (sampling locations SW-16, SW-14, and SW-26), water column measurements of dissolved total mercury and methylmercury are similar (or slightly elevated for total mercury) to those observed in the rest of Pompton Lake.

This nearshore Delta pattern is more easily observed when the data are plotted as transects through the Delta. Possible transects are shown in Figure 10. Figures 11 through 13 show all sampling events as radial transects from shore near the mouth of the Delta to the distal portion of the Delta. As seen in these figures, the nearshore samples contain elevated dissolved total mercury and methylmercury concentrations relative to samples obtained from the more distal locations (nearer the 800-foot arc). The pattern of elevated dissolved mercury and methylmercury is less distinct when concentrations are viewed as transects across the Delta. The exception is the dissolved methylmercury data collected in the August sampling event (see Figure 14). For this latter data set, there is a clear elevation of methylmercury in surface water collected at the nearshore sites (W-15 and SW-27). The more central sites have less methylmercury (see Figure 14). In contrast, when the nearest shore sampling location results are examined (see Figure 15), the highest dissolved mercury and methylmercury concentrations are located nearest to the mouth of Acid Brook (SW-11, SW-31, and SW-24).

Sediment Total Mercury Concentrations vs. Surface Water Mercury and Methylmercury Concentrations

To determine whether sediment total mercury values are a good predictor of surface water methylmercury values, sampling sites were selected to cover a wide range of sediment total mercury values. May and August 2004 results show that dissolved total mercury and methylmercury concentrations generally correlate positively with the sediment total mercury values (see Figures 16 and 17). However, the May 2004 dissolved total mercury results correlated positively with total sediment mercury best when total sediment mercury was greater than 50 ppm (see Figure 16). Similarly, although the scatter in the data is greater, the dissolved May 2004 methylmercury concentrations were comparable amongst sites with total sediment mercury concentrations less than 100 ppm.

Dissolved methylmercury values increase above background (non-Delta sites) when sediment total mercury values are above 50 ppm. A similar relationship for dissolved methylmercury was also observed in the January and May 2005 sampling events (see Figures 18 and 19). The relationship between water column dissolved mercury, methylmercury, and sediment total mercury concentrations is much less clear in the August 2004 sampling results (see Figure 17). During this sampling event, there appeared to be little correlation between sediment total mercury and dissolved surface water mercury or methylmercury.

Discussion

In May 2004, particle-associated mercury results showed moderate positive correlations with sediment total mercury results (see Figure 4). However, particle-associated methylmercury results did not correlate well with sediment total mercury (see Figure 4). Because the highest sediment total mercury results were collected from locations in the shallowest part of the Delta, it is possible that unfiltered surface water samples may be confounded by sediment particle entrainment during sampling. The dissolved fractions of surface water mercury and methylmercury do not have possible sediment interferences; further discussion focuses on these data.

The results of all four sampling events indicate that surface water concentrations of total mercury and methylmercury vary across the Delta. Results are summarized in Figures 20 and 21. Although the absolute total mercury and methylmercury concentrations vary between sampling events (e.g., the lowest total mercury and methylmercury concentrations were observed in January 2004), general trends are consistent. If surface water concentrations are indeed correlated to methylmercury production in sediments, the Delta should not be viewed as a single entity and sediment total mercury is not a good indicator of potential methylmercury production. Nearshore environments currently proposed for excavation may be important sites of mercury methylation. At this time, the effects of a nearshore environment (e.g., warmer water, more organic material) cannot be separated from the proximity to the mouth of the Acid Brook and exposure to mercury and nutrients from this source.

The importance of environment on mercury methylation is further reinforced by the results from the deep hole site (SW-1) (see Table 1). This site has sediment total mercury levels presumed to be similar to the rest of the non-Delta portions of the lake. However, in May 2004, SW-1 had the highest non-Delta concentration for dissolved total mercury and methylmercury. In August 2004, SW-1 was sampled both deep in the water column (i.e., below the chemocline) and at the surface. The deep sample was observed to be anoxic with a distinct smell of sulfide, indicating that the water column in this area had stratified to form an anoxic hypolimnion. This deep sample contained the highest dissolved methylmercury and total mercury values measured during the sampling event. The surface water sample collected at SW-1, however, was similar to other non-Delta sites, possibly the result of dilution from the recent rains and the rest of the lake.

When synthesized, deep hole and Delta sample results suggest that under specific environmental conditions (e.g., the anoxic conditions in the water column of the deep hole), small amounts of mercury in sediment can coincide with elevated surface water methylmercury. However, the prediction that larger amounts of sediment mercury will result in proportionally larger amounts of methylmercury is not supported by the data. Although surface water samples collected at locations with sediment total mercury concentrations above 100 ppm had methylmercury values that were elevated, the increase in surface water methylmercury at these sites was not proportional to the increase in sediment total mercury. In May 2004, dissolved methylmercury concentrations were observed to be above background levels only when the underlying sediments exceeded 100 ppm total mercury. The increases in surface water dissolved methylmercury as a function of sediment total mercury were modest, even when associated sediment total mercury increased by orders of magnitude. The only exception to this relationship was observed in August 2004, when no clear correlation existed between sediment total mercury and filtered, unfiltered, or particle-associated surface water total mercury and methylmercury. These results reinforce the following interpretations:

- Sediment total mercury is not a good predictor of surface water methylmercury concentrations.
- Elevated sediment total mercury concentrations in and of themselves in the Delta environment may not lead to elevated surface water methylmercury concentrations.

It is likely that in the Delta sediment total organic carbon, ambient temperature, or a combination of other environmental characteristic(s) may be a better predictor of surface water methylmercury than sediment total mercury. Outside of the relatively shallow and nonstratifying waters of the Acid Brook Delta, mercury methylation may be controlled by water column stratification in addition to proximity to shore. The low correlation between sediment total mercury and methylmercury in sediments and surface water has been observed at other sites, including Onondaga Lake, New York (Henry, et al., 1995) and a comparison of Lavaca Bay (Texas) and the Venice Lagoon (Italy) (Bloom, et al., 2004).

The importance of nearshore environments in mercury methylation has been noted for other systems. Kainz, et al. (2003) found methylmercury was generally highest in the surficial sediments of nearshore sites in Lake Lusignan. Henry, et al. (1993) also observed elevated methylmercury in porewaters of littoral sites in Onondaga Lake when compared to porewaters of profundal sediments. However, in this latter example, bulk sediment measurements of methylmercury were higher in the profundal sediments.

The proposed Delta sediment excavation and removal focuses on the nearshore sediments where methylmercury production may be highest (see Figures 20 and 21). Figure 22 shows dissolved methylmercury concentrations for all four sampling events vs. sediment mercury. These three figures show that the sediment sampling locations (typically the nearshore) associated with elevated concentrations of dissolved surface water methylmercury are slated for removal.

References

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TABLES

Table 1
Unfiltered and Dissolved Total and Methylmercury and TSS for All Sampling Events

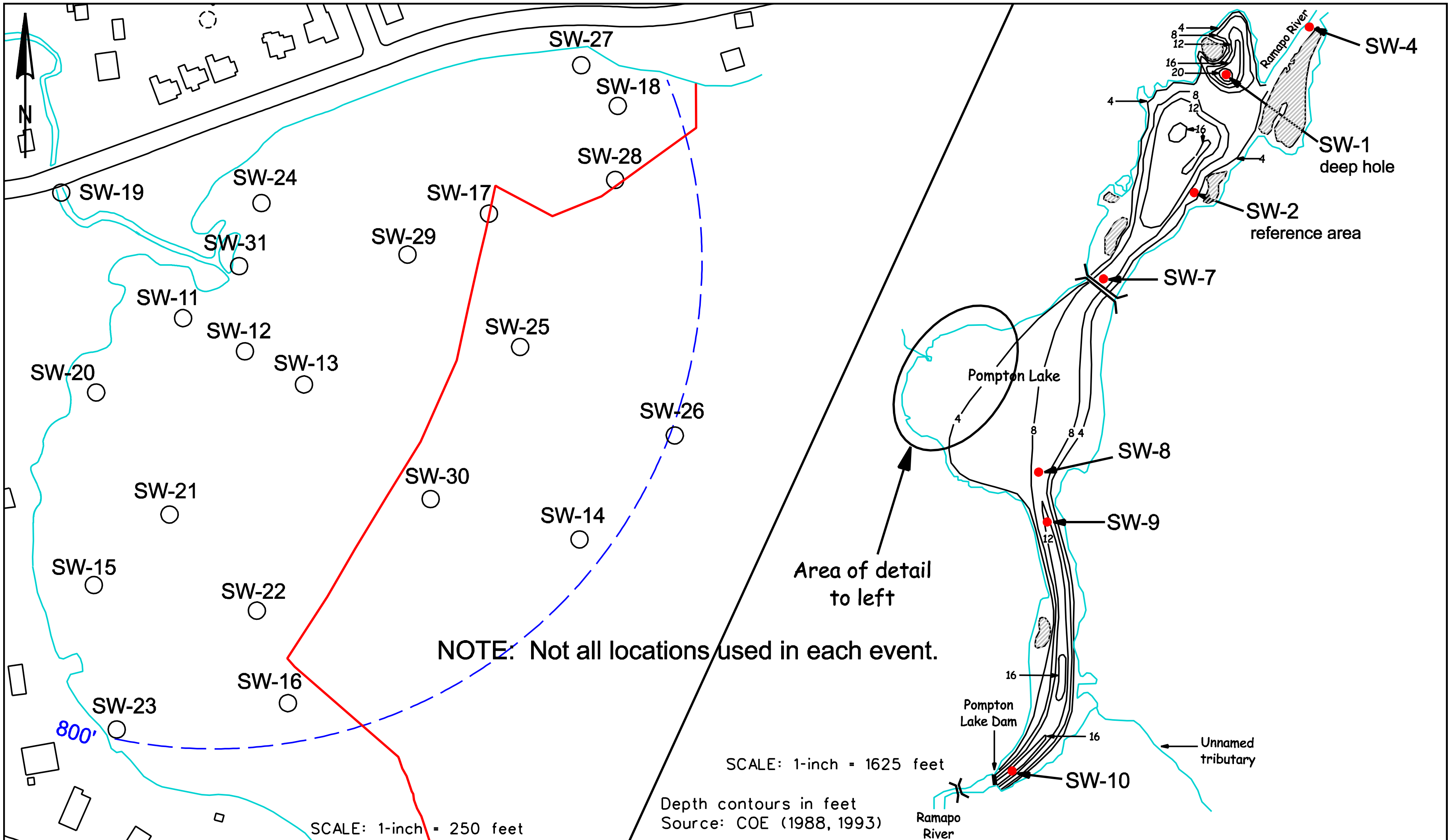
Sample Site	Estimated Total Sediment Hg (ug/g dry wt)	May-04 Unfiltered Total Hg (ng/L)	May-04 Dissolved Total Hg (ng/L)	May-04 Unfiltered MeHg (ng/L)	May-04 Dissolved MeHg (ng/L)	May-04 TSS (mg/L)	August-04 Unfiltered Total Hg (ng/L)	August-04 Dissolved Total Hg (ng/L)	August-04 Unfiltered MeHg (ng/L)	August-04 Dissolved MeHg (ng/L)	August-04 TSS (mg/L)	January-05 Unfiltered Total Hg (ng/L)	January-05 Dissolved Total Hg (ng/L)	January-05 Unfiltered MeHg (ng/L)	January-05 Dissolved MeHg (ng/L)	January-05 TSS (mg/L)	May-05 Unfiltered Total Hg (ng/L)	May-05 Dissolved Total Hg (ng/L)	May-05 Unfiltered MeHg (ng/L)	May-05 Dissolved MeHg (ng/L)	May-05 TSS (mg/L)
SW 1 Deep	0.4						6.39	3.13	2.400	2.013	41.1										
SW 1 Surface	0.4	9.18	2.26	0.383	0.172	3.9	27.7	1.24	0.041	0.032	1.70							0.94		0.061	
SW 2	0.4	5.18	1.71	0.431	0.164	3.3	5.62	2.02	0.102	0.027	14.3							1.16		0.062	
SW 3																		1.10		0.072	
SW 4	0.4	2.75	1.69	0.299	0.168	3.0	8.91	2.46	0.156	0.043	11.9										
SW 5																					
SW 6																					
SW 7	0.4	2.36	1.53	0.274	0.141	3.9	*na*	2.10	*na*	0.017	*na*		0.86		0.023			0.95		0.051	
SW 8	0.4	8.16	2.20	0.239	0.157	3.3	*na*	1.79	*na*	0.041	*na*		1.02		0.015*			1.06		0.056	
SW 9	0.4	7.18	1.54	0.252	0.129	3.0	*na*	1.90	*na*	0.047	*na*							1.08		0.063	
SW 10	0.4	5.82	1.74	0.230	0.122	3.6	12.6	1.45	0.101	0.016	4.90							1.29		0.069	
SW 11	157	153.5	16.33	0.968	0.548	5.8	816	10.9	1.231	0.172	27.5		2.76		0.077			6.23		0.302	
SW 12	132	423	16.48	1.022	0.375	9.1	*na*	5.53	*na*	0.127	*na*		1.24		0.026			1.72		0.095	
SW 13	109	151.1	8.97	0.501	0.210	6.7	38.5	2.58	0.126	0.058	5.28		1.45		0.040			1.12		0.064	
SW 14	3	40.28	3.43	0.242	0.080	5.9	13.8	1.78	0.105	0.033	4.35		0.89		0.018			0.99		0.056	
SW 15	168	*broken*	5.09	*broken*	0.249	4.4	63.6	2.37	0.408	0.115	6.55		1.90		0.033			1.98		0.159	
SW 16	40	58.29	3.73	0.279	0.133	5.6	*na*	1.63	*na*	0.038	*na*		1.38		0.028			1.27		0.063	
SW 17	0.4	330	3.25	0.765	0.201	14.2	9.60	1.80	0.100	0.036	5.35		1.05		0.020			1.27		0.049	
SW 18	8	56.87	4.00	0.615	0.179	7.5	*na*	1.68	*na*	0.049	*na*		1.07		0.031			1.23		0.077	
SW 19A		54.05	34.07	0.332	0.229	1.1	278	15.8	0.820	0.303	3.37										
SW 19B							20.3*	42.6*	0.286	0.450	0.70										
SW 20	1486						*na*	7.13	*na*	0.101	*na*		2.76		0.064			24.0		0.307	
SW 21	128						*na*	2.64	*na*	0.044	*na*		1.75		0.027			2.11		0.072	
SW 22	13						*na*	2.42	*na*	0.088	*na*		1.57		0.023			1.62		0.060	
SW 23	0.4						*na*	2.32	*na*	0.059	*na*		1.52		0.036			1.21		0.065	
SW 24	103						*na*	8.07	*na*	1.410	*na*		1.05		0.034			105		0.313	
SW 25	20						*na*	1.97	*na*	0.018	*na*		1.10		0.024			0.99		0.055	
SW 26	0.4						*na*	2.02	*na*	0.045	*na*		1.01		0.022			1.23		0.050	
SW 27	16						284	2.21	0.953	0.241	4.65		1.30		0.026						
SW 28	1						*na*	2.12	*na*	0.039	*na*		0.99		0.025			6.90		0.095	
SW 29	64						*na*	2.09	*na*	0.021	*na*		1.00		0.031			294		0.168	
SW 30	91						*na*	3.14	*na*	0.055	*na*		2.28		0.029			18.8		0.089	
SW 31	9							173	4.59	0.533	0.150	9.20		0.95		0.034					

na = not applicable because unfiltered samples was not

*dissolved > total - IDs may have been reversed in the

* below estimated MDL

FIGURES



LEGEND

Sample ID

Location

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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Pompton Lakes, New Jersey

Surface Water Sampling Location Map

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 1

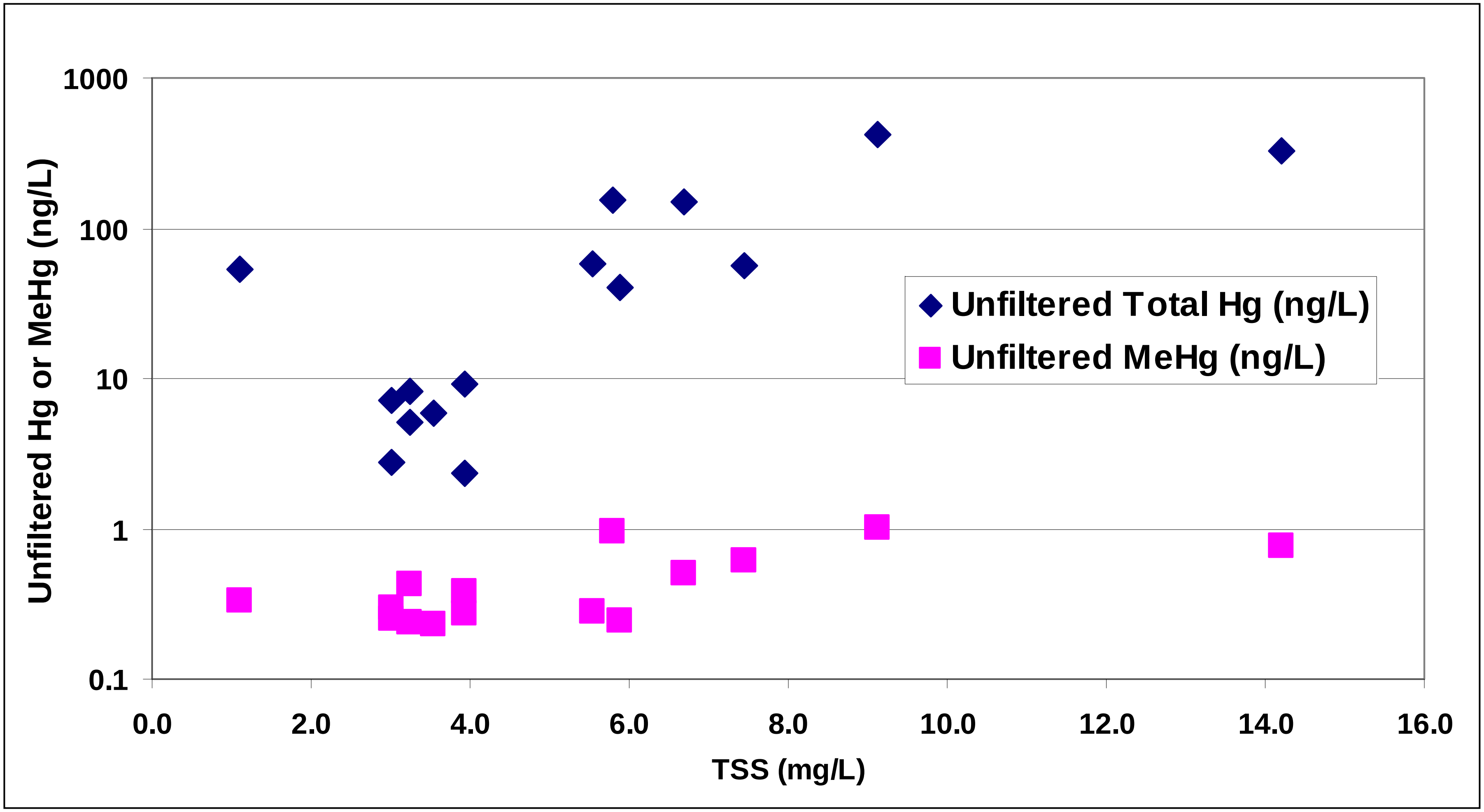


Figure 2. TSS vs. Unfiltered Total Mercury (Hg) and Methylmercury (MeHg)
May 2004 Sampling Event

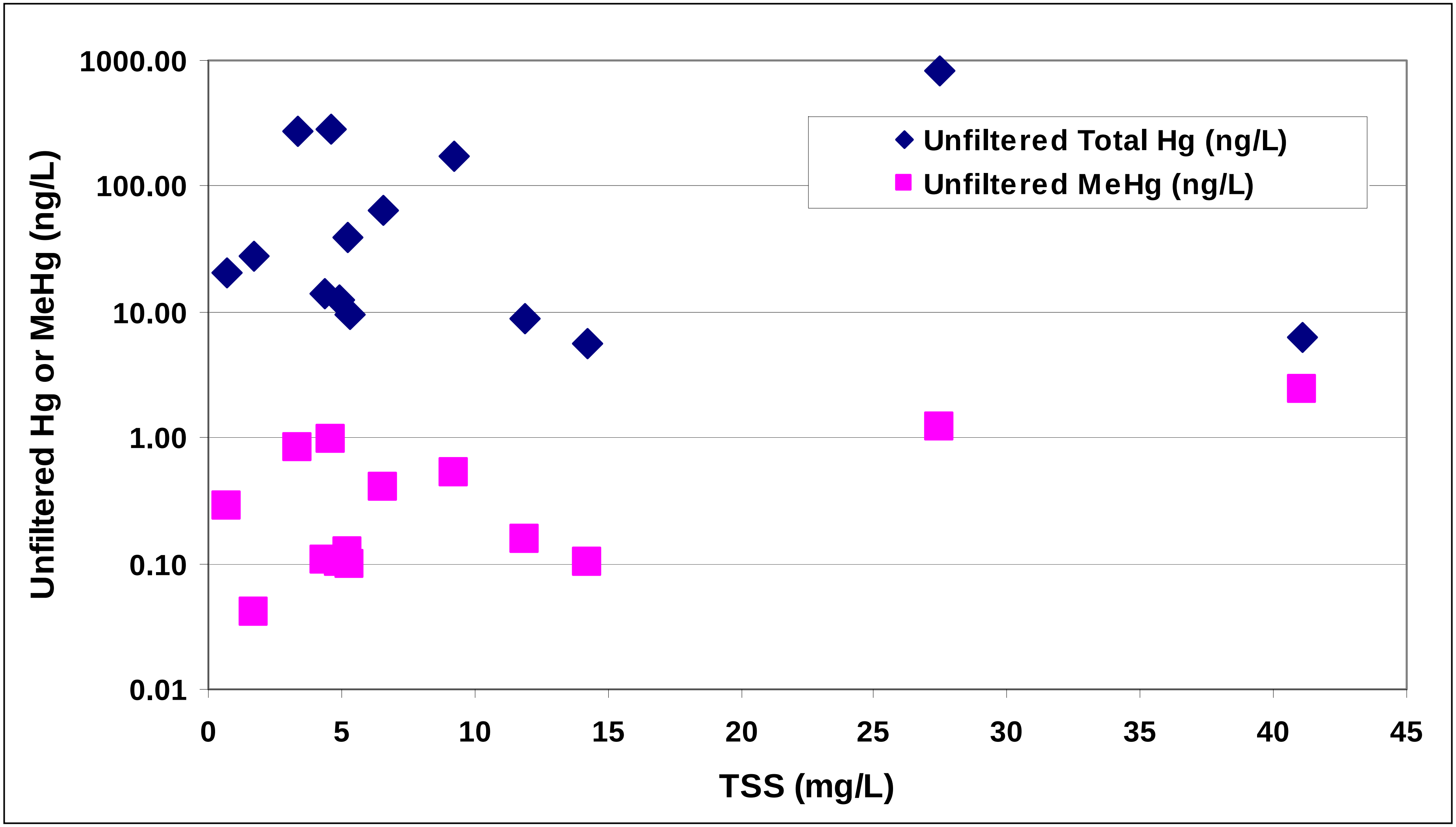


Figure 3. TSS vs. Unfiltered Total Mercury (Hg) and Methylmercury (MeHg)
August 2004 Sampling Event

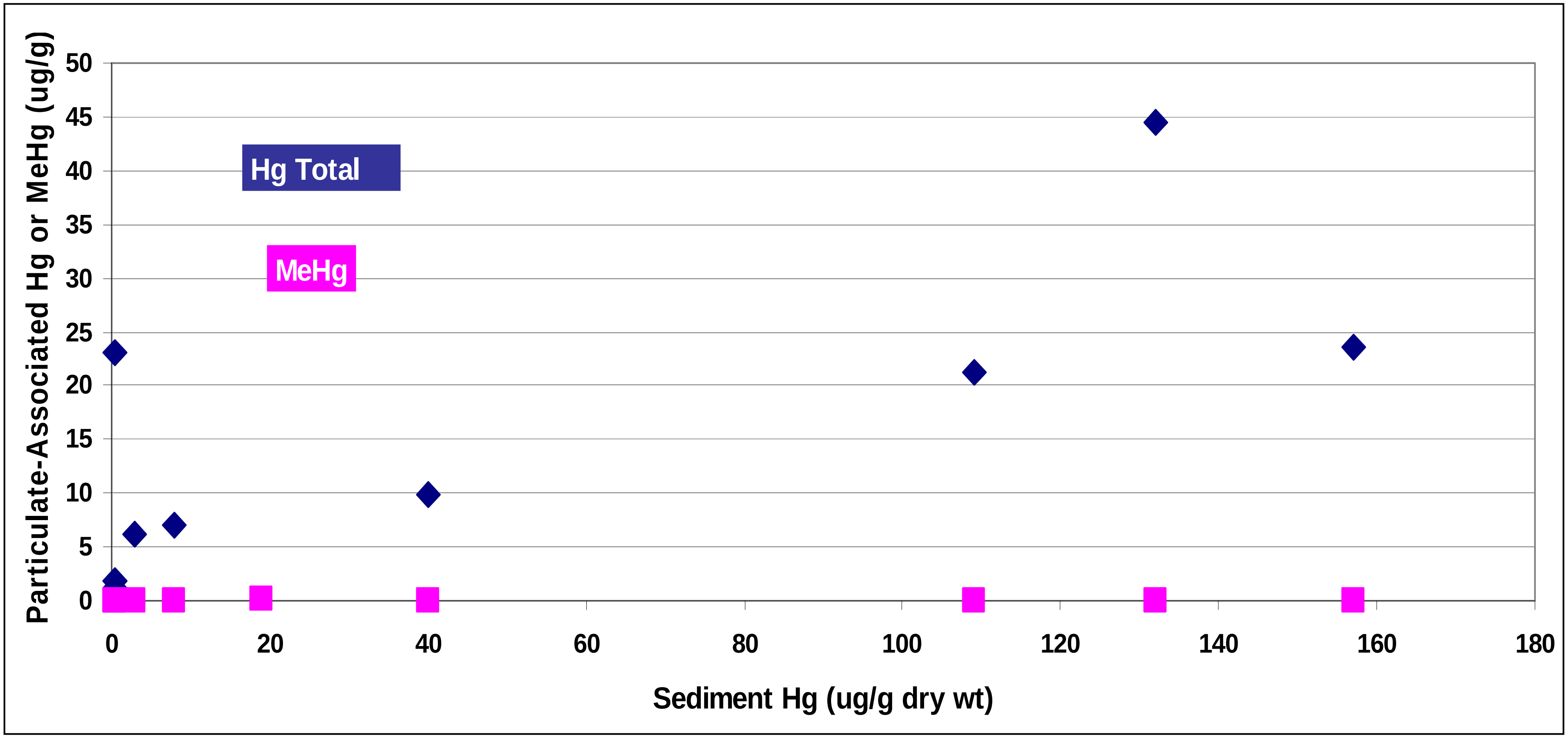


Figure 4. Sediment Mercury (Hg) vs. Particulate-Associated Mercury (Hg) or Methylmercury (MeHg)
May 2004

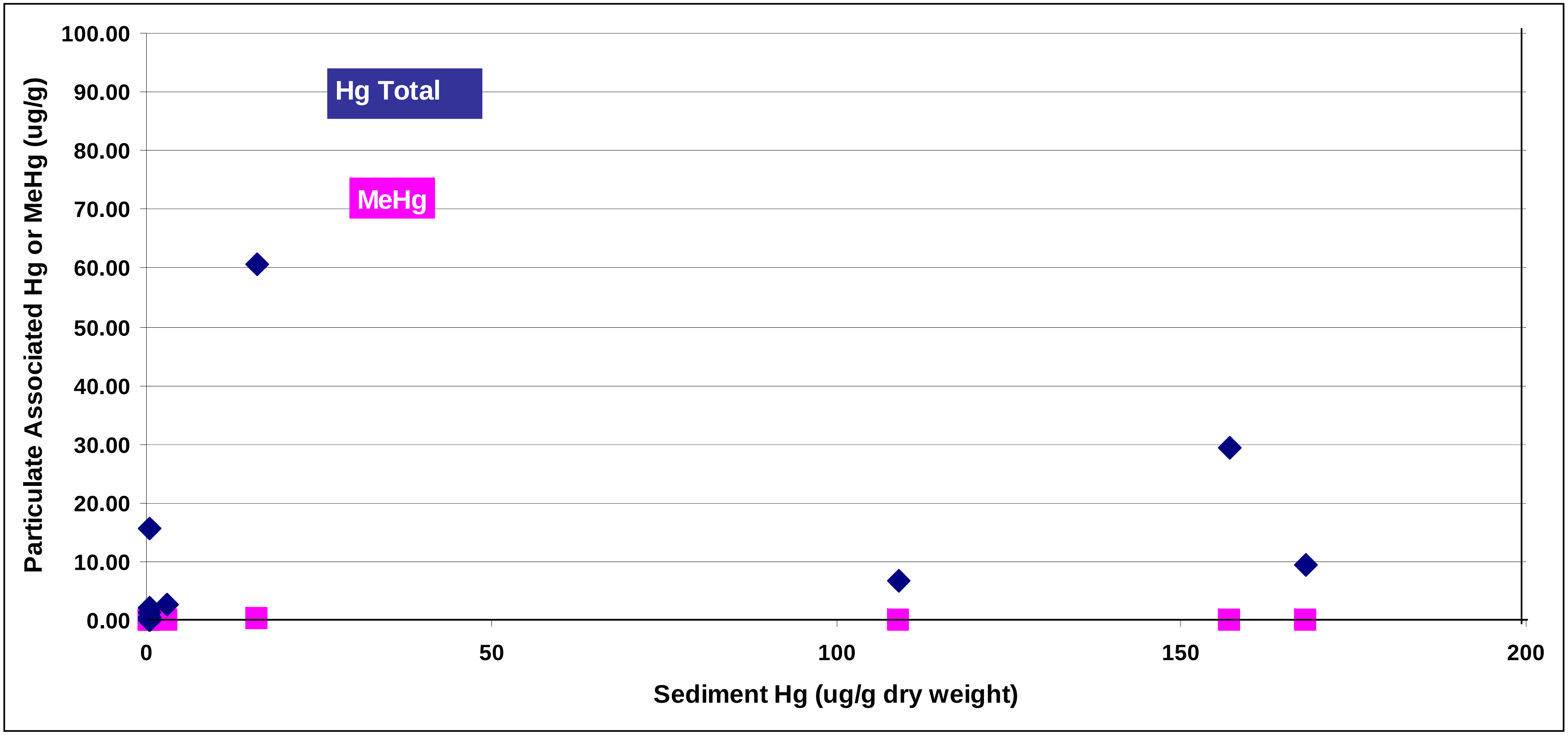
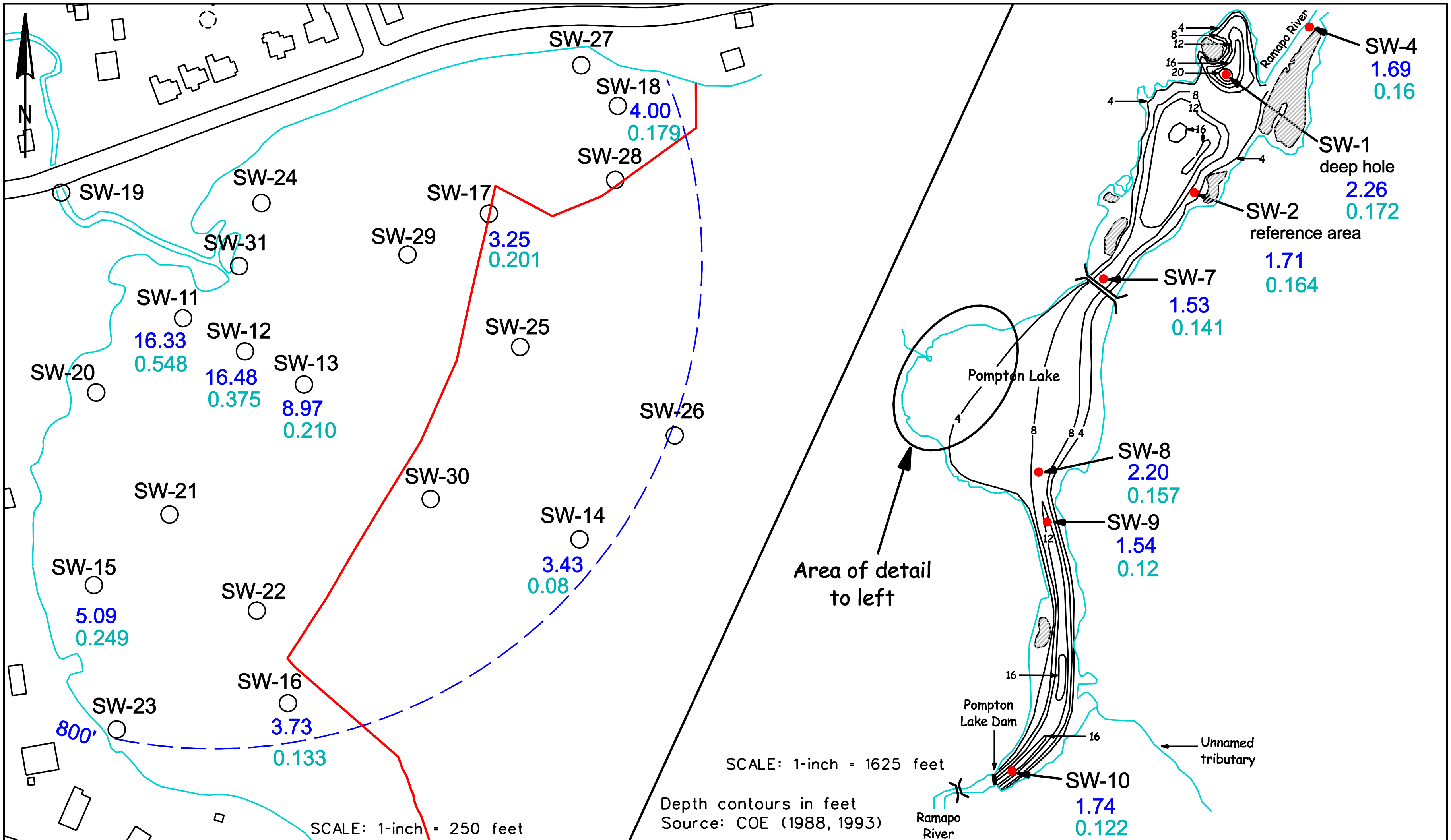


Figure 5. Sediment Mercury (Hg) vs. Particulate-Associated Mercury (Hg)
and Methylmercury (MeHg)
August 2004



LEGEND

Sample ID

Location

Total Dissolved Mercury (ng/L)

Dissolved Methylmercury (ng/L)

ng/L = nanograms per liter

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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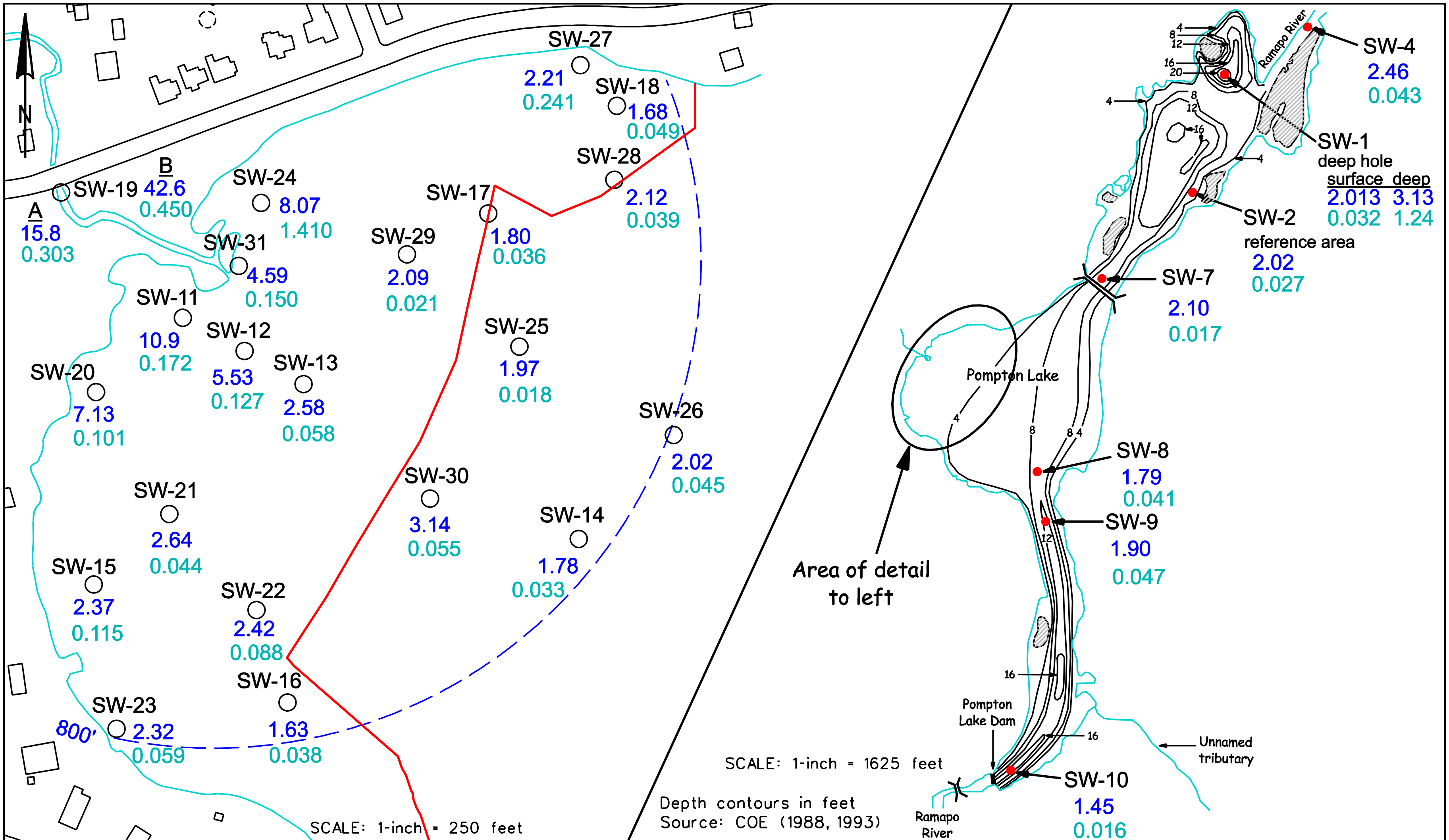
May 2004 Surface Water Results (Dissolved)

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 6



LEGEND

Sample ID
Location
Total Dissolved Mercury (ng/L)
Dissolved Methylmercury (ng/L)
ng/L = nanograms per liter
Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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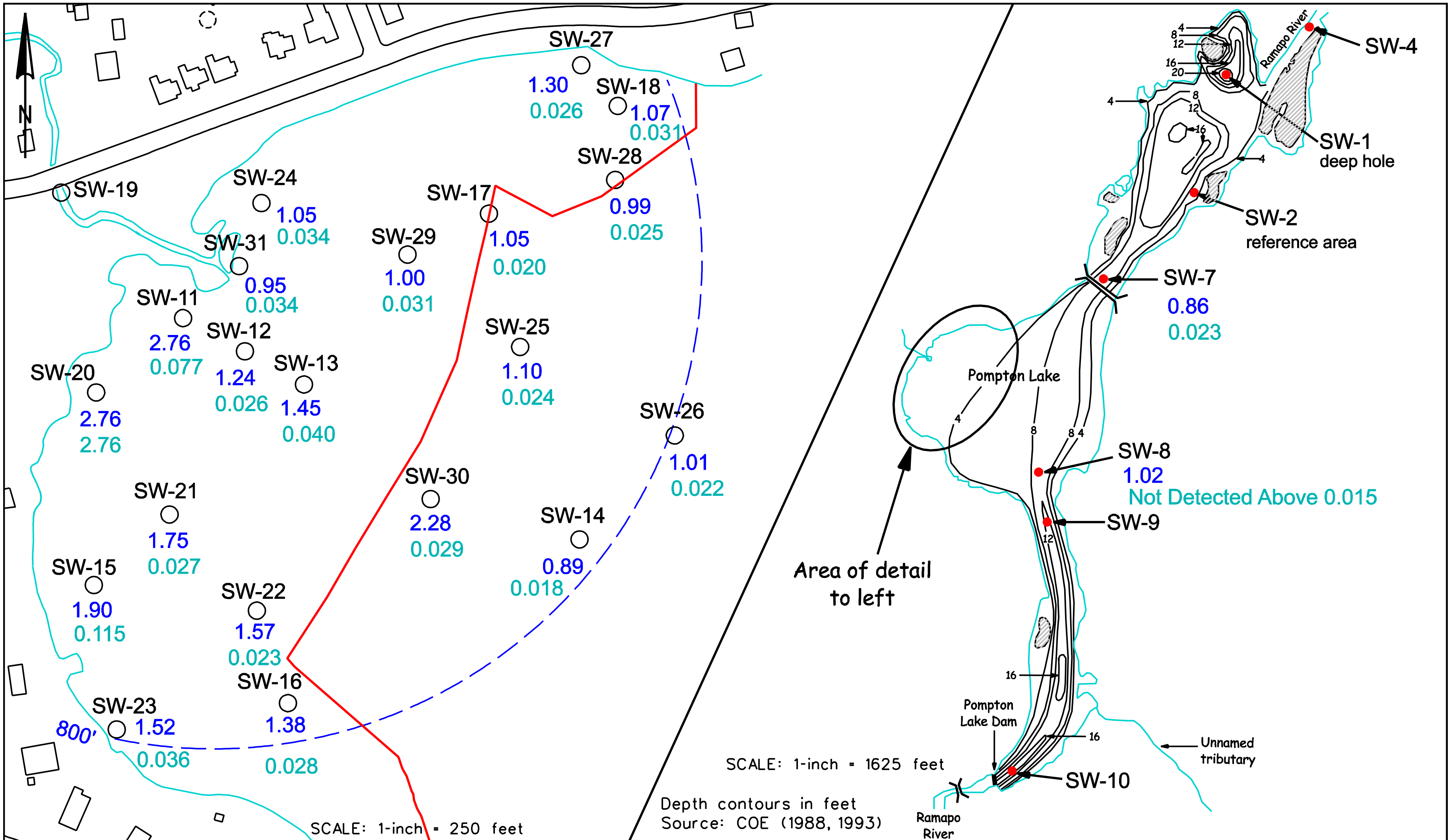
August 2004 Surface Water Results (Dissolved)

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 7



LEGEND

Sample ID

Location

Total Dissolved Mercury (ng/L)

Dissolved Methylmercury (ng/L)

ng/L = nanograms per liter

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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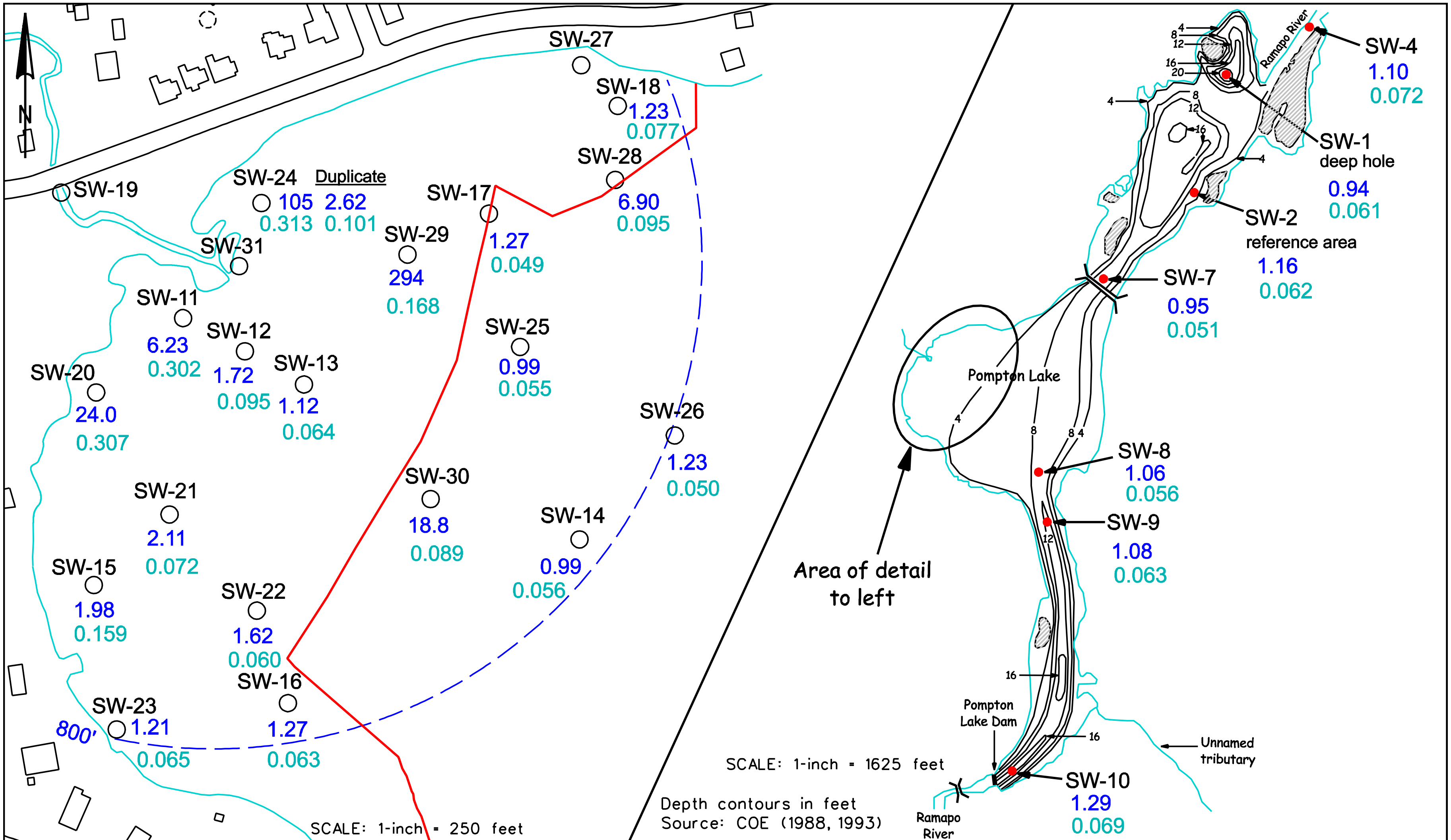
January 2005 Surface Water Results (Dissolved)

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 8



LEGEND

Sample ID

Location

Total Dissolved Mercury (ng/L)

Dissolved Methylmercury (ng/L)

ng/L = nanograms per liter

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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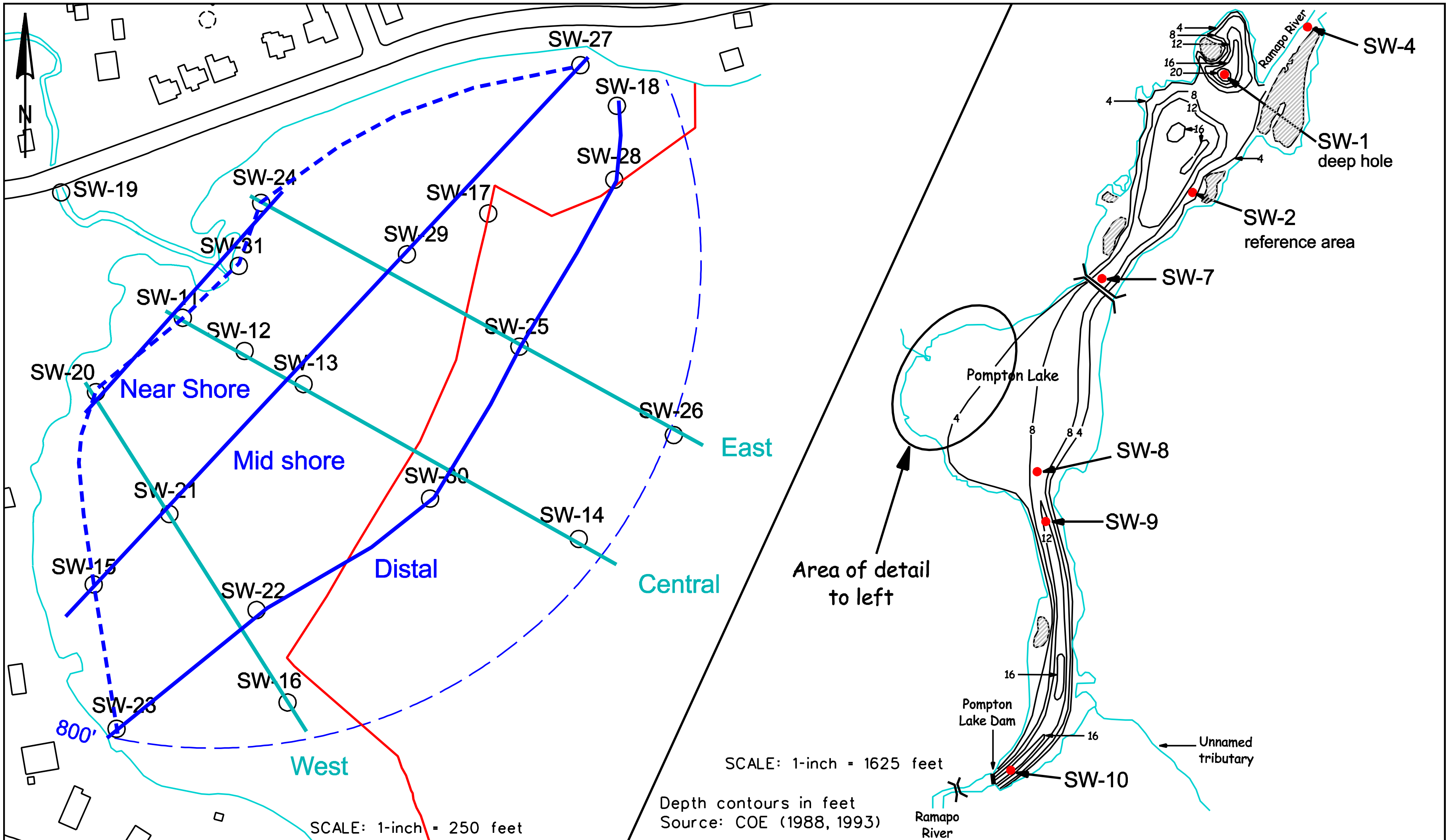
Pompton Lakes, New Jersey

May 2005 Surface Water Results (Dissolved)

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 9



LEGEND

Sample ID

Location

Radial Transects

Transverse Transects

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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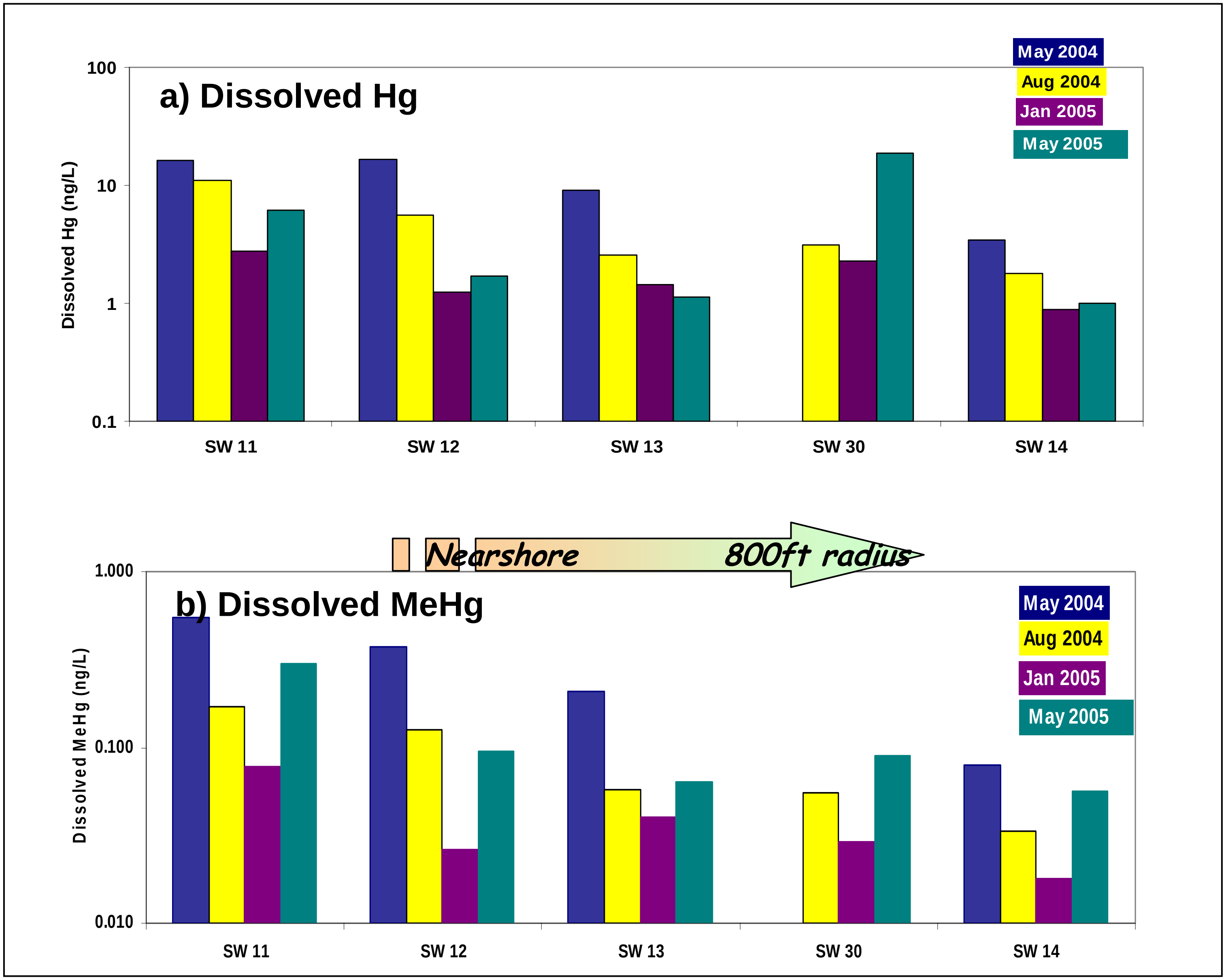
Pompton Lakes, New Jersey

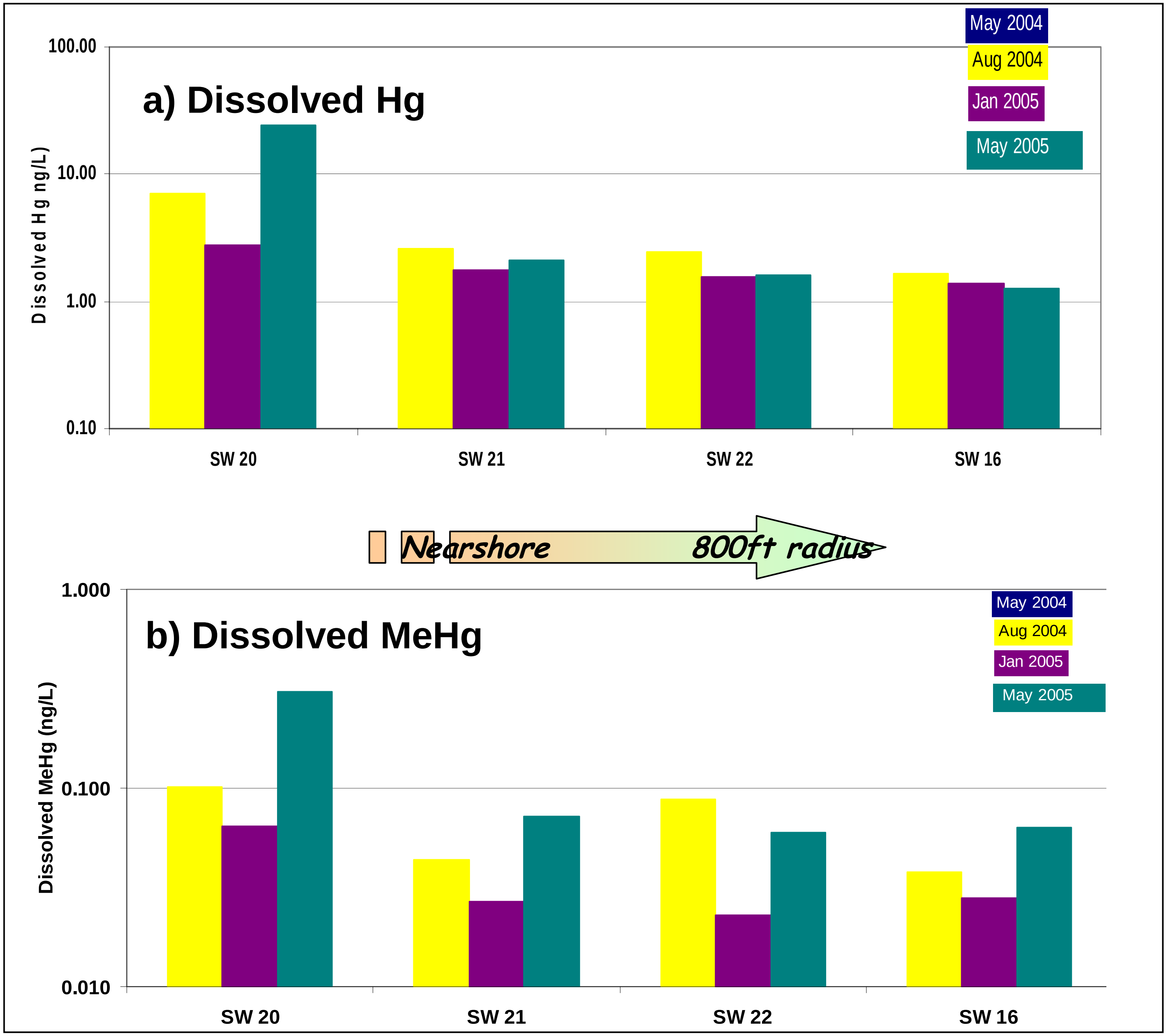
Possible Sampling Location Transects

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

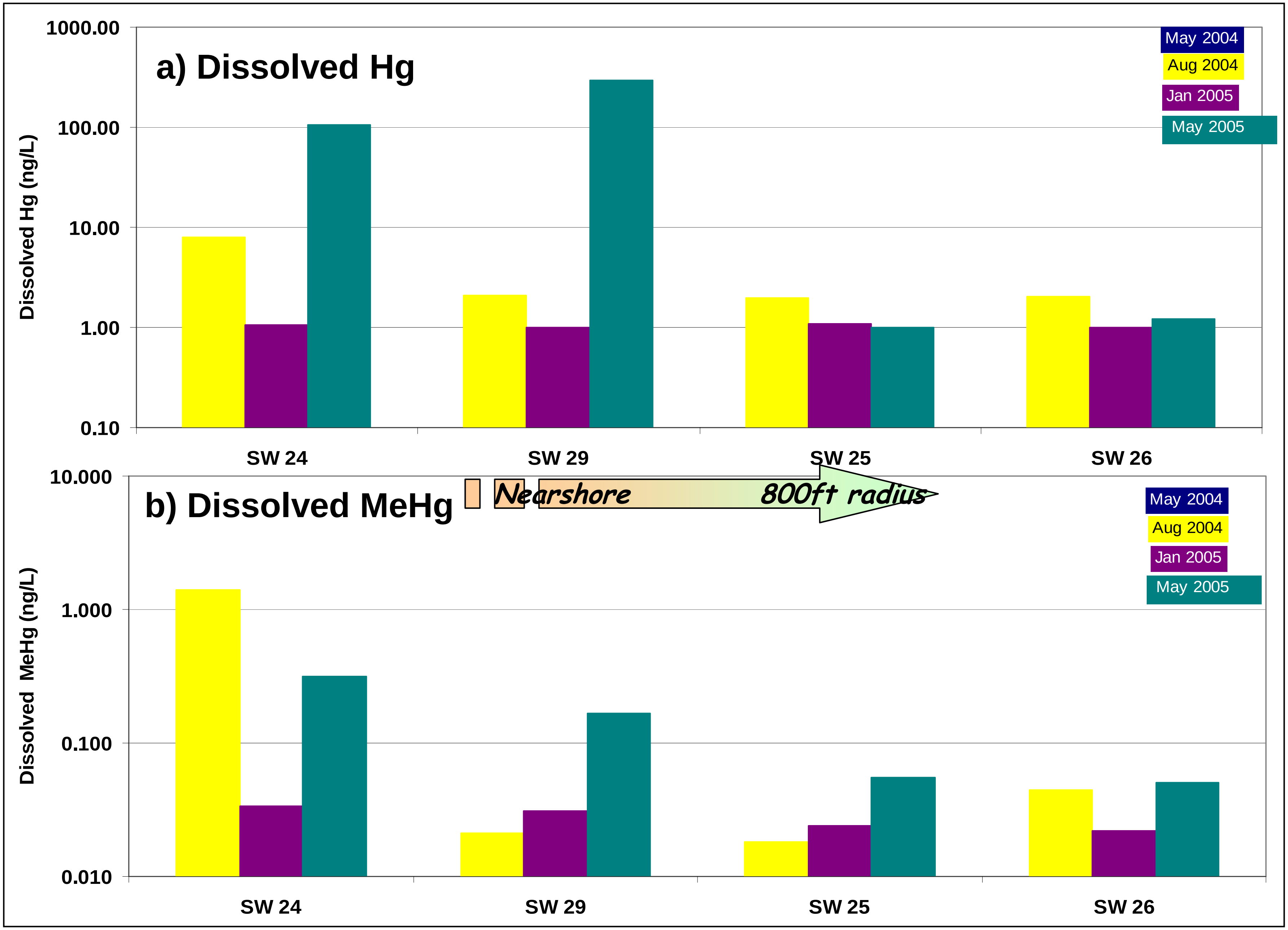
Figure 10



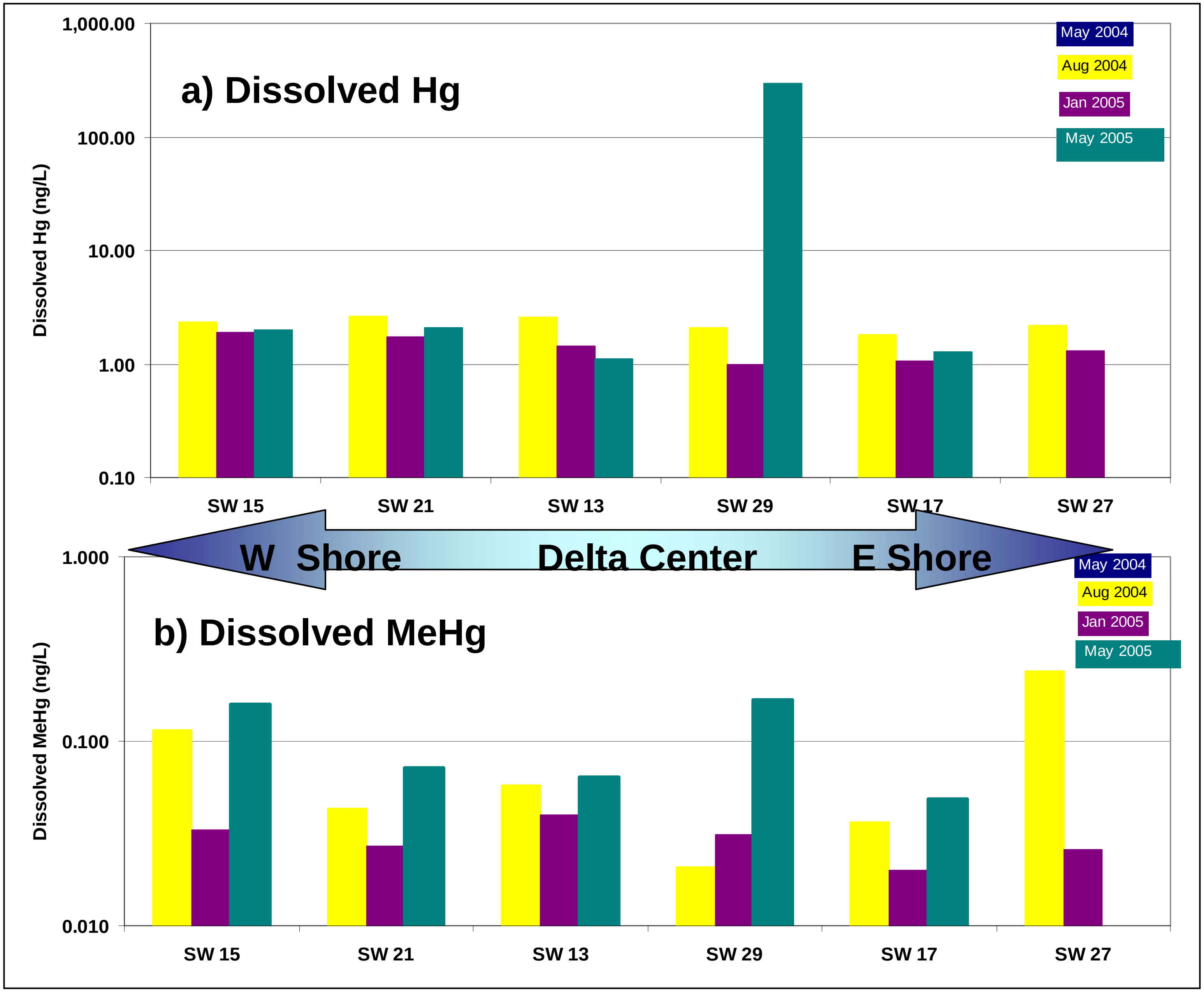
Figures 11a and 11b. Central Radials: Dissolved Total Mercury (Hg) or Methylmercury (MeHg) for all Sampling Events



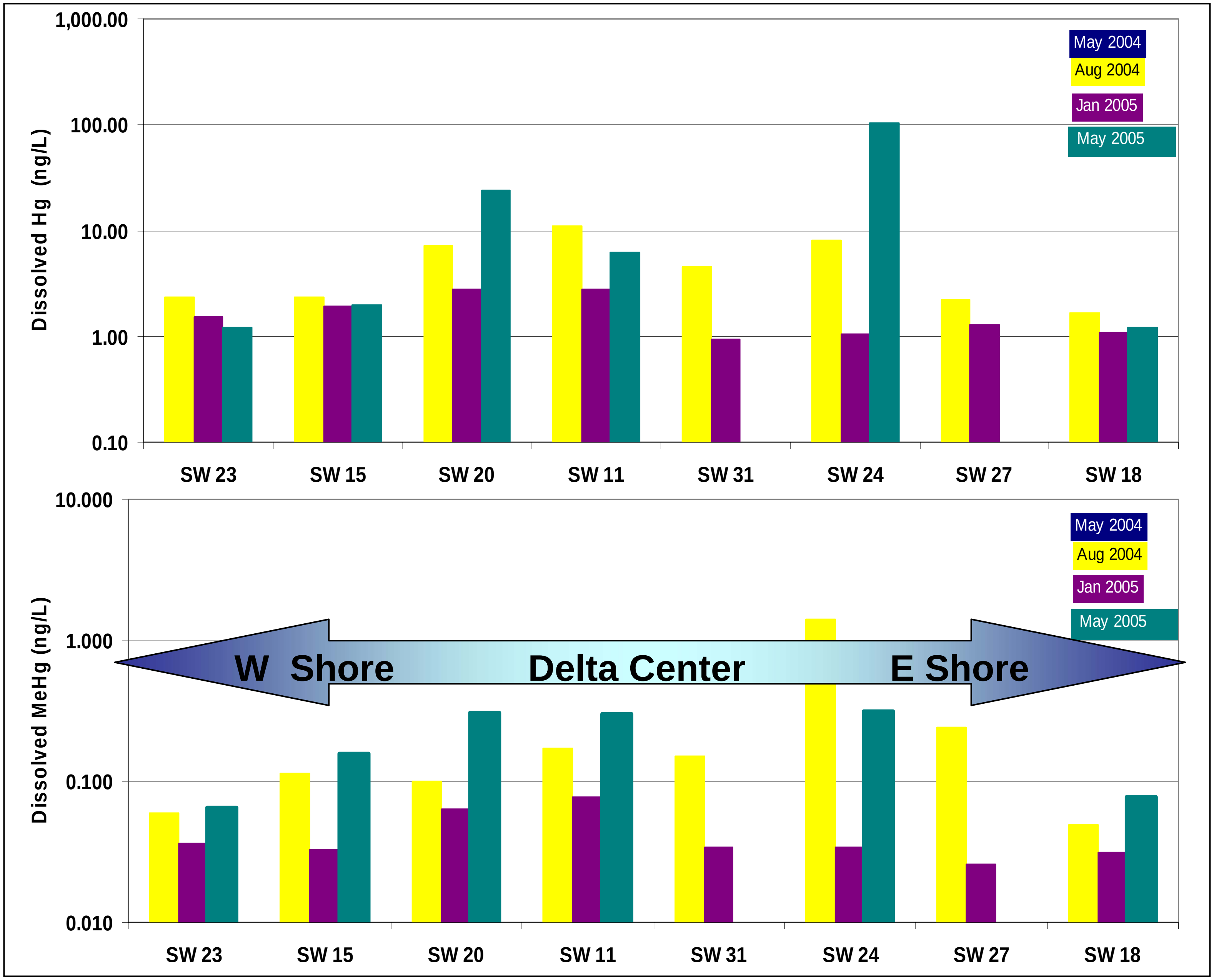
Figures 12a and 12b. West Radials: Dissolved Total Mercury (Hg) and Methylmercury (MeHg) for all Sampling Events



Figures 13a and 13b. East Radials: Dissolved Total Mercury (Hg) and Methylmercury (MeHg) for all Sampling Events



Figures 14a and 14b. Transverse Mid: Dissolved Total Mercury (Hg) and Methylmercury (MeHg) for all Sampling Events



Figures 15a and 15b. Circumference Nearest Shore: Dissolved Total Mercury (Hg) and Methylmercury (MeHg) for all Sampling Events

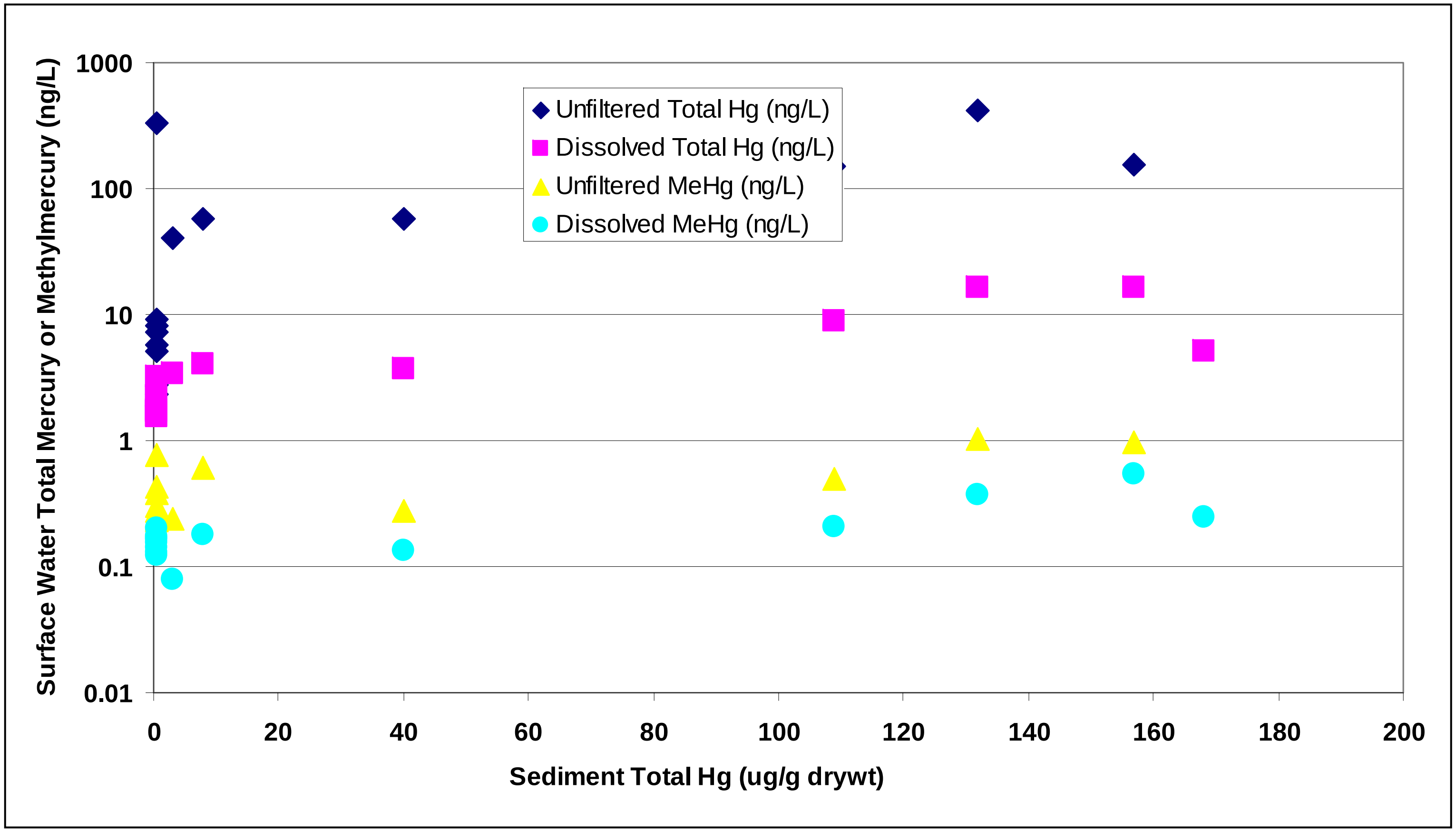


Figure 16. Sediment Total Mercury vs. Surface Water Total Mercury and Methylmercury (May 2004)

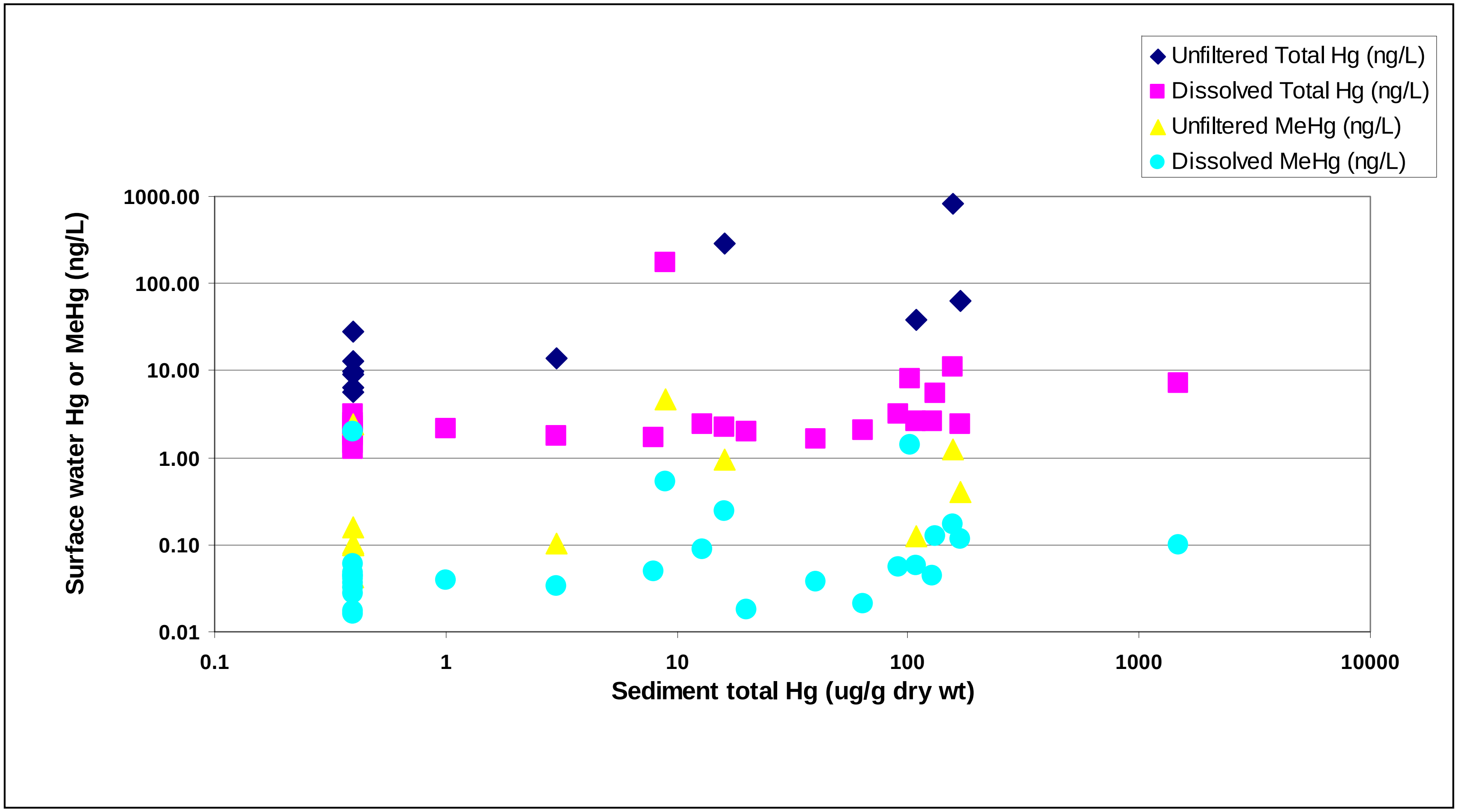


Figure 17. Sediment Total Mercury (Hg) vs. Surface Water Unfiltered and Dissolved Total Mercury and Methylmercury (MeHg) (August 2004)

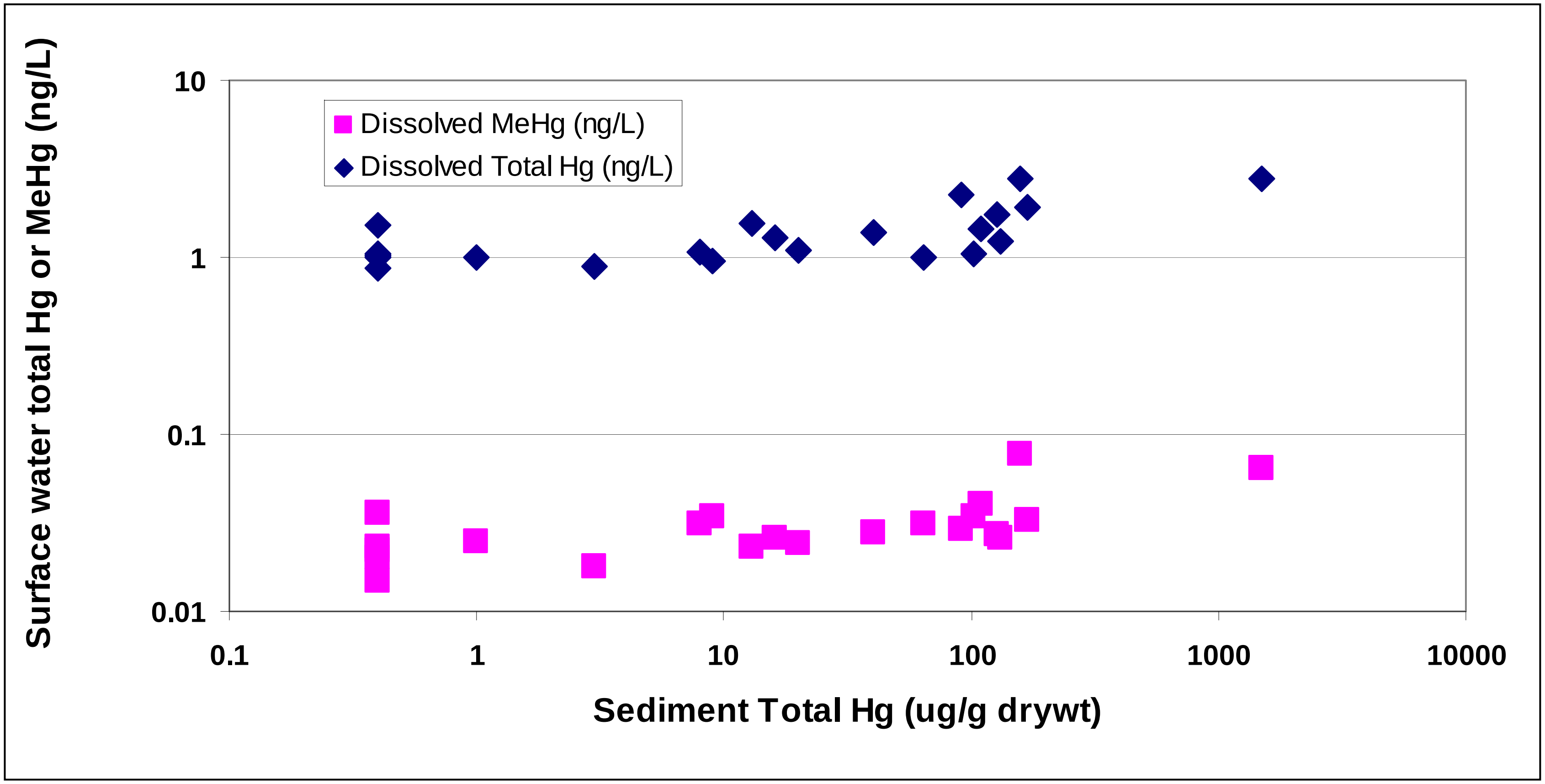


Figure 18. Sediment Total Mercury (Hg) vs.
Surface Water Dissolved Total Mercury (Hg) and Methylmercury (MeHg) (January 2005)

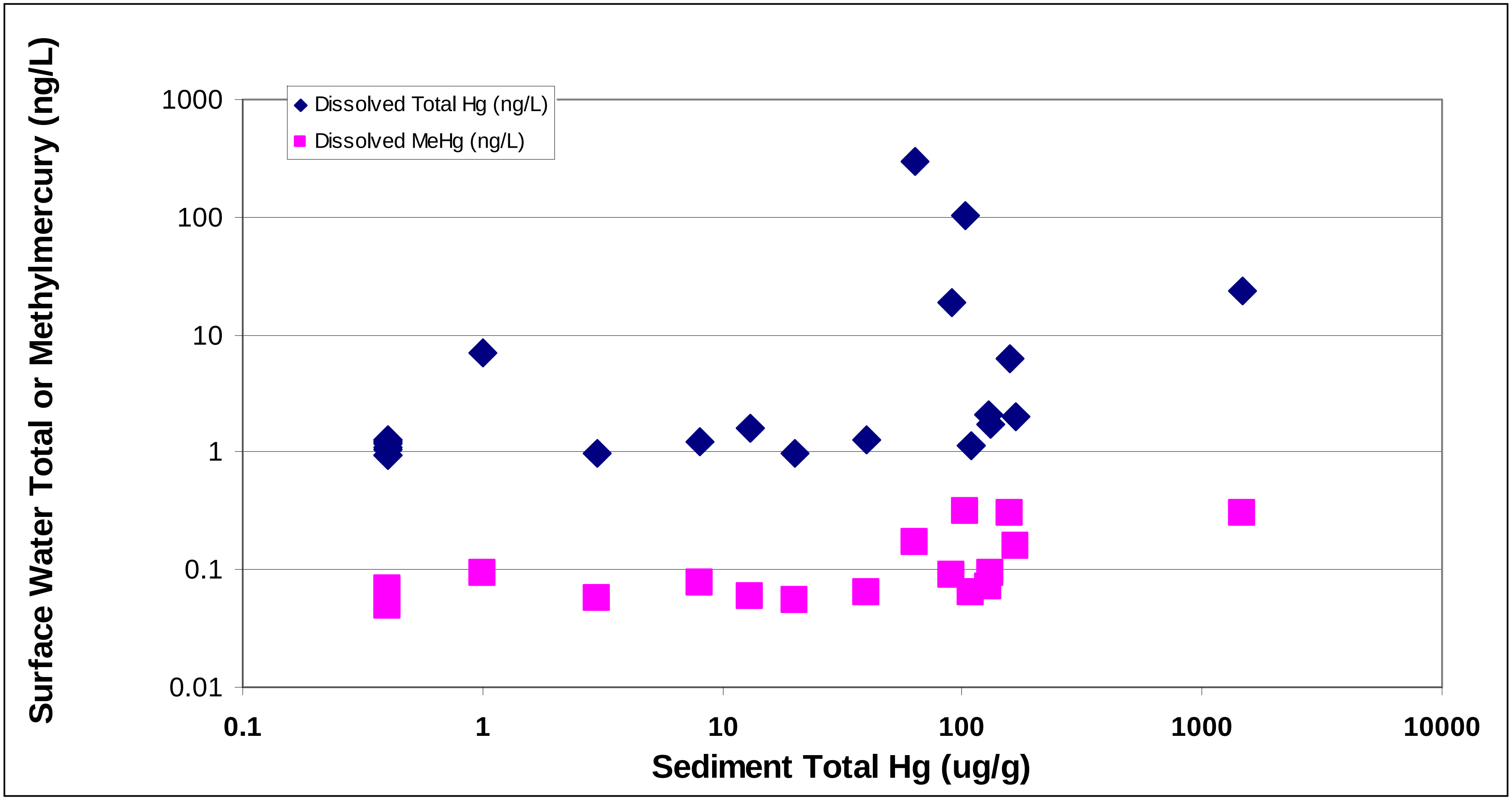
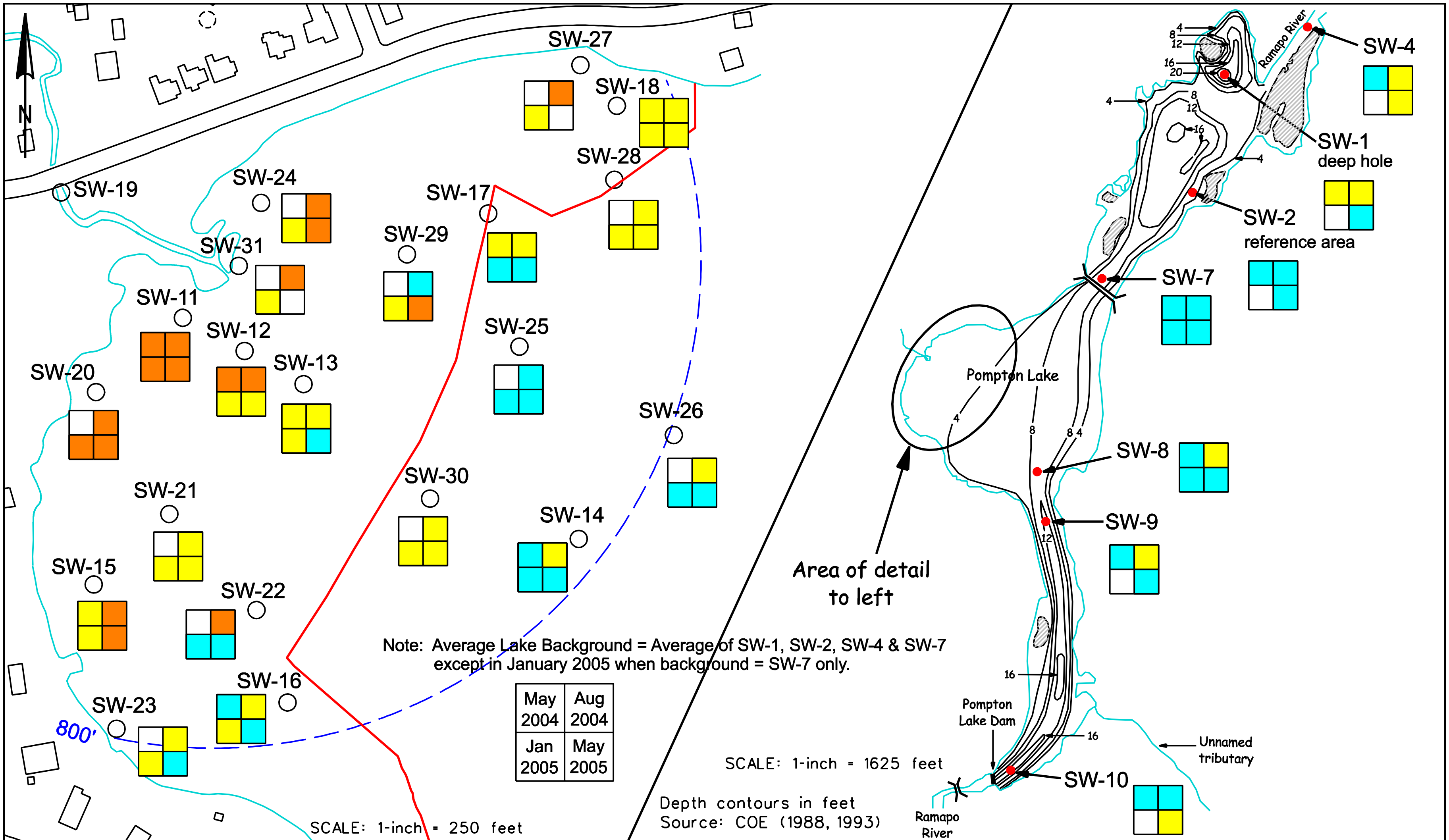


Figure 19. Sediment Total Mercury (Hg) vs.
Surface Water Dissolved Total (Hg) and Methylmercury (MeHg) (May 2005)



LEGEND

Sample ID

Location

≤ 1X Average of Lake Background

> 1X - ≤ Average of Lake Background

> 2X Average of Lake Background

Sample Not Collected

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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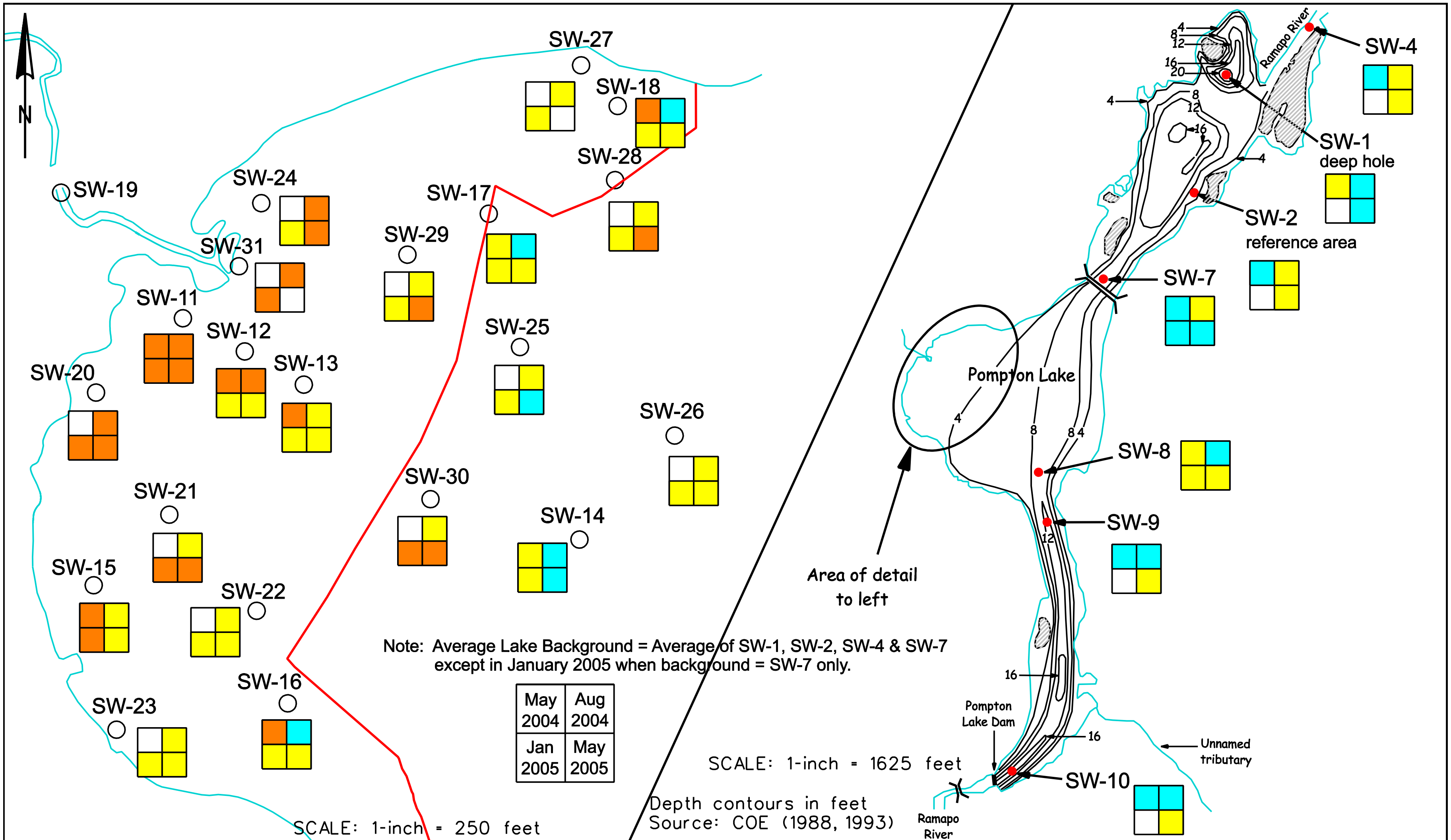
All Surface Water Results
Dissolved Methylmercury

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 20



LEGEND

Sample ID

Location

≤ 1X Average of Lake Background

> 1X - ≤ 2X Average of Lake Background

> 2X Average of Lake Background

Sample Not Collected

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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All Surface Water Results
Total Dissolved Mercury

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 21

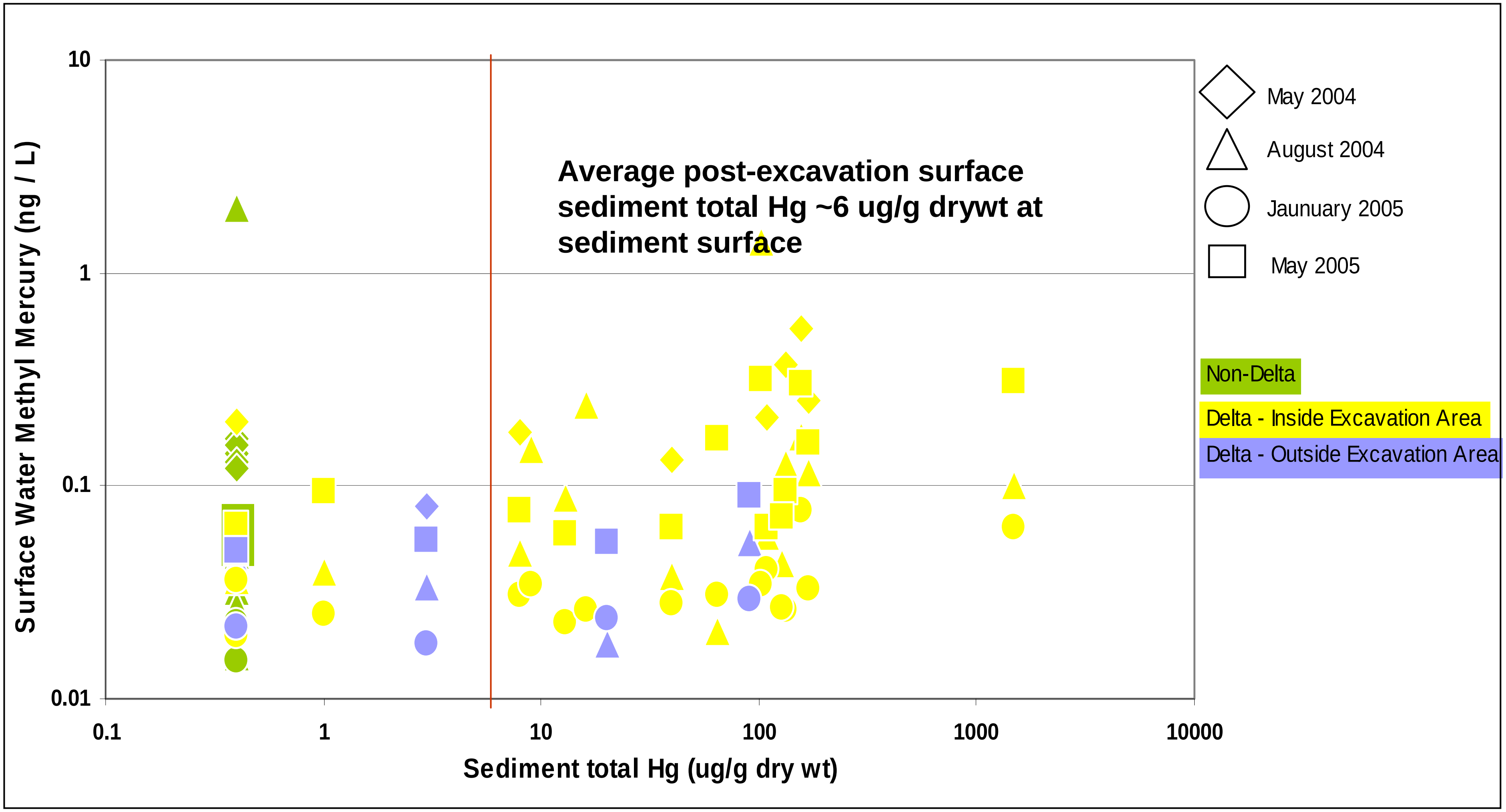

Figure 22. Sediment Total Mercury (Hg) vs. Surface Water Methylmercury (MeHg) for all Sampling Events

APPENDIX B
DELTA SEDIMENT
SAMPLING AND ANALYSIS REPORT

Delta Sediment Sampling and Analysis

This report discusses the methods and results from surface sediment and sediment core sampling that was performed in the Acid Brook Delta (Delta) in August 2004 and January 2005. The characterization of mercury in the uppermost centimeter of sediment is important for several reasons. First, this is the sediment layer that contacts the water column and is a site of mass transport of mercury and methylmercury across the sediment/water interface. Second, the uppermost centimeter of sediment is generally accepted as an important site for mercury methylation. Finally, this portion of the sediment represents an exposure path for a range of biota to mercury and methylmercury. Similarly, the characterization of deep sediment obtained by coring is important in that it offers insight into the sediment history and mercury deposition and into the relative stability of mercury deposits.

Objectives

The objectives of the sediment sampling were as follows:

- Determine the total mercury and methylmercury distribution in the Delta sediments, both horizontally in the uppermost centimeter and with depth.
- Determine the sediment deposition history and the associated total mercury deposition history in the Delta.
- Determine the response of the Delta in the past 50+ years (after mercury use at the plant ceased) and the stability of mercury deposits.
- Determine the potential relationship of total mercury and methylmercury concentrations in sediments to surface water concentrations and to the proximity of the shoreline and Acid Brook discharge point.

Methods

Surface sediment and sediment core samples were collected in August 2004 and January 2005. Sampling locations are shown in Figure 1. The uppermost centimeter of sediment and five sediment cores were obtained and analyzed for total mercury in August 2004. The uppermost centimeter of sediment was sampled and analyzed for total mercury and methylmercury in January 2005. One additional sediment core (labeled “lakeside”) was collected in January 2005. In many cases, sediment collection sites corresponded to the surface water sampling sites described in Appendix A of the report titled *Draft Remedial Action Proposal for Acid Brook Delta Sediments* [DuPont Corporate Remediation Group (CRG), 2006a].

All sediment samples (both the cores and uppermost centimeter samples) were collected with identical coring equipment, as illustrated in Figures 2 through 5. For the uppermost centimeter samples, the remainder of the core was discarded. The general equipment and method adhered to U.S. Environmental Protection Agency standards (USEPA, 2001). The equipment pictured in the figures and used was manufactured by Aquatic Research, Inc. Samples were analyzed for total mercury, methylmercury, and loss on ignition (LOI). LOI analyses were performed by Lancaster Laboratories and total mercury and methylmercury analyses were performed by Studio Geochemica.

Figures 2 through 5 show photos of the collection apparatus and the fine-scale sectioning of the sediment cores. Figure 2 shows the three main elements of the sediment core retrieval equipment. On the right is the clear plastic tube that is pushed into the sediment until refusal is reached. On the left is the long, rod-like handle and check valve assemblies. The clear plastic core barrel is securely attached to the check valve assembly by a hose clamp. The check valve opens freely as the barrel is inserted into the sediment, but it closes tightly, keeping a vacuum as the core is extracted and brought onto the boat. A small plug of underlying peat is also retrieved with the core bottom, which aids in core retention.

Figure 3 shows the core extrusion mechanism (the long screw) and the spacer that is used to accurately control slice thicknesses. Figure 4 shows a 3-cm sediment slice extruded into the trough zone, from which it will be scraped into a sample jar with a spatula. The process of extruding and scraping into jars is repeated until the entire core is extruded and placed in jars. The slice thickness is varied along the length of the core by changing the thickness of the spacer. Figure 5 shows a 1-cm slice of top sediment ready to be scraped into the sample jar.

The filled sample jars are immediately chilled on ice and placed in a cooler until shipment to the laboratory. Aliquots for methylmercury are placed in smaller glass vials, immediately frozen on dry ice, and shipped on dry ice to the laboratory.

Two of the six sediment cores retrieved were dated by Flett Research of Winnipeg, Ontario, Canada, using Pb-210 and Ra-226 dating techniques and the Constant Rate of Supply (CRS) model (http://www.flettresearch.ca/Webdoc4.htm). The CRS model, in this instance, constrained the bottom of the core to a date of 1906, the year the dam was completed.

Results

Results for the uppermost centimeter of sediment, total mercury as a function of depth, and radioisotope dating are provided in the subsections below.

Uppermost Centimeter of Sediment

Total sediment mercury concentrations for the surficial 6 inches (15 cm) of Delta sediments were obtained in a comprehensive sediment sampling event in December 2003. Results are provided in Figure 2 of the *Acid Brook Delta Remedial Investigation Report* (DuPont CRG, 2006b). Sediment mercury concentrations from the 6 inch deep sampling event were generally lower, but similar in trend results, from the uppermost centimeter sediment sampling. Sediment concentrations for the non-Delta portions of the lake were presumed to be similar to those measured in the reference site sediments reported in the Phase II ecological study (Exponent and The Academy of Natural Sciences, 1999), ranging between 0.25 and 0.43 micrograms per gram (µg/g) dry wt over the top 8 cm of sediment.

Samples of the uppermost centimeter of Delta sediments were collected using the same equipment and methods reported above for the deep cores. Samples were analyzed for total mercury in August 2004 and total mercury and methylmercury in January 2005. Results for these events are as follows:

- August 2004
  Figure 6 shows the total mercury concentrations in the top layer of sediments obtained in August 2004. These data are also shown in tabulated form in Table 1. The dotted line in Figure 6 is the 800-foot radius from the mouth of Acid Brook. While total mercury

concentrations in the most recent (upper 1 cm) deposits are generally much lower than those observed in underlying deposits, concentrations remain elevated above background levels (i.e., non-Delta locations). The highest concentrations occur near the mouth of Acid Brook and near the shorelines, particularly the western shoreline. The total mercury concentrations drop off near the 800-foot radius in the center of the Delta.

- January 2005
  Figure 7 shows the total mercury and methylmercury concentrations in the top 1 cm of sediments obtained in January 2005 as well as the LOI percentages for these samples. Corresponding filtered surface water samples were collected at the same locations on the same day and following day. With the exception of location SW-31 (near the mouth of Acid Brook), the surficial sediment methylmercury concentrations are highest near the mouth of Acid Brook and near the shoreline. LOI results from samples collected at SW-31 differed from other area sediment samples in that percentage was very low, indicating a high fraction of sand. SW-31 samples visibly contained more sand than other sites. Figures 8 and 9 are plots comparing total mercury and methylmercury concentrations in top sediments to the corresponding dissolved concentrations of total and methylmercury in the water column during the same time period. These plots show a poor correlation between total sediment mercury and surface water total mercury. In comparison, the relationship between sediment methylmercury and surface water methylmercury is somewhat more positive but the correlation is still not strong.

  In both Figures 8 and 9, the nearest shore locations (SW-11, SW-12, and SW-24) are annotated. However, when compared in terms of proximity to shoreline in Figure 10 (distance to shoreline was estimated from a map), there appears to be a strong negative correlation between distance from the shoreline and sediment total mercury, sediment methylmercury, and LOI. Those sites with the greatest distance from the shore had lower sediment mercury, methylmercury, and total organic carbon (as measured by LOI). Sampling location SW-31 is annotated on this figure to draw attention to the unusually low LOI observed at this site.

Total Mercury as a Function of Depth

Figure 10 shows the locations of the six sediment cores retrieved from the Delta in August 2004 and January 2005. Additionally, one core was collected from the same reference area that was characterized in the Phase II ecological investigation (Exponent and The Academy of Natural Sciences, 1999) located several thousand feet upstream in the lake (SW-2). All cores included the entire sediment column and a small plug of the peat layer beneath the sediment. Figure 11 shows the depth profiles of total mercury for each of the six cores. The results are shown in tabulated form in Table 2. The cores have distinct mercury profiles with maximum mercury concentrations found at comparable depths in each core, indicating a stable sediment environment with little or no large-scale mixing. In each core, the sediments below the maximum mercury concentrations (typically the deepest 10 cm) show mercury concentrations less than 0.5 µg/g dry wt. The most surficial sediments show mercury concentrations much lower than the maximum mercury concentrations. However, surficial sediment mercury concentrations remain elevated compared to both deep core results and results from surficial samples collected outside of the Delta.

Assuming that the bottom of the cores represent circa 1900 and the surficial sediment layers represent current deposition, sediment core results suggest that mercury releases began shortly after the dam was built and diminished abruptly near the middle of the last century. This is consistent with the known history of mercury use at the plant upstream of Acid Brook. Radiological dating was applied to the cores to further correct mercury deposition dates and allow accurate measurement of modern sediment deposition rates.

Radioisotope Dating

Radioisotope dating was performed on cores E and C-34 (see Figure 11). The preferred modeling approach for dating, reported by Flett (http://www.flettresearch.ca/Webdoc4.htm) and shown in Figures 12 through 15, constrained the lowest sediment layer to the year 1906, which is the approximate year the lake was flooded. Figures 12 and 14 show the age of the cored sediments as a function of depth. These results indicate that sediments above the highest mercury concentrations have been deposited in the last 50 to 55 years.

Figures 13 and 15 show the calculated sediment deposition rates as a function of depth. A comparison of these figures show that sediment deposition rates in the Delta have been variable over time and space (within the Delta) but show an increasing trend with time. The C-34 core (collected at the center of the Delta near the 800-foot radius) shows a generally increasing rate of sediment deposition that approaches 0.21 g/cm^2/year over the last eight years (see Figure 14). In contrast, Core E (collected near the western shore of the Delta) shows a recent decrease in sedimentation rate over the last 16 years, with rates currently approaching 0.14 g/cm^2/year (see Figure 15). The overall gradual increase in deposition rate may be, in part, due to changes in land use in the watershed. Because the sediment is highly organic in nature (typically greater than 10% LOI), gradual increases in nutrient runoff might also have contributed to this trend.

Discussion

The 2004 and 2005 surface sediment survey results offer new insights into mercury behavior in the Delta. Specifically, there is a weak relationship between total mercury and methylmercury in the top sediments when compared to the stronger relationship between methylmercury in top sediments and shoreline/Acid Brook distance (see Figure 10). However, the distinction between the effects of the nearshore environment and proximity to the mouth of Acid Brook cannot be made from these samples.

Similarly, there seems to be a weak relationship between top sediment mercury and methylmercury concentrations and the associated, near-synoptic dissolved concentrations in the overlying water column observed in January 2005. However, the January 2005 surface water results had atypically low methylmercury values when compared to measurements made in May 2004, August 2004, and May 2005. It is possible that during this time methylmercury production was at a seasonal low, and relationships between surface water methylmercury and sediment methylmercury would be difficult to discern. The effect of shore proximity on methylmercury in sediments may be the result of additional inputs of organic matter (as reflected in the LOI measurements) and possibly warmer temperatures that could stimulate mercury methylation.

The analysis and dating of sediment cores produced results similar to expectations. The band of the most elevated mercury was deposited during a discrete time period over 50 years before present, as expected. This band of mercury has remained stable in the areas cored, as evidenced by the distinct maximum for mercury observed at these depths. Sediment deposition rates have not been steady over time in the Delta. In fact, there appears to be variation in sediment deposition within the Delta. The sedimentation rate appears to be generally increasing and, in the case of Core 34, this trend holds to the present time. In contrast, Core E suggests that sedimentation may be decreasing over the last 16 years in the more distal area of the Delta from which this core was collected. Surficial sediments in the Delta remain above background levels for mercury. This continued elevation of sediment concentrations may represent ongoing inputs of mercury or possibly long-term mixing of the original mercury inputs in the more shallow parts of the Delta. However, the “lakeside” core collected near the shoreline also shows a distinct maximum concentration for mercury deep in the sediments, suggesting little large-scale disturbance. It should be remembered that an area around the mouth of Acid Brook (the upland Delta area) is slated for remediation. This unremediated portion of the brook may at this time be a contributor of mercury to the Delta water column and sediments.

The proposed excavation limits are shown in Figure 1. Sediments between this line and the shoreline will be excavated. The proposed excavation will target sediments with the highest methylmercury concentrations. Core analyses suggest that deeper mercury-containing sediments outside of the proposed excavation area are stable and not likely to be part of the sediment transport dynamics of this system.

References

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Exponent and The Academy of Natural Sciences. 1999. *Acid Brook Delta Ecological Investigation Phase II Report*. August.

USEPA. 2001. *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*. EPA823-B-01-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

TABLES

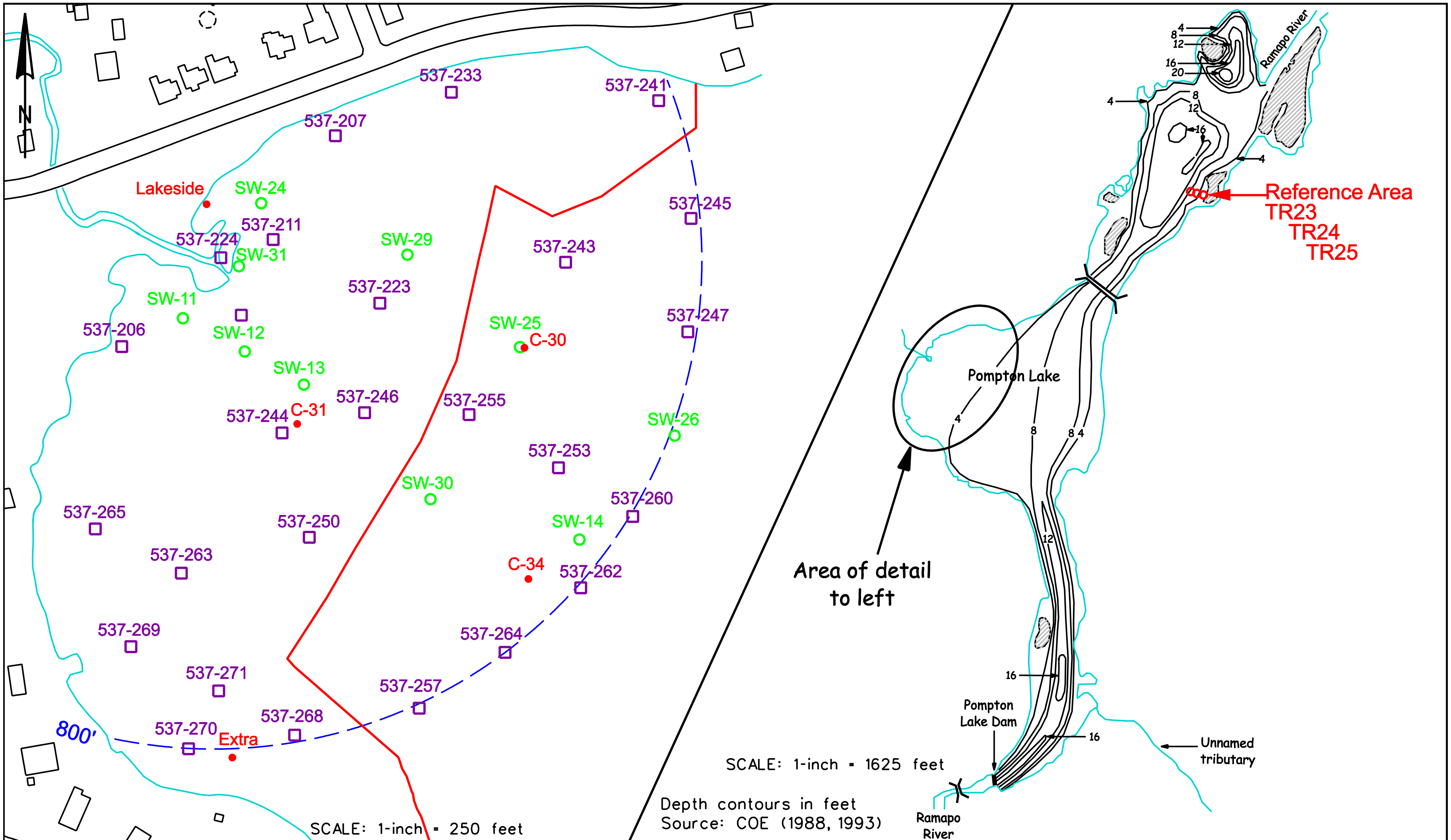
Table 1
Top 1 cm Sediment Concentrations

Location/Sample I.D.	Result (ug/g, dry)
POM-E-537-206-1	100.
POM-E-537-207-1	56.8
POM-E-537-211-1	49.8
POM-E-537-211-1	36.1
POM-E-537-223-1	41.3
POM-E-537-224-1	43.9
POM-E-537-233-1	36.8
POM-E-537-233-1	36.8
POM-E-537-241-1	10.9
POM-E-537-243-1	10.6
POM-E-537-244-1	41.0
POM-E-537-245-1	4.86
POM-E-537-246-1	34.1
POM-E-537-247-1	3.28
POM-E-537-250-1	26.8
POM-E-537-253-1	11.4
POM-E-537-255-1	21.4
POM-E-537-257-1	11.8
POM-E-537-260-1	7.11
POM-E-537-262-1	4.76
POM-E-537-263-1	39.9
POM-E-537-264-1	8.58
POM-E-537-265-1	84.1
POM-E-537-268-1	18.6
POM-E-537-269-1	47.0
POM-E-537-270-1	23.5
POM-E-537-271-1	27.8
Reference Locations	
POM-E-537-TR23-1	0.233 J
POM-E-537-TR24-1	0.279 J
POM-E-537-TR25-1	0.408 J

Table 2
Mercury Depth Profiles (ug/g dry wt) vs. Depth (cm) for Deep Sediment Cores (August 2004)

C-30	Hg, ppm-dry	C-31	Hg, ppm-dry	C-34	Hg, ppm-dry	"E"	Hg, ppm-dry	Ref	Hg, ppm-dry	Lakeside	Hg, ppm-dry
0-1cm	21.2	0-1cm	43.5			0-2cm	28.8	0-3cm	.275J	0-2 cm	89.5
1-2	22.5	1-2	51.4	2-5cm	8.5	2-4	23.7	3-5	0.4	2-4	108
2-3	23.9	2-3	67.7	5-8	8.8	4-6	26.2	5-7	0.5	4-6	115
3-6	23.2	3-6	56.5	8-11	8.7	6-8	29.7	7-9	0.5	6-8	138
6-9	23.9	6-9	59.8	11-14	12.1	8-10	29.8	9-11	0.5	8-10	129
9-12	24.6	9-12	66.3	14-17	13.4	10-12	35.7	11-13	0.6	10-12	108
12-15	30.4	12-15	69.3	17-20	13.6	12-14	36.7	13-15	0.7	12-14	108
15-18	64.9	15-18	106	20-23	13.5	14-16	32.4J	15-17	0.8	14-16	132
18-21	107	18-21	273	23-26	13.7	16-18	59.4	17-19	1.2	16-18	130
21-24	113	21-24	537	26-29	19	18-20	101	19-21	1.2	18-20	163
24-27	96.7	24-27	959	29-32	26.5	20-22	162	21-23	1.8	20-22	219
27-30	36.2	27-30	1060	32-35	43.6	22-24	226	23-25	2.8	22-24	259
30-33	1.4	30-33	168	35-38	95.2	24-26	468	25-27	4.2	24-26	406
33-36	0.4	33-36	16.2	38-41	105	26-28	436	27-29	0.9	26-28	427
36-39	.060J	36-39	3.8	41-44	38.1	28-30	411	29-31	1.1	28-30	441
39-42	.053J	39-42	0.792	44-47	1.8	30-32	119	31-33	1.3	30-32	282
42-45	.050J	42-45	.278J	47-50	.180J	32-34	4.5	33-35	1.8	32-34	51.6
45-48	.046J	45-48	.126J	50-53	.048J	34-36	0.9	35-37	1.6	34-36	13.7
48-49	.066J	48-51	.045J	53-56	.120J	36-38	1	37-39	0.2	36-38	3.75
-		51-52	.053J	56-57	.134J	38-40		39-41	.017J		

FIGURES



LEGEND

- Thin Sliced Cores August 2004
- Top 1-cm Sample August 2004
- Top 1-cm Sample January 2005
- Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

CORPORATE REMEDIATION GROUP

An Alliance Between
DuPont and URS Diamond

2000 Cannonball Road
Pompton Lakes, New Jersey

Acid Brook Sediment Sampling Sites
August 2004 and January 2005

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 1

Figure 2. Sediment Core Retrieval Equipment

Figure 3. Sediment Core Extrusion Mechanism and Spacer

Figure 4. Three Centimeter Sediment Core Slice Extruded into Trough Zone

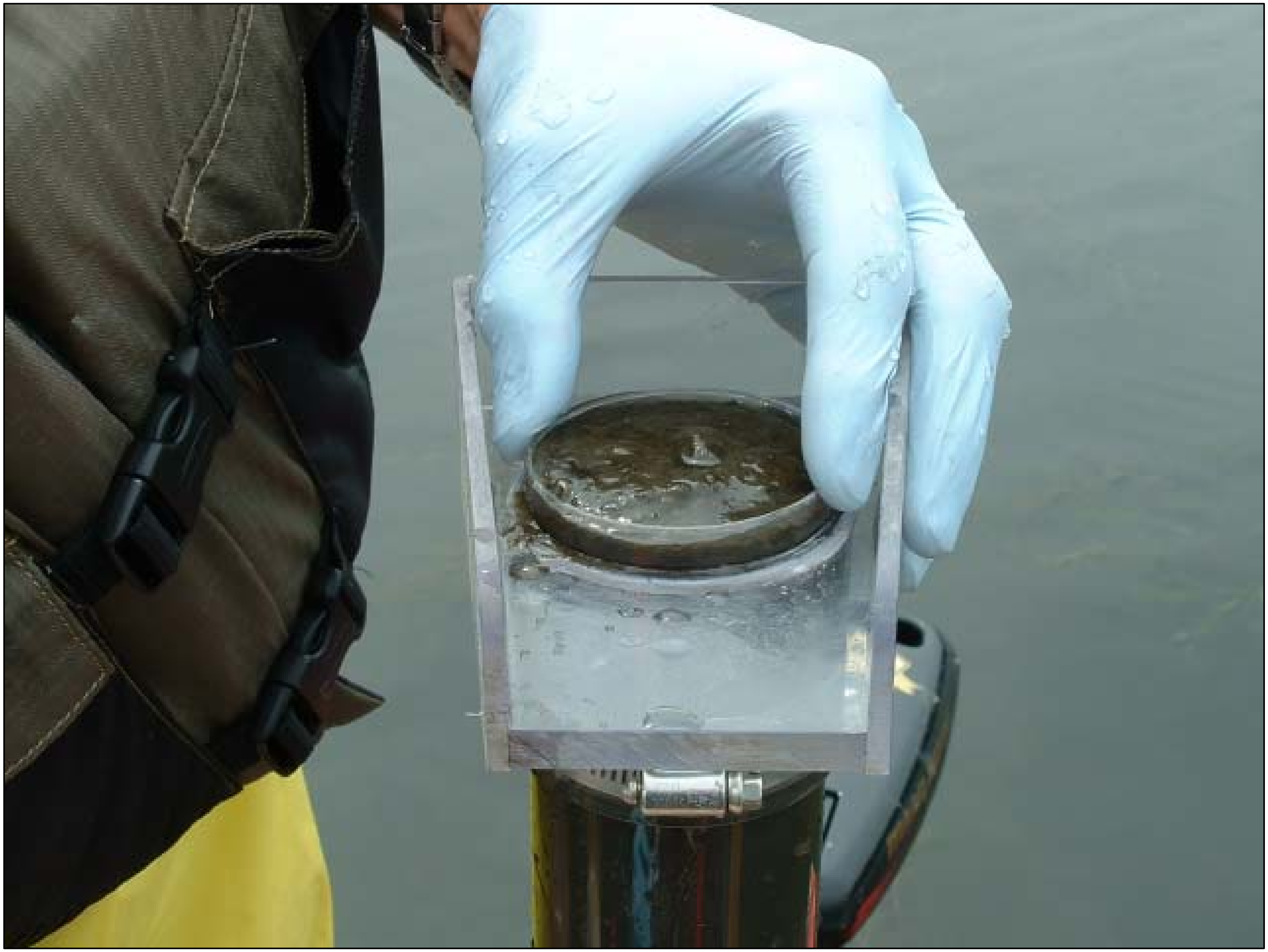


Figure 5. One Centimeter Sediment Core Slice Extruded into Trough Zone

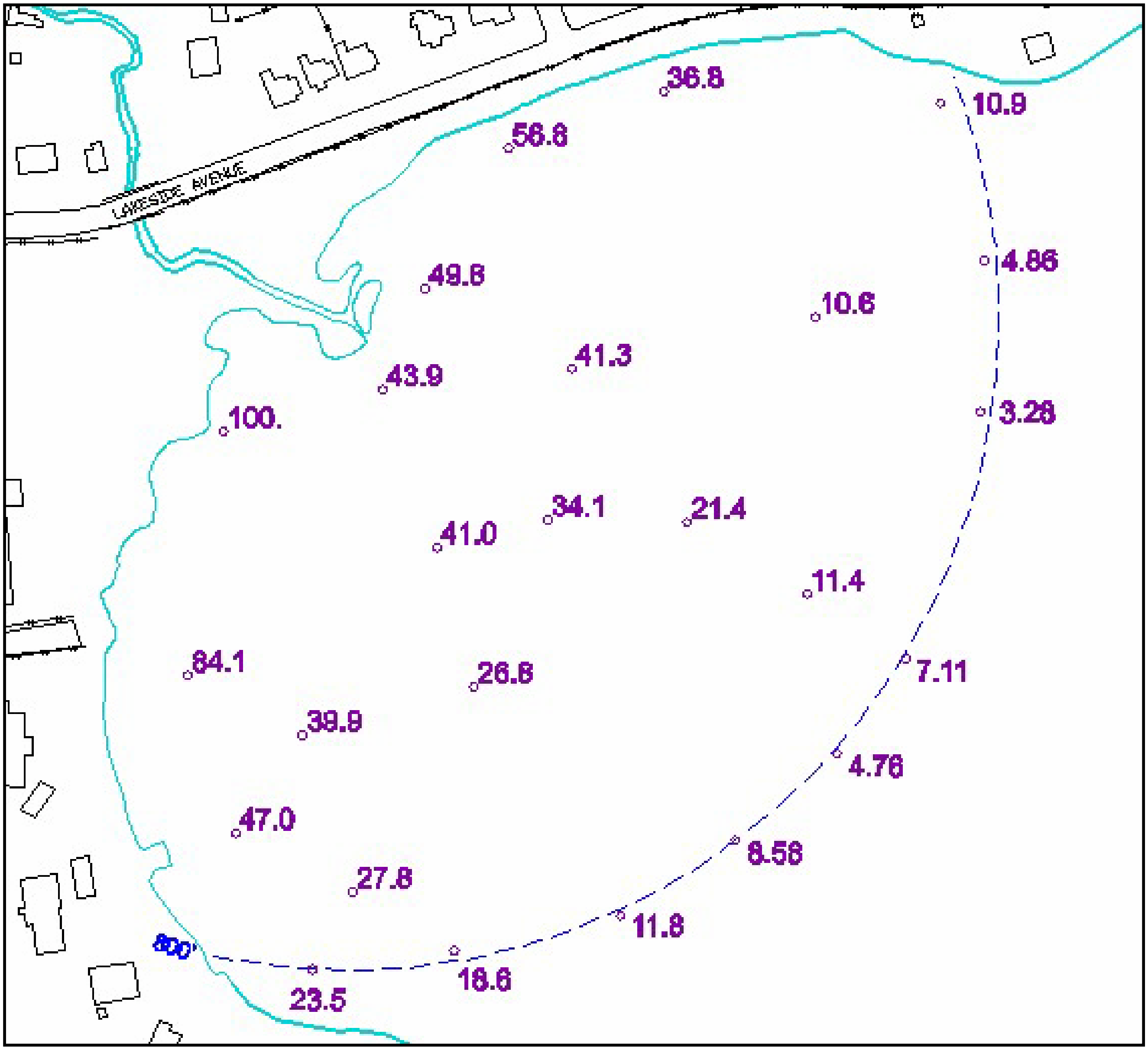
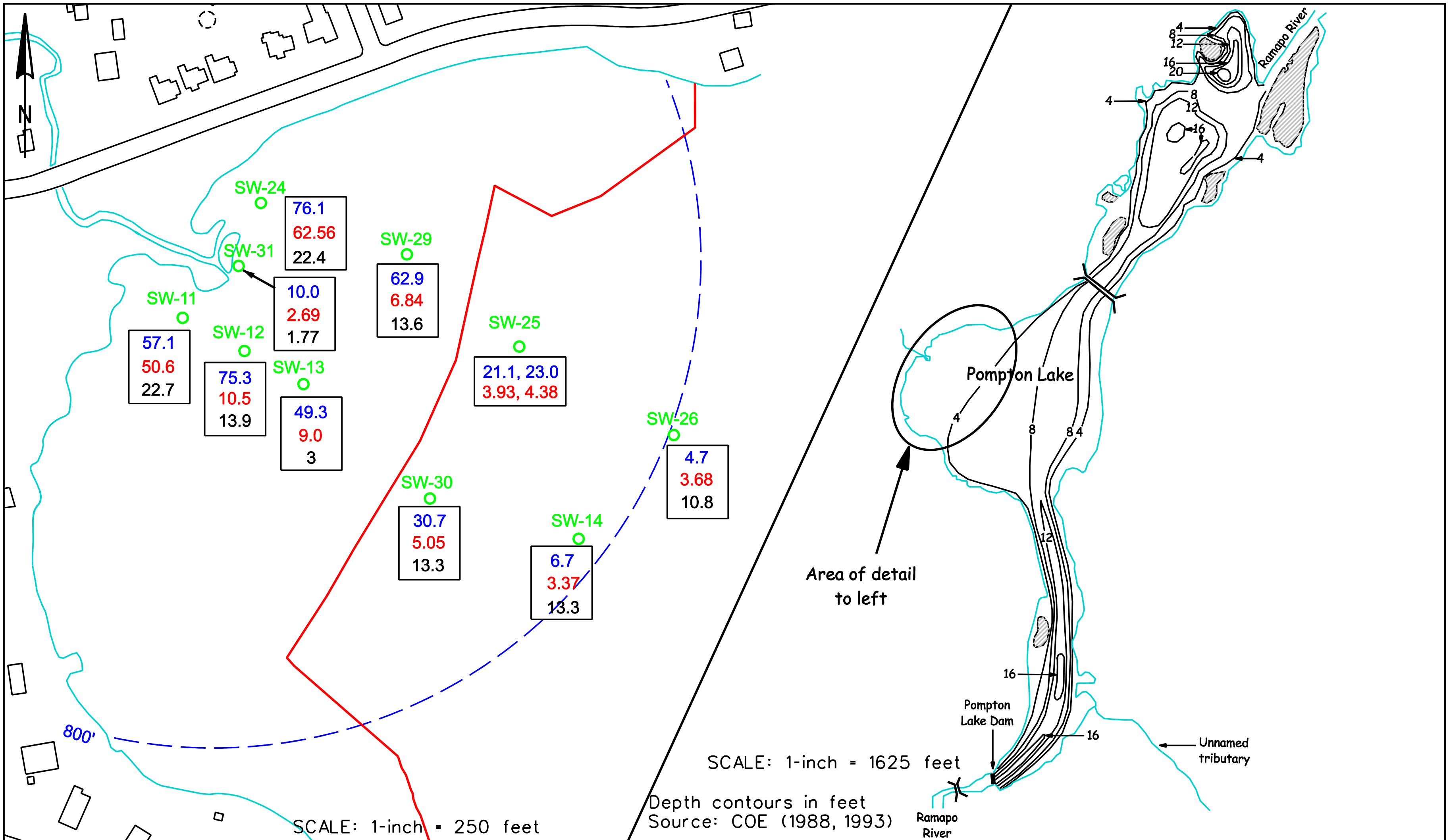


Figure 6. Total Mercury Concentrations (ppm) in Top 1 cm Sediment (August 2004)



LEGEND

Top 1-cm Sample January 2005

Total Mercury (ug/g dry weight)

Methylmercury (ng/g dry weight)

Loss on Ignition (LOI) (%)

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

DUPONT

CORPORATE REMEDIATION GROUP

An Alliance Between
DuPont and URS Diamond

2000 Cannonball Road
Pompton Lakes, New Jersey

Total Mercury, Methylmercury and LOI
In Top Centimeter of Sediments, January 2005

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 7

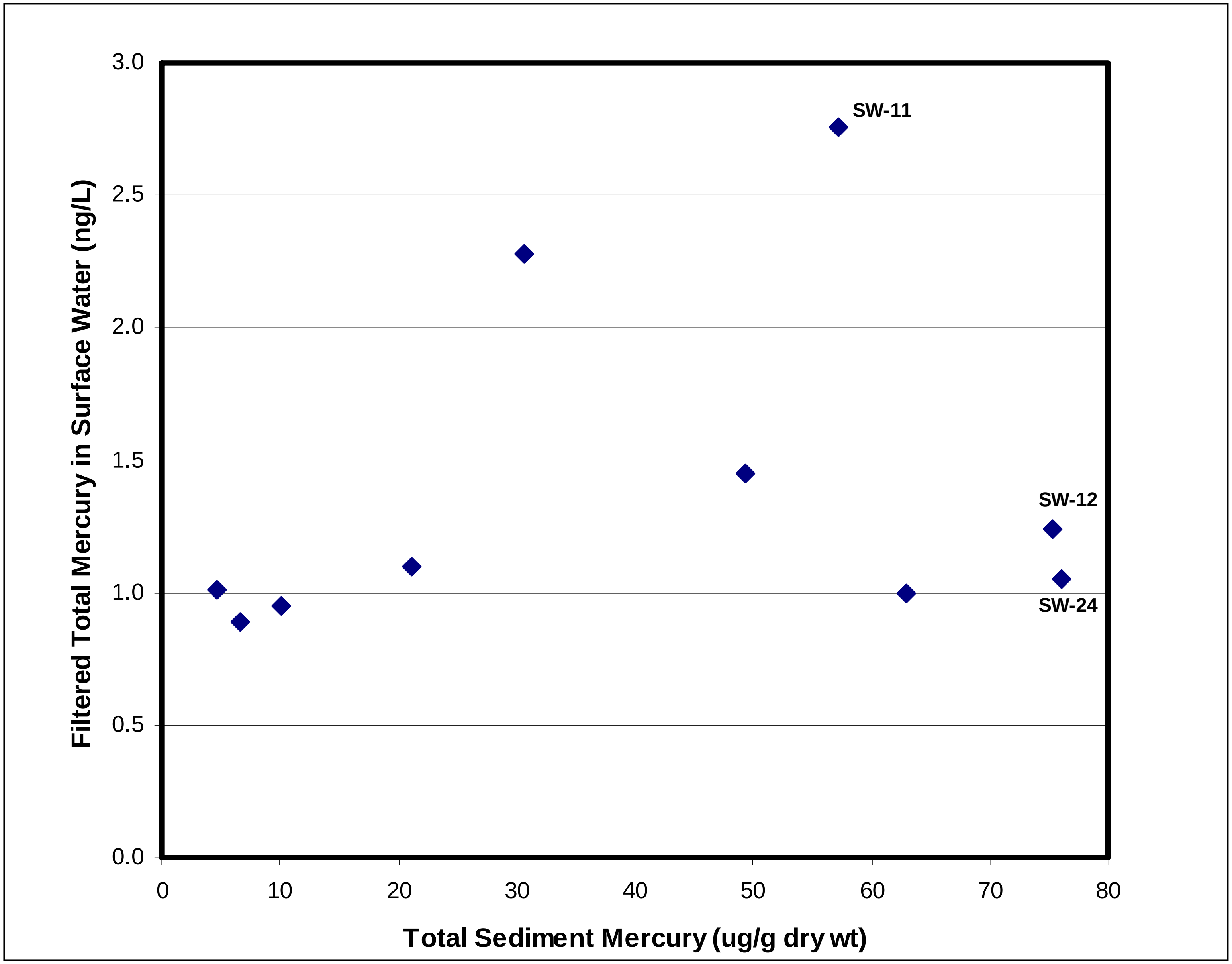


Figure 8. Total Sediment Mercury (ug/g dry wt) vs. Filtered Total Mercury in Surface Water (ng/L) (January 2005)

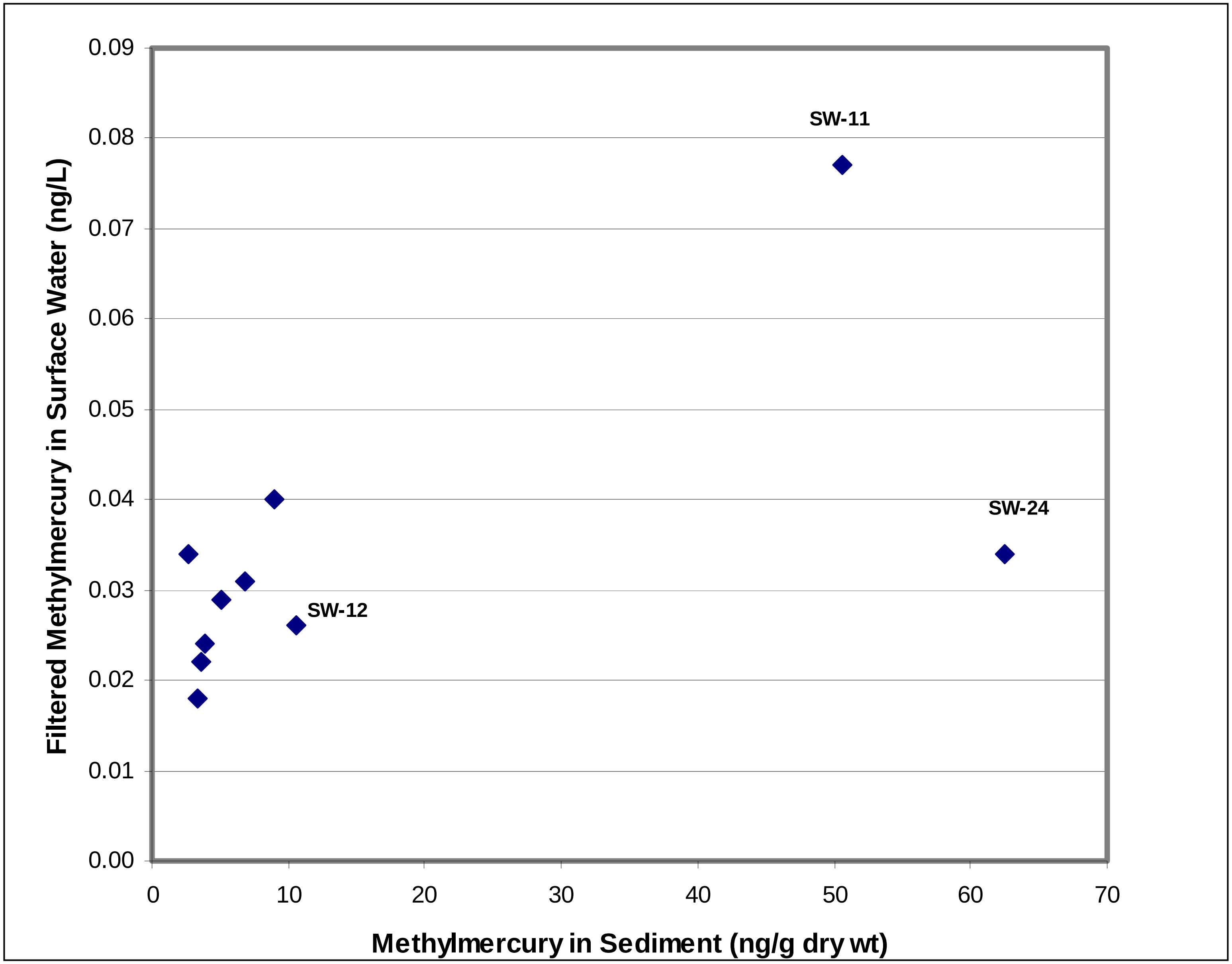


Figure 9. Sediment Methylmercury (ng/g dry wt) vs. Filtered Methylmercury in Surface Water (ng/L) (January 2005)

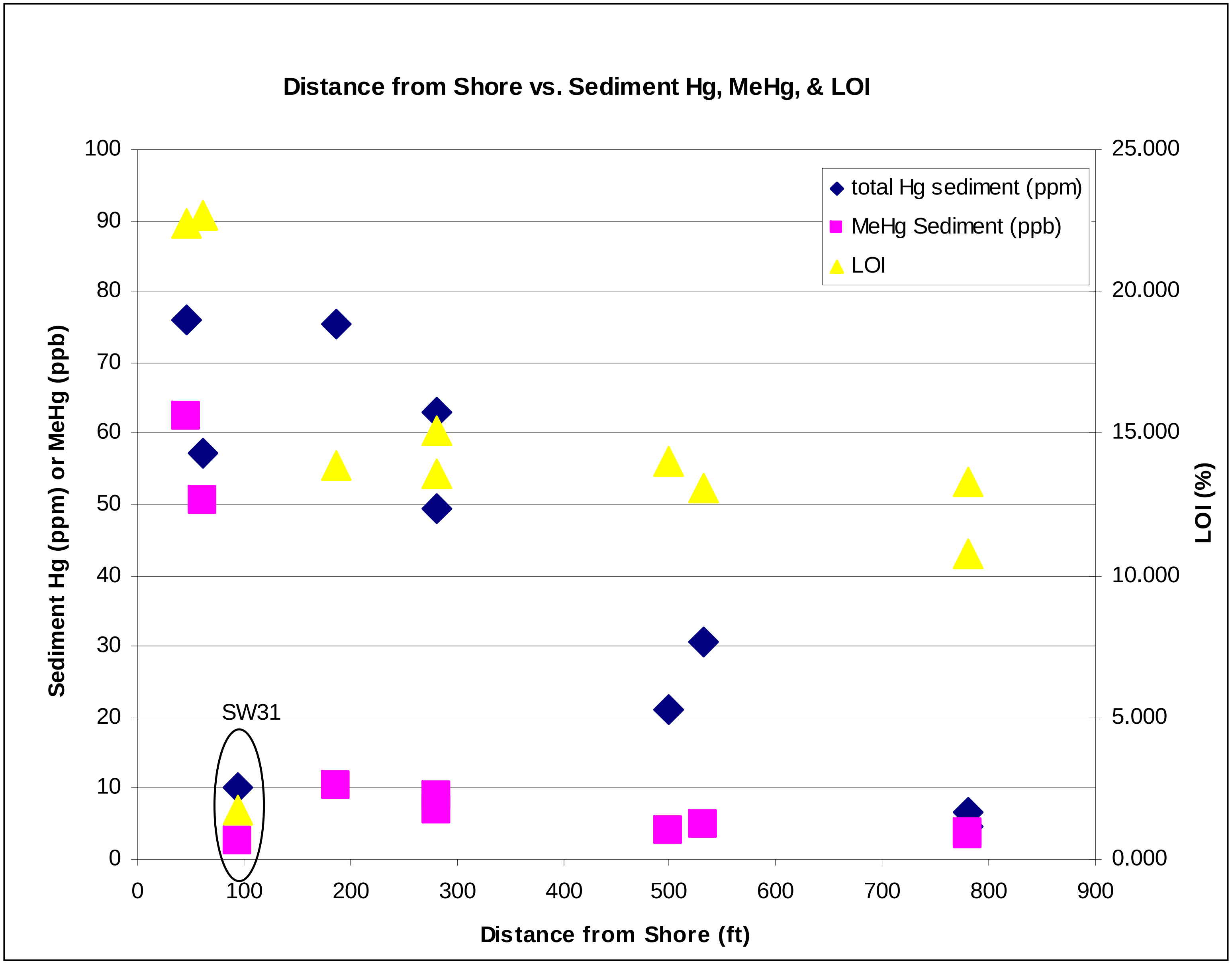


Figure 10. Distance from Shore vs. Sediment Mercury (ug/g dry wt), Methylmercury (ng/g dry wt), and LOI (%) (January 2005) (Distance from shore was estimated using a map.)

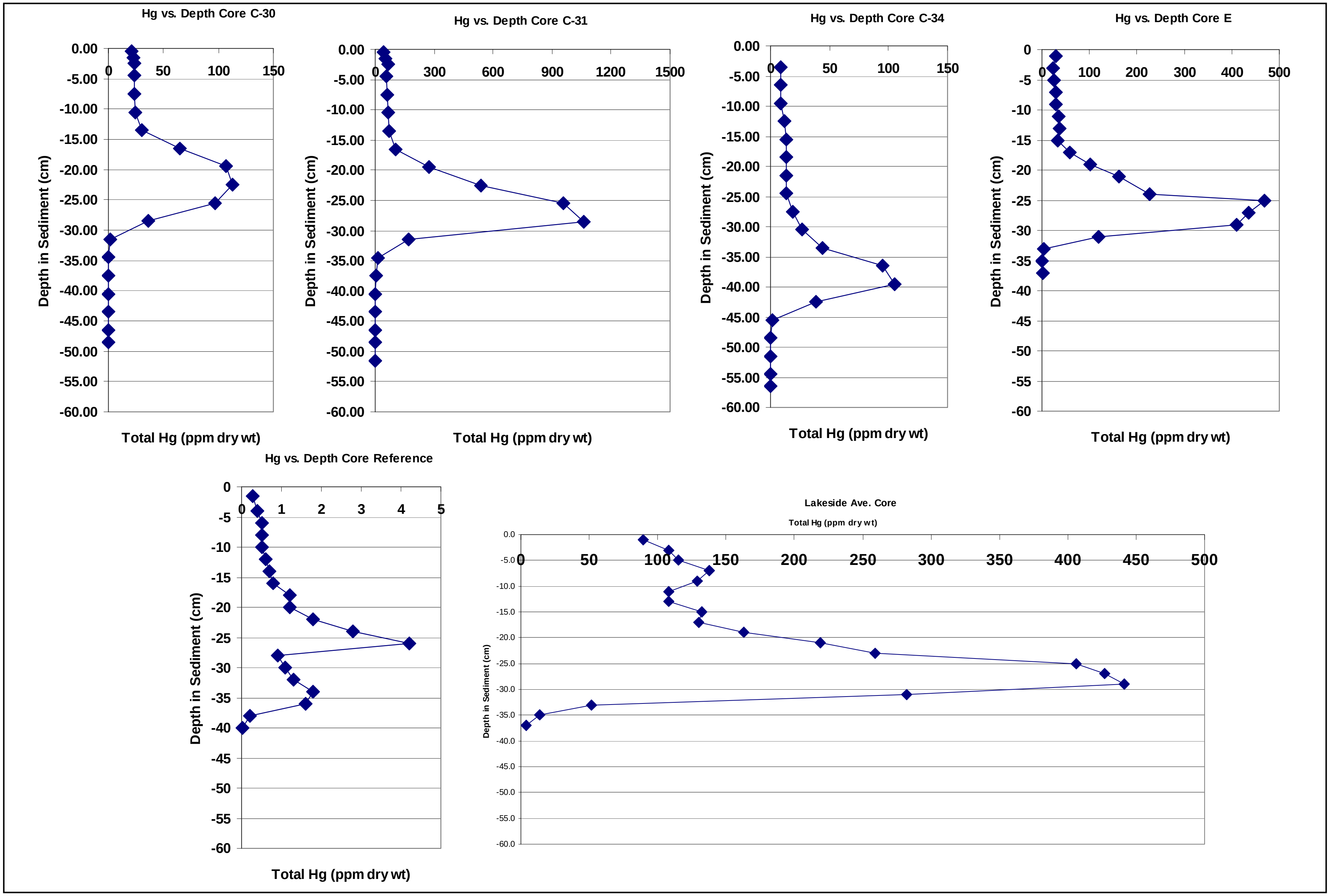


Figure 11. Total Mercury (ppm dry wt) vs. Sediment Depth

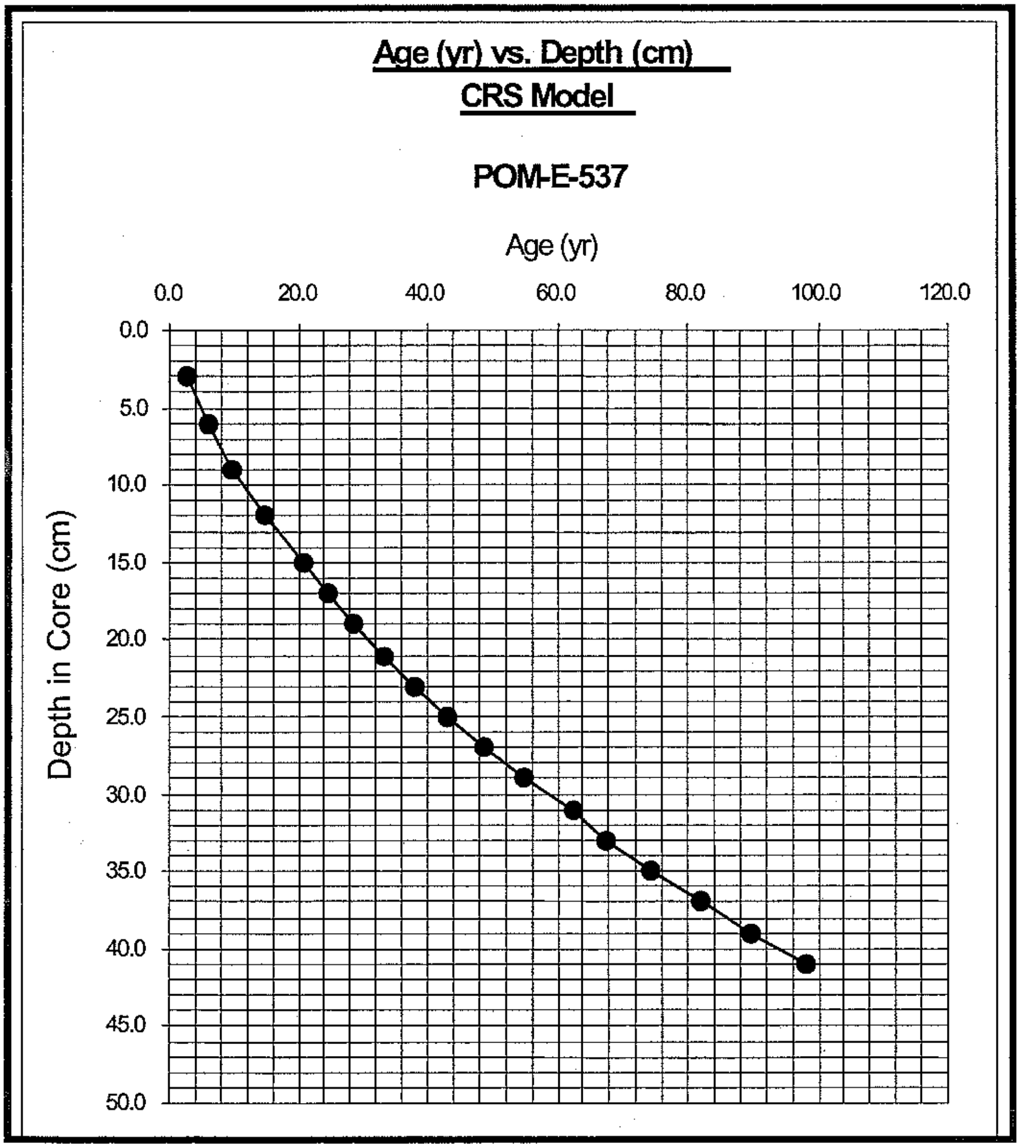


Figure 12. Radiological Dating Curve, Age vs. Depth (Core C-34 at 800-ft radius, center Delta)

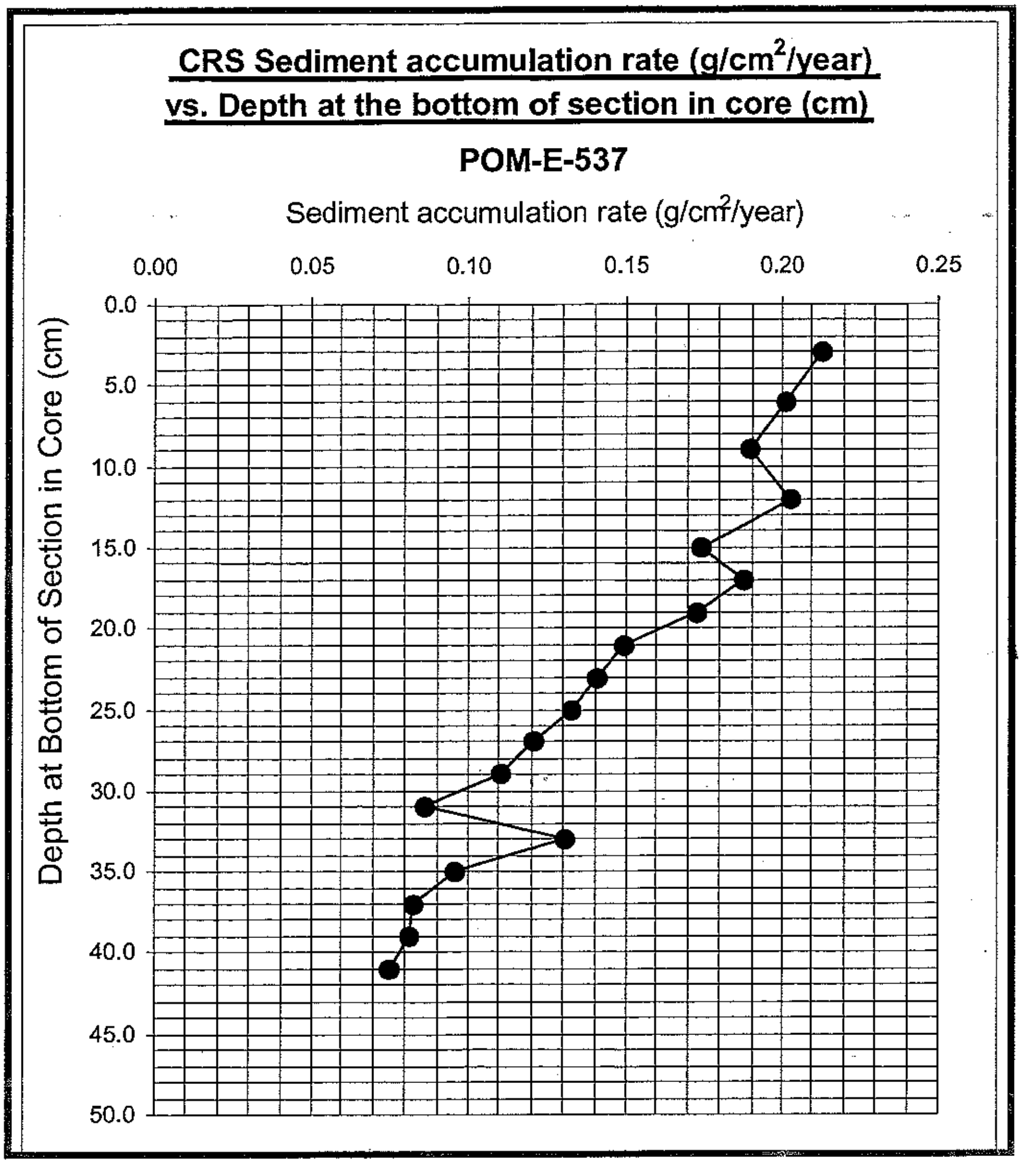


Figure 13. Radiological Dating Curve, Sediment Accumulation Rate vs. Depth (Core C-34 at 800-ft radius, center Delta)

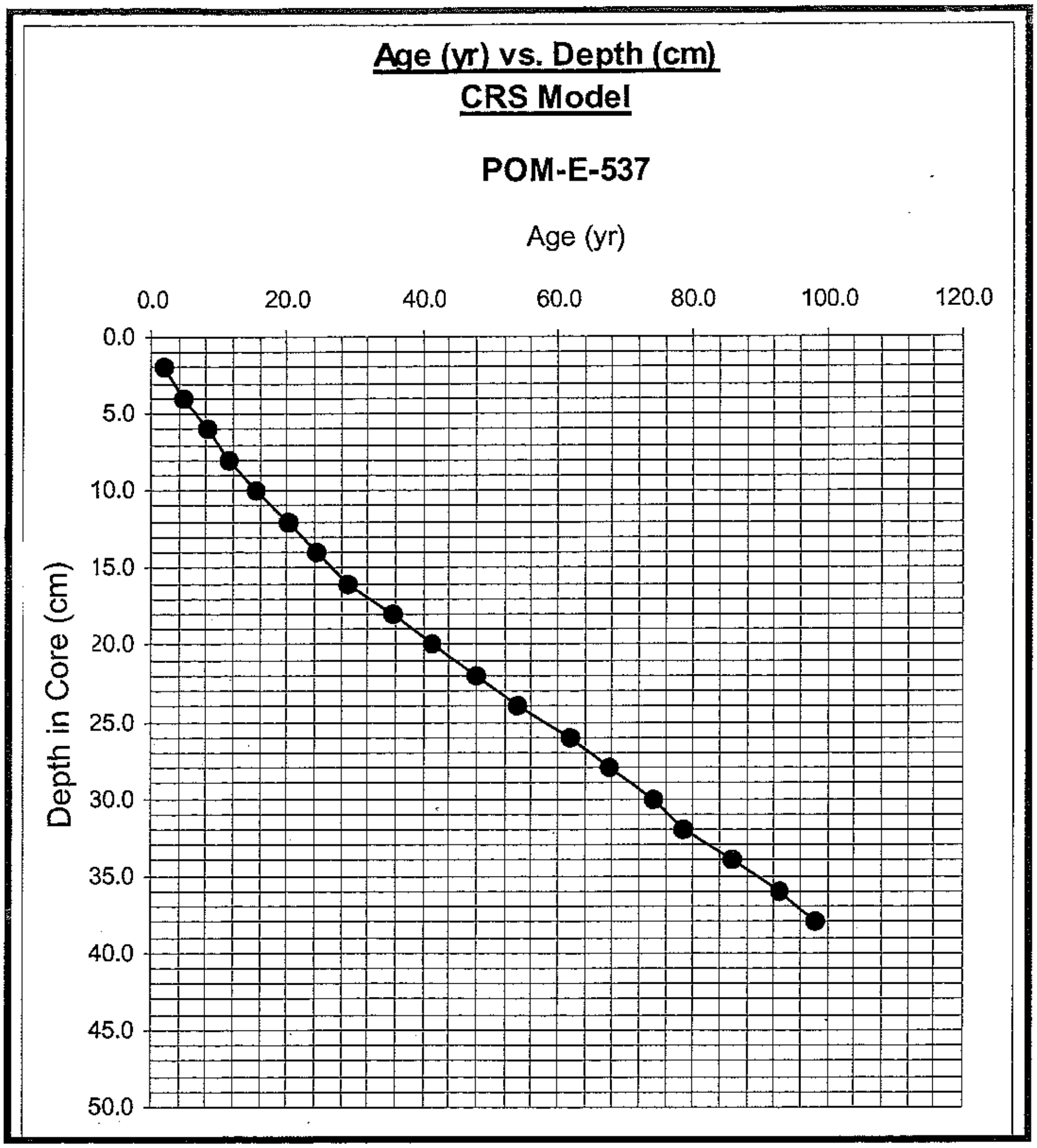


Figure 14. Radiological Dating Curve, Age vs. Depth (Core Extra near Western Shoreline)

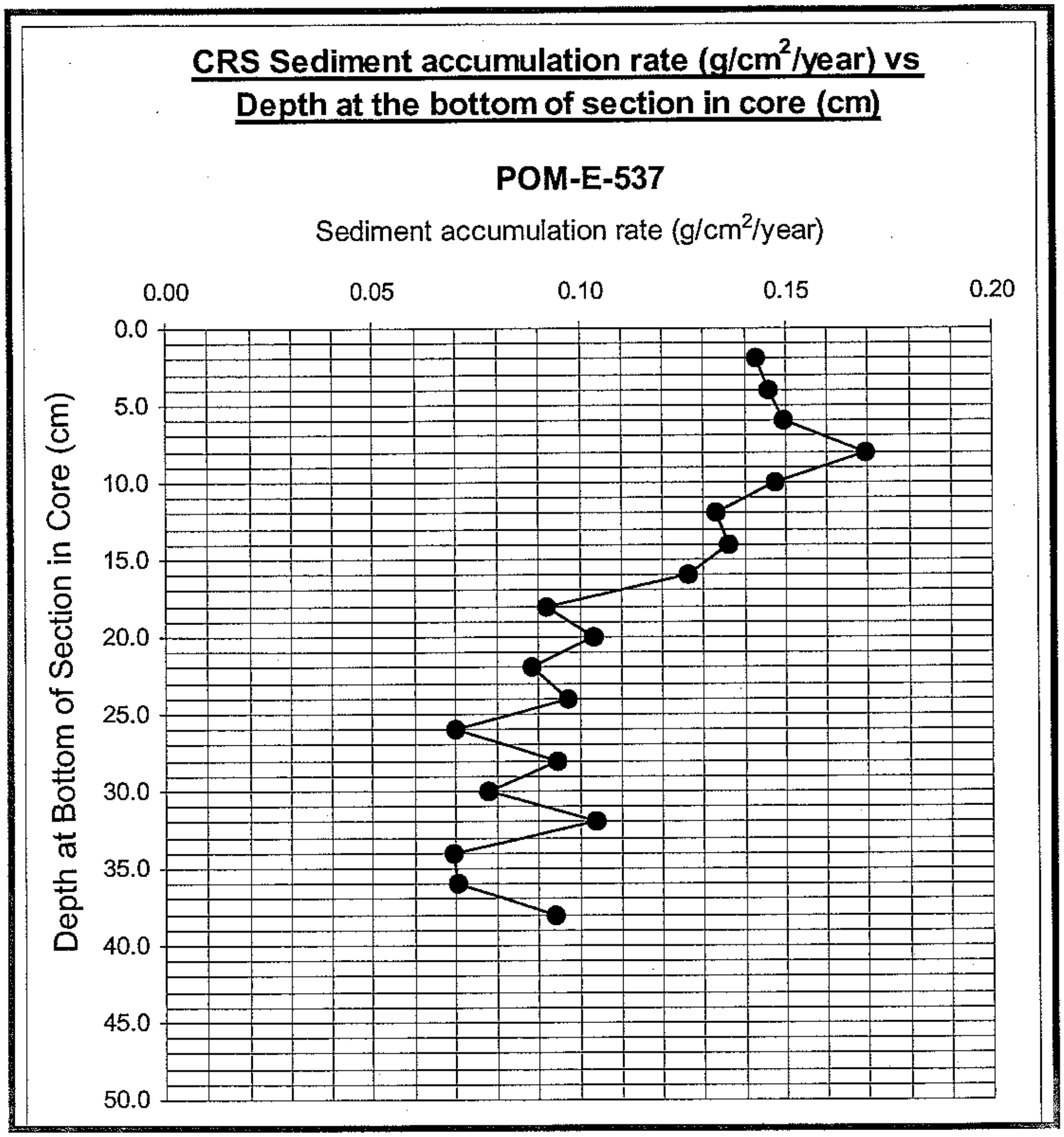


Figure 15. Radiological Dating Curve, Sediment Accumulation Rate vs. Depth (Core Extra near Western Shoreline)

APPENDIX C
BENTHIC FLUX CHAMBER AND SEDIMENT-WATER MICROCOSM STUDIES

Benthic Flux Chamber and Sediment-Water Microcosm Studies

Benthic flux chambers (BFCs) allow direct measurement of in situ chemical fluxes from discrete areas of sediment while the use of laboratory-scale, sediment-water batch systems (microcosms) allow observation of reactions under controlled conditions. BFCs were applied in the Pompton Lake system to assess which sediments are the most important contributors of methylmercury to the water column. Laboratory microcosm studies using Pompton Lake sediments were used to explore the effects of environmental conditions and total mercury on the mercury methylation potential under laboratory conditions. Coupled, the resulting data contribute to an accurate conceptual model of the role of sediments in mercury cycling in the Pompton Lake system and provide input into the final remedy selected for the Acid Brook Delta (Delta).

Objectives

The BFC study had the following two objectives:

- Quantify in situ flux of dissolved total mercury and methylmercury from several locations (representing a range of total sediment mercury concentrations) and proximity to shore in the Delta and one reference site.
- Compare surface water dissolved total mercury and methylmercury flux measurements from the sediment with surface water.

Accurate flux measurements of mercury species from the sediments allow conclusions to be drawn regarding the relative contribution of Delta sediments to the overall mercury budget of Pompton Lake. However, it should be remembered that BFC data are solely flux measurements of mercury species from the sediments into the water column. If a positive methylmercury flux is measured, then methylmercury production in sediments is probable and assumed. However, a measurement of the rate of methylmercury flux from the sediment into the water column is not a measurement of the rate of methylmercury production within the sediments.

In contrast, net methylmercury production can be measured in sediment-water microcosms. However, mercury methylation in these experiments must be considered “potential” because the microcosms represent sediments under conditions not representative of those in situ (e.g., well-mixed batch system). Although the microcosm study described in this report contains the results of a preliminary study intended as a test of concept, the results were consistent with the BFC observations. The experimental design of the microcosm study was based on similar experiments described by Bloom, et al., (2003).

The microcosm study had the following main objectives:

- Examine the relationship between total sediment mercury and methylmercury production.
- Compare the relative availability for methylation of sediment-associated mercury in the Delta to freshly added highly bioavailable mercury.

Materials and Methods

Benthic Flux Chambers

Sediment mercury and methylmercury efflux were calculated from porewater gradients of these compounds in vertically stratified cores collected in April and August 1998. Three cores were collected from the center of the Delta and the reference area during each sampling event. The results were reported in the Phase II ecological study (Exponent and The Academy of Natural Sciences, 1999). In the 1999 report, the fluxes derived from the analysis of sediment porewater mercury and methylmercury concentrations were extrapolated to estimate the overall contribution of the Delta to the Pompton Lake mercury and methylmercury mass balance.

The BFCs that were used in the Acid Brook Delta and described in this report were developed by DuPont with input from Dr. Gary Gill at Texas A&M. BFCs are typically deployed in either pairs to aid in the understanding of variability in the sediment flux data or as side-by-side transparent and opaque versions to investigate the potential effects of diurnal cycling on mercury and methylmercury flux from the sediments (see Figure 1).

For this study, BFCs were deployed twice—once in April 2005 and again in August 2005. BFC deployment sites corresponded to surface water sampling sites used in 2004 and 2005 [DuPont Corporate Remediation Group (CRG), 2006]. Dissolved oxygen (DO) was measured in the field using internal DO probes in the BFC or, for water samples collected from the BFC, an external DO meter. Both methods used the same equipment, a YSI 550A DO meter. Additional methods used during these deployments were as follows:

- April 2005
  The first deployment of the BFCs (transparent chambers only) at Pompton Lake occurred in April 2005. Transparent BFCs were placed at nine locations within the Delta and at one surface water reference location upstream of the Delta (see Figure 2). At the Delta BFC sites, surface water samples were also collected and analyzed for methylmercury. The objective of this first effort was to measure the methylmercury flux from a diverse range of subaqueous environments and sediment mercury concentrations. Surface water was also collected and analyzed for dissolved methylmercury.

- August 2005
  A second BFC deployment occurred in August 2005 at two locations (SW-15 and SW-13) within the Delta (see Figure 2). The objective of the second deployment was to examine the possible diurnal redox cycle effects on methylmercury flux from sediments. To achieve this objective, methylmercury flux was measured using transparent and opaque BFCs at each site. During deployment, the valves of the opaque BFC located at SW-13 were not in the correct position and oxygen-rich external water continued to enter the BFC during the measurement period. As a result, DO in this BFC remained at concentrations close to the surface water DO. This result contrasts with the much lower DO concentrations present in the other BFCs. Throughout the incubation period, surface water samples were collected and analyzed for methylmercury. Water column samples were collected near the sediment/water interface (near sediment) and at the top of the water column (near surface).

A general description of the materials and methods used during BFC deployment is provided in the following paragraphs.

The sediment area enclosed by the BFC is approximately 974 square centimeters (151 square inches) and has an internal wetted volume of approximately 12.5 liters (3.30 gallons). Each BFC has an internal pump to circulate the water within the BFC to avoid concentration gradients. The pump can also move surface water from the outside to the inside of the BFC. The BFC also has four 2 inch diameter equalization ports for equilibrating inside and outside water prior to the start of the sampling cycle. An additional port allows for measurement of potential groundwater seepage.

The BFC has visible gauge plates near the bottom edge and four ¾-inch diameter spuds to ensure that the apparatus is securely keyed into the subaqueous environment of interest. This setup ensures that no sediment disturbance or exchanges of external surface water occur with the water within the BFC once the sampling cycle begins.

The BFC can be positioned in the water by wading or by divers depending on the water depth. After placement, the BFC is allowed to equilibrate with the surrounding water for 30 to 60 minutes. Then the ports are closed, the circulation pump valves are actuated to slowly circulate the water inside of the BFC, and the seepage bag is opened. Sampling begins with an initial sample at time zero and continues thereafter for several hours. Samples are typically withdrawn on an hourly basis over four hours or until the DO level drops to 50% of the starting level. Samples are withdrawn using several 25-milliliter (ml) syringes, and the samples are filtered using a 0.45-micron filter. The samples are shipped on ice for low level mercury and methylmercury analysis at Texas A&M University, Galveston (Texas).

Sediment-Water Microcosms

Sediment-water microcosms were constructed from bulk surficial (approximately top 6 inches) sediments and surface water. The microcosms were maintained under anoxic conditions during preparation and incubation using basic techniques for the culture of anaerobic bacteria. Some microcosms were amended with additional organic matter to stimulate the microbial populations, decrease oxidation reduction potential, and produce environmental conditions favorable for mercury methylation.

Bulk sediments were collected from the Delta at the following locations:

- Site 537-205, a nearshore location in the eastern portion of the Delta previously shown (December 2003) to have total mercury levels of 697 micrograms per gram dry weight (µg/g dry wt) (referred to in this report as “High Mercury Delta Sediments”)
- Site 537-231, a central location previously shown (December 2003) to have total mercury levels of 61 µg/g dry wt (referred to in this report as “Low Mercury Delta Sediments”).

Additionally, sediments were collected from the upstream reference site later used for BFC deployment (referred to in this report as “Reference Sediments”) in May 2004 (see Figure 2). Surface water was also collected from the SW-2 reference site at the same time.

Collected sediments and water were stored on ice and shipped to the laboratory for construction of the microcosms. Sediment samples for the slurries were collected in May 2004 and stored at 4^{o}C until used in the experiment in June 2004. The experiment concluded in July 2004.

Microcosms were prepared under an oxygen-free (N_2) atmosphere in a Coy glovebag using N_2-sparged surface water to dilute the sediments to 25% (by wet weight). The following six sediment slurries were prepared (sediment weights are wet weight):

1) Reference Sediments (500 g) + Reference Water (to make 2 L)
2) Reference Sediments (485 g) + Reference Water (to make 2 L) + High Mercury Delta Sediments (15 g)

3) Reference Sediments (335 g) + Reference Water (to make 2 L) + Low Mercury Delta Sediments (165 g)
4) Reference Sediments (500 g) + Reference Water (to make 2 L) + 5 parts per million (ppm) (final concentration) mercuric chloride ($HgCl_2$) in Aqueous Solution
5) High Mercury Delta Sediments (500 g) + Reference Water (to make 2 L)
6) Low Mercury Delta Sediments (500 g) + Reference Water (to make 2 L)

The Delta sediments were added to Slurries 2 and 3 in different ratios in an attempt to achieve similar final total mercury concentrations. Each sediment slurry was sampled for an initial analysis of total mercury and methylmercury and total organic carbon. The remainder of the slurry was dispensed into six serum flasks as 250-ml aliquots to prepare experimental slurries. Of these aliquots, replicate pairs were treated as follows:

1) No amendment
2) 1X Organic Carbon (10 mg/L pyruvate, 40 mg/L yeast extract)
3) 10X Organic Carbon (100 mg/L pyruvate, 400 mg/L yeast extract)

The organic carbon sources used were selected as compounds that would be readily available to anaerobic bacteria that might be involved in mercury methylation. Individual experimental slurries were incubated in the dark on a shaker at room temperature and subsampled for methylmercury and methane gas production (an indication of anaerobic conditions and low oxidation-reduction potential) after five and 30 days of incubation. Methane gas was analyzed on the headspace of the slurry subsample using gas chromatography with flame ionization detection. Because subsampling of the microcosms introduced increasing headspace in the slurries, methane analyses are qualitative rather than quantitative.

Slurry samples for total mercury and methylmercury were frozen and stored before being shipped to and analyzed at Dr. Robert Mason's laboratory at the University of Maryland. Mercury was analyzed in sediment slurries using sample preparation methods outlined in Mason and Lawrence (1999) and quantified using cold vapor atomic fluorescence (CVAFS) according to Bloom and Fitzgerald (1988). The protocols outlined in U.S. Environmental Protection Agency (USEPA) Method 1631 were used (USEPA, 1995). Methylmercury in sediment slurries was analyzed using sample preparation methods from Horvat, et al. (1993) and quantified using CVAFS according to Bloom (1989).

Results

Benthic Flux Chambers

Methylmercury and total mercury fluxes calculated from sediment cores in 1999 are shown for comparison in Table 1. During the first deployment in April 2005, transparent BFCs were used in pairs at each of the nine Delta locations and one non-Delta reference location. The non-Delta reference location was the same reference site used in the Phase II ecological study (Exponent and The Academy of Natural Sciences, 1999). Of the 10 locations studied, several areas (SW-2 and SW-14 through SW-17) showed positive methylmercury fluxes in at least one BFC, including the non-Delta reference site SW-2. Other sites showed negative methylmercury fluxes in both BFCs (SW-11, SW-13, SW-18, SW-21, and SW-24) (see Figure 3). The highest positive methylmercury flux result [22.1 to 24.8 nanograms per square meter per day ($ng/m^2/d$)] occurred at SW-15 on the southwestern side of the Delta. The other Delta sites with positive fluxes were comparable to or lower than the methylmercury flux measured at the reference location SW-2 (3.9 to 8.9 ng/m^2/d). However, it should be noted that no other BFC measurements were obtained from the reference site. Given the observed high variability in benthic fluxes of methylmercury in the Delta, it is likely that the reference site fluxes would show similar variability. In some cases, this variability could result in lower or even negative methylmercury fluxes. The results did not show a strong spatial pattern with distance from shore or mercury concentration in sediment, and they did not correlate strongly with surface water concentrations. However, surface water concentrations of methylmercury measured during this sampling showed a pattern consistent with three previous surface water sampling events (DuPont CRG, 2006). Specifically, nearshore sites contained elevated methylmercury concentrations while sites nearer the center of the Delta had lower concentrations (see Figure 3). Even though the BFC measurements were unexpected because they did not correlate with surface water methylmercury concentrations, the trends measured in the BFCs were consistently linear (see Figure 4).

After reviewing April data results, DuPont tested the hypothesis that diurnal redox cycling may result in increased methylmercury fluxes from the Delta sediments in the dark. A diurnal redox cycle could be caused by the light-dependent oxygenic photosynthesis carried out by plants and algae during the daylight hours, followed by DO consumption during the night (when oxygenic photosynthesis is not active). The changes in DO concentrations could influence co-precipitation of mercury with other trace metals like dissolved iron and manganese (also monitored within the BFCs during the 20-hour test). During high DO levels of the day, co-precipitation of mercury and metal oxides could occur at the sediment surface. Trace metals and mercury species could then be resolubilized during the night when DO levels decrease and metal oxides are solubilized through anaerobic microbial respiration processes. Additionally, methylmercury production is favored in environments where oxygen concentrations are low or nondetectable. Diurnal redox cycling has been observed to affect methylmercury efflux in the Everglades (Florida), Lavaca Bay (Texas), and the San Francisco Bay (California) estuary systems (Gilmour, et al., 1998; Gill, et al., 1999; Gill, 2002).

To test this hypothesis, two experimental approaches were used. The first approach used an opaque BFC that blocked light from the interior of the BFC to simulate night conditions, thereby reducing the algal mat's light-dependent production of DO. The second approach involved conducting a 24-hour sampling of the BFC and surface water. If the results from the two strategies were comparable, the opaque BFC could be used during normal working hours, which would reduce the safety concerns associated with working on water at night.

During the August 2005 BFC sampling event, transparent and opaque BFCs were used in pairs at two locations (SW-13 and SW-15) (see Figure 2). At each site, a second pair of transparent and opaque BFCs containing DO probes was co-deployed at the same locations. The DO probes were confined to a separate BFC to avoid possible mercury contamination from electronic DO probes that might confound methylmercury flux analyses. The data from August (see Figure 5) is consistent with the April 2005 data in that SW-15 showed a consistently positive methylmercury flux under both light and dark conditions while methylmercury fluxes at SW-13 were negative under both light and dark conditions. In contrast to April 2005 data, August 2005 results for methylmercury as a function of time were less linear (see Figures 6 and 7). The responses of increased dissolved manganese, iron, and decreased DO during the 24-hour incubation in the transparent and opaque chambers are shown in Figures 8 and 9. For SW-13, the environment in the transparent BFC became increasingly reduced and anoxic over the 24-hour incubation. This is evidenced by the increase in the soluble manganese and iron and the decrease in DO measured both in samples collected from the BFC and by the probe in a parallel BFC) (see Figure 8). However, due to a valve malfunction with the opaque BFC, no evidence of decreased redox potential (no change in soluble manganese and iron) exists. The DO samples collected from this BFC remained relatively constant. The DO measured by a probe in the parallel opaque BFC did decrease, supporting the interpretation that failure to close the valve affected the internal oxidation reduction potential of the other opaque BFC. Similarly, both the transparent and opaque BFCs at SW-15 showed evidence of decreases in oxidation-reduction potential (increased manganese and iron) and DO (see Figure 9). The use of the opaque chambers at SW-13 and SW-15 in August did not appear to significantly affect methylmercury or oxidation-reduction potential in comparison to the transparent BFCs over 24 hours of observation.

Also during the August 2005 event, dissolved methylmercury in surface water was monitored synoptically near the sediment surface and near the water surface at both the deployment locations for 24 hours (see Figure 10). Similar to the flux chambers, a diurnal effect was not observed in methylmercury concentrations in surface water. This result further supports the conclusion that methylmercury efflux is not affected by diurnal redox cycling in this system.

Sediment-Water Microcosms

Total mercury concentrations in the sediment water slurries (see Table 2) were lower than expected based on previous sampling of the surface sediments at these sites and based on the spike of a known amount of $HgCl_2$ solution to Slurry 4. Additionally, the "High Mercury Delta Sediments" appeared to have less mercury than the "Low Mercury Delta Sediments."

The methylmercury values from the sediment-water microcosms are shown in Figures 11 through 13. In each case, the average of the duplicate slurries is shown for each condition and time point (except as noted in the figure). In most cases, the greatest net methylmercury production occurred within the first five days of incubation. In some cases, a net loss of methylmercury was observed at the 32-day time point. The addition of organic carbon had the greatest effect on the unamended reference sediments (see Figure 11), and reference sediments amended with "Low Mercury Delta Sediments" (see Figure 11). In these cases, the greatest net methylmercury production was observed in slurries that received the highest dose of organic carbon. In the other sediment slurries, organic carbon appeared to have little effect on net methylmercury production (see Figures 12 and 13). All slurries produced methane during the experiment, indicating that anaerobic and reducing conditions were maintained throughout incubation. Methane production generally paralleled organic carbon addition in that slurries receiving the most organic carbon had the highest methane concentrations and those receiving no organic carbon had the lowest methane concentrations (data not shown).

Overall, the greatest net methylmercury production was observed in reference sediments that were amended with $HgCl_2$ (see Figures 12 and 13). Even though sediment slurries of the high mercury Delta sediments had higher total mercury concentrations relative to the $HgCl_2$-amended slurries (108 and 96 µg/g dry wt vs. 32 µg/g dry wt, respectively), they produced an order of magnitude less methylmercury over the first five days of incubation (see Figure 13). Sediment slurries of the "Low Mercury Delta Sediments" had an overall low net production of methylmercury when compared with unamended reference sediments and reference sediments amended with Delta sediments. Reference sediments amended with Delta sediments showed little net methylmercury production except for the already noted reference sediments amended with “Low Mercury Delta Sediments” and high organic carbon (see Figures 10 and 11).

Conclusions

Benthic Flux Chambers

In comparison to the methylmercury fluxes calculated in 1999 (Exponent and The Academy of Natural Sciences, 1999), fluxes measured with the BFCs were positive and greater. This result likely does not represent an increase in methylmercury flux from Delta sediments since 1999. The literature suggests that BFCs will typically result in higher measured fluxes in comparison to fluxes calculated from gradients (Gill, et al., 1999; Gill, 2002). However, even though flux measurements directly measured with BFCs were elevated relative to earlier calculated fluxes (Exponent and The Academy of Natural Sciences, 1999), fluxes of mercury from Delta sediments were found to be low (4 to 30 times lower) compared to both measurements obtained in mercury-impacted river sediments at a site not associated with Pompton Lakes (same equipment used) and to other sites in the literature.

BFC data from August 2005 generally support the BFC results from April 2005. With regard to methylmercury flux from the sediments, the Delta is heterogeneous. Some areas produce an apparent positive efflux of methylmercury and other areas possibly act as a methylmercury sink. In contrast, at the reference area upstream of Delta influence, methylmercury flux was higher or comparable to all but one Delta location. It is possible that the nearshore environment of the reference area has more control over methylmercury efflux than sediment mercury concentrations in this area. Additionally, similar to the results from the Delta, the variability in methylmercury efflux at the reference site is expected to be high. Additional measurements may have resulted in lower or negative values for methylmercury efflux.

However, methylmercury flux results from Delta locations do not mimic the generally elevated (above background) surface water concentrations observed at nearshore locations during several sampling events. Therefore, surface water concentrations are not a good predictor of what BFCs may show in terms of methylmercury flux at individual underlying locations. One possible explanation for the apparent uncoupling of BFC measurements and surface water methylmercury concentrations is limited circulation and exchange of surface water within the Delta due to dense growth of aquatic vegetation.

A high variability in methylmercury fluxes (including negative fluxes of methylmercury into the sediments) has been reported by other researchers (Gill, et al., 1999; Gill, 2002). Measurements of methylmercury efflux from sediment cores collected at Lahontan reservoir (Nevada) (Kuwabara, et al., 2002) showed that intra-site variability obscured inter-site variability. A similarly high variability in methylmercury fluxes was also observed in marine sediments in Lavaca Bay (Gill, et al., 1999). Some of the variability in the Lavaca Bay methylmercury flux measurements is attributable to diurnal effects (Gill, et al., 1999). However, similar studies in the Delta indicate that decreases in DO and oxidation reduction potential associated with diurnal effects are not a major controller of methylmercury efflux.

With regard to the management of mercury-impacted Delta sediments, BFC results do not contraindicate the proposed sediment removal action. The only Delta sediment area showing a consistently elevated flux (SW-15, the far southwestern portion), is slated for removal. Lower flux results from portions of the Delta also slated for removal suggest that the proposed remedy is at least conservative with regard to removing sediments involved in methylmercury flux and will address nearshore sediments that may be active producers of methylmercury only on a seasonal basis.

Sediment-Water Microcosms

The anomaly of the low total mercury values measured in the sediment slurries may be result of incomplete mixing and/or uneven distribution of particulate matter in the sediment slurries. The range in particulate matter in the microcosms (as determined by dry weights, data not shown) suggests that this latter possibility may be an explanation. Alternatively, the sediments were not sieved or homogenized before slurry preparation so it is possible that the highly heterogeneous nature of the sediments resulted in sediment slurries with unexpected mercury concentrations (even when prepared using similar sediments) (e.g., Slurries 2 and 6).

Regardless of total mercury concentrations, the sediment-water microcosms should have presented ideal conditions for mercury methylation. These experimental systems were incubated at room temperature under uniformly anoxic and reducing conditions and were well mixed during incubation—conditions that are unlikely to occur in the Delta. Most of the microcosms resulted in little or no net methylation of mercury. Significant mercury methylation occurred only in microcosms where inorganic mercury was added as the highly bioavailable form of $HgCl_2$ (Slurry 4) and, to a much lesser degree, in microcosms prepared with “High Mercury Delta Sediments” collected from a nearshore site (Slurry 5). The results from these microcosms indicate that the sediments are competent for methylmercury production and that low levels of mercury methylation are the result of the limited bioavailability of mercury to the methylating organisms.

The effect of adding readily available organic carbon to the sediment slurries resulted in some stimulation of methylmercury production but only in the microcosms prepared from unamended reference sediments or reference sediments amended with “Low Mercury Delta Sediments.” The general insensitivity of mercury methylation in these experiments to added organic carbon is likely a result of the highly organic nature of these sediments. Against a background of percent levels of total organic carbon, the addition of mg/L concentrations of pyruvate and yeast extract may have been insignificant.

Summary

Net methylmercury production in the microcosms relative to the experimental treatment is consistent with BFC results. Specifically, BFC results indicate that methylmercury efflux may be highly variable and is not controlled by sediment total mercury concentrations. Similarly, these results are consistent with the observation that methylmercury in surface water does not correlate well with total mercury concentrations in the underlying sediments. The BFC studies and the preliminary microcosm studies suggest that mercury associated with Delta sediments is relatively unavailable for methylation. Taken together, these experiments support the conceptual model that the Delta is a complex environment where mercury methylation is controlled by environmental characteristics other than total mercury concentrations and that much of the mercury in the Delta is relatively inert with respect to methylmercury production.

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TABLES

Table 1
Flux of Mercury Species from Pompton Lakes Sediments
as Calculated from Porewater Gradients

Date of Collection	Site	Total Mercury Flux ($ng/m^2/d$)	Methylmercury Flux ($ng/m^2/d$)
April 1998	Delta	9.26	0.78
April 1998	Reference	-0.64	0.19
August 1998	Delta	-36.5	10.7
August 1998	Reference	-0.12	2.54

Source: (Exponent and The Academy of Natural Sciences, 1999)

Table 2
Total Mercury in Sediment Slurries

Slurry Composition	Total Mercury (μg/g dry wt)
1- Ref Sed + Ref H_2O	0.456
2- Ref Sed + Ref H_2O + High Mercury Delta Sed	2.2
3- Ref Sed + Ref H_2O + Low Mercury Delta Sed	4.0
4- Ref Sed + Ref H_2O + $HgCl_2$ (aq)	32.2
5- High Mercury Delta Sed + Ref H_2O	96.5
6- Low Mercury Delta Sed + Ref H_2O	108.3

FIGURES

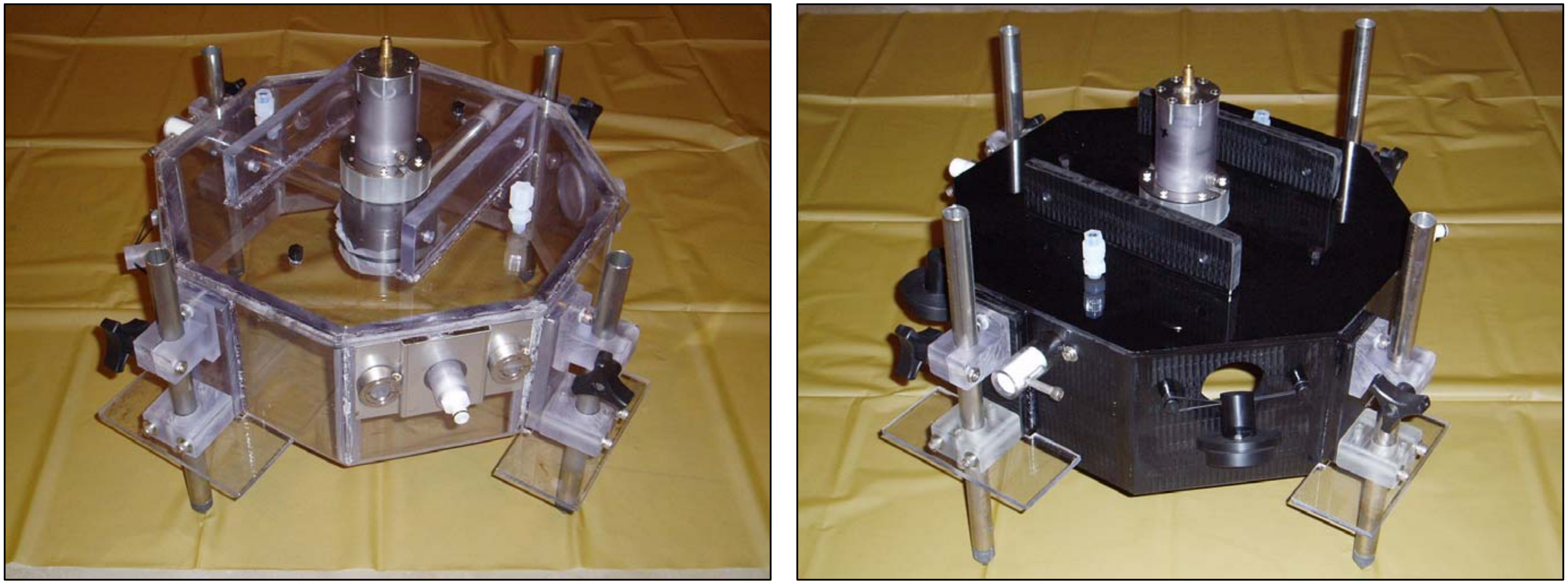
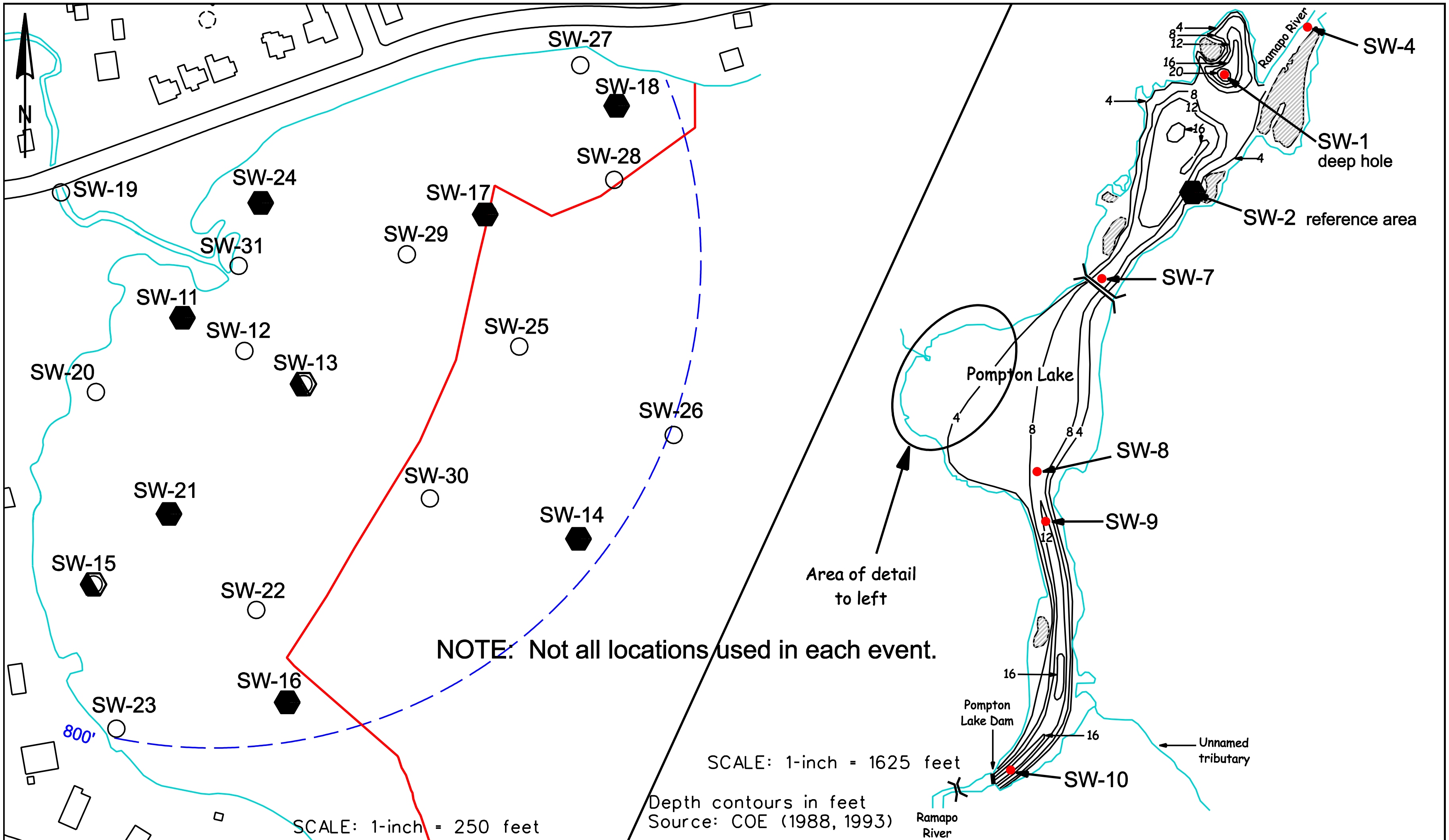


Figure 1. Clear and Opaque Benthic Flux Chambers



LEGEND

Sample ID

Location of Surface Water Samples

Benthic Flux Chaber Location - April 2005

Benthic Flux Chaber Location
April and August 2005

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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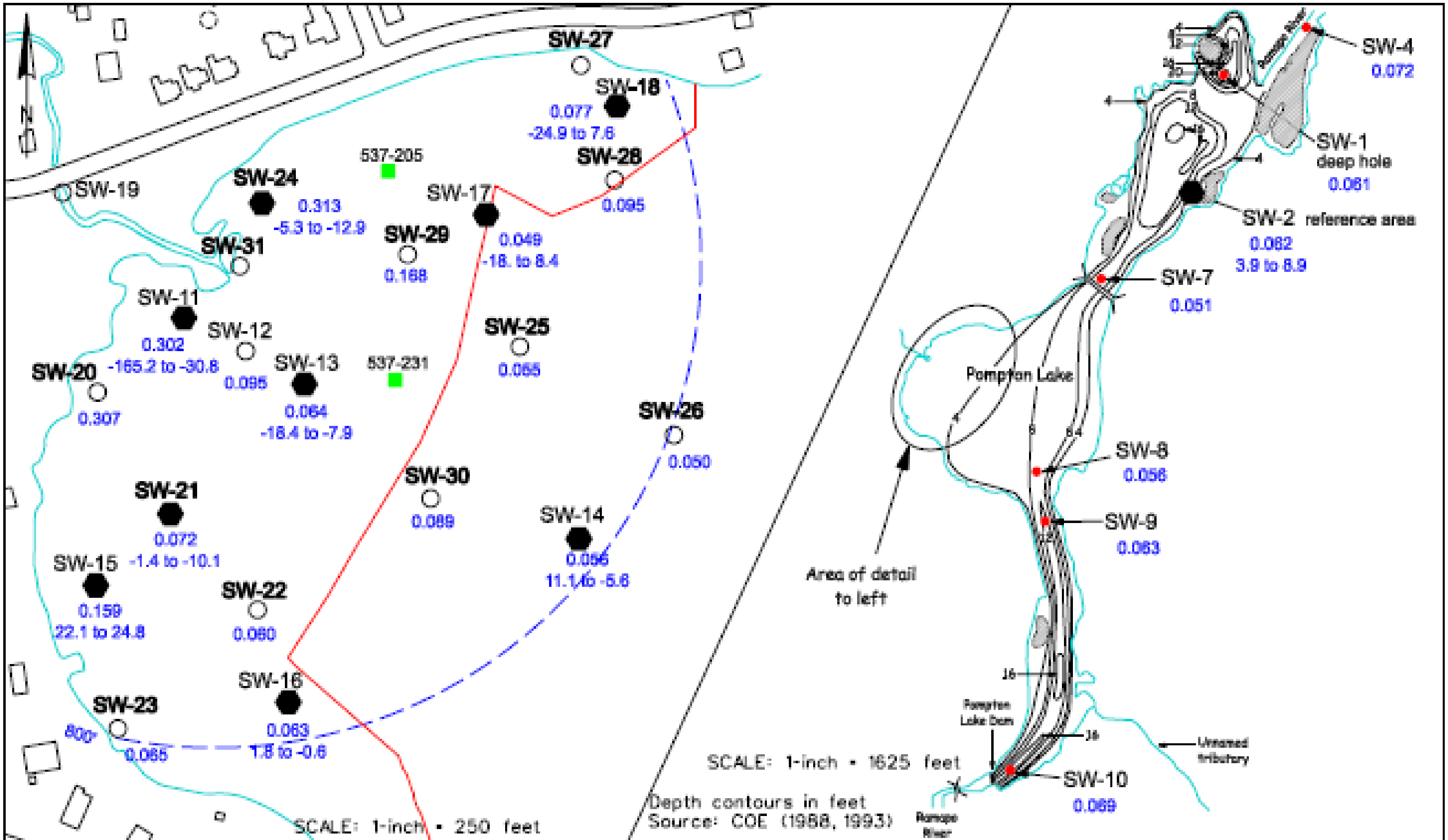
Surface Water and Benthic Flux Chamber
Sampling Location Map

ACID BROOK DELTA
DUPONT POMPTON LAKES WORKS
POMPTON LAKE, NEW JERSEY

Figure 2



LEGEND

Sample ID

Location

Benthic Flux Chaber Location

Sediment-water microcosm study

Surface Water Methylmercury (ng/L)

Flux Range (ng m-2day-1)

Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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Methylmercury Surface Water and Flux Data
April 2005

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Figure 3

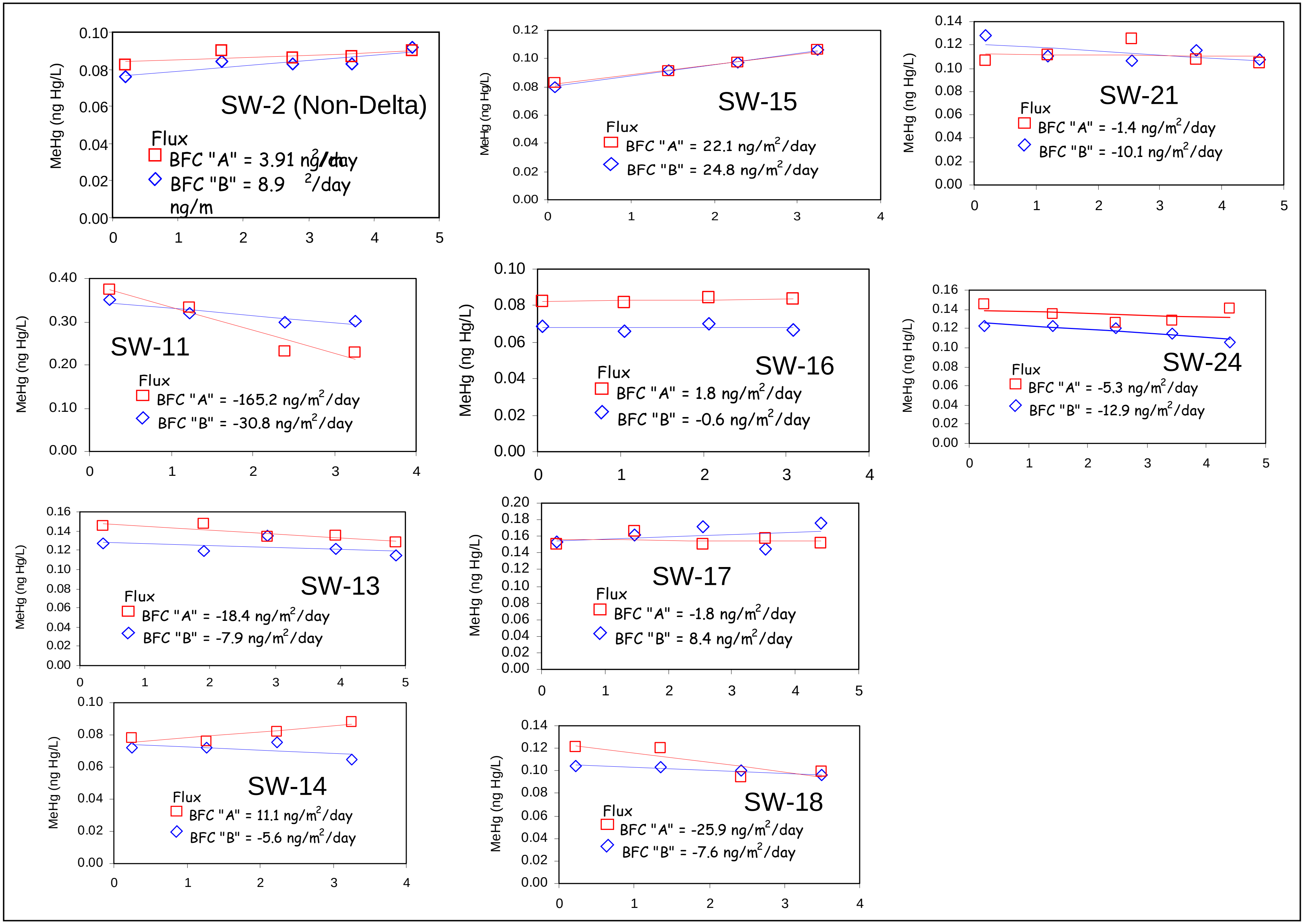
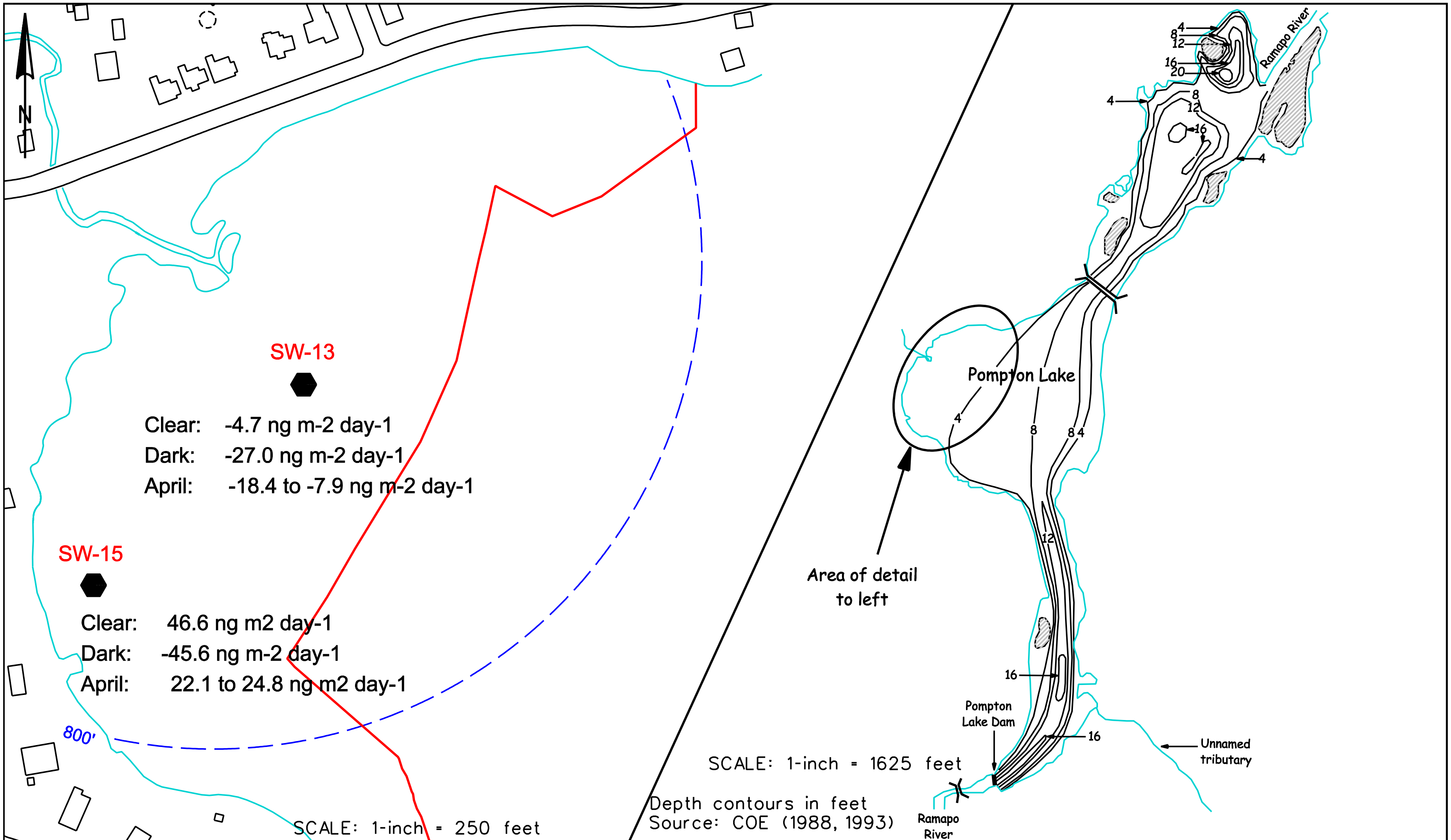


Figure 4. Time vs. Methylmercury Concentrations within BFCs (April 2005)



LEGEND
Sample ID
Location
Benthic Flux Chaber Location
Proposed Excavation Limit

MAPPER: ME Vetter
DATE: May 31, 2006
DRAWING: delta sw figs.dgn

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Methylmercury Flux Data
August 2005

ACID BROOK DELTA
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Figure 5

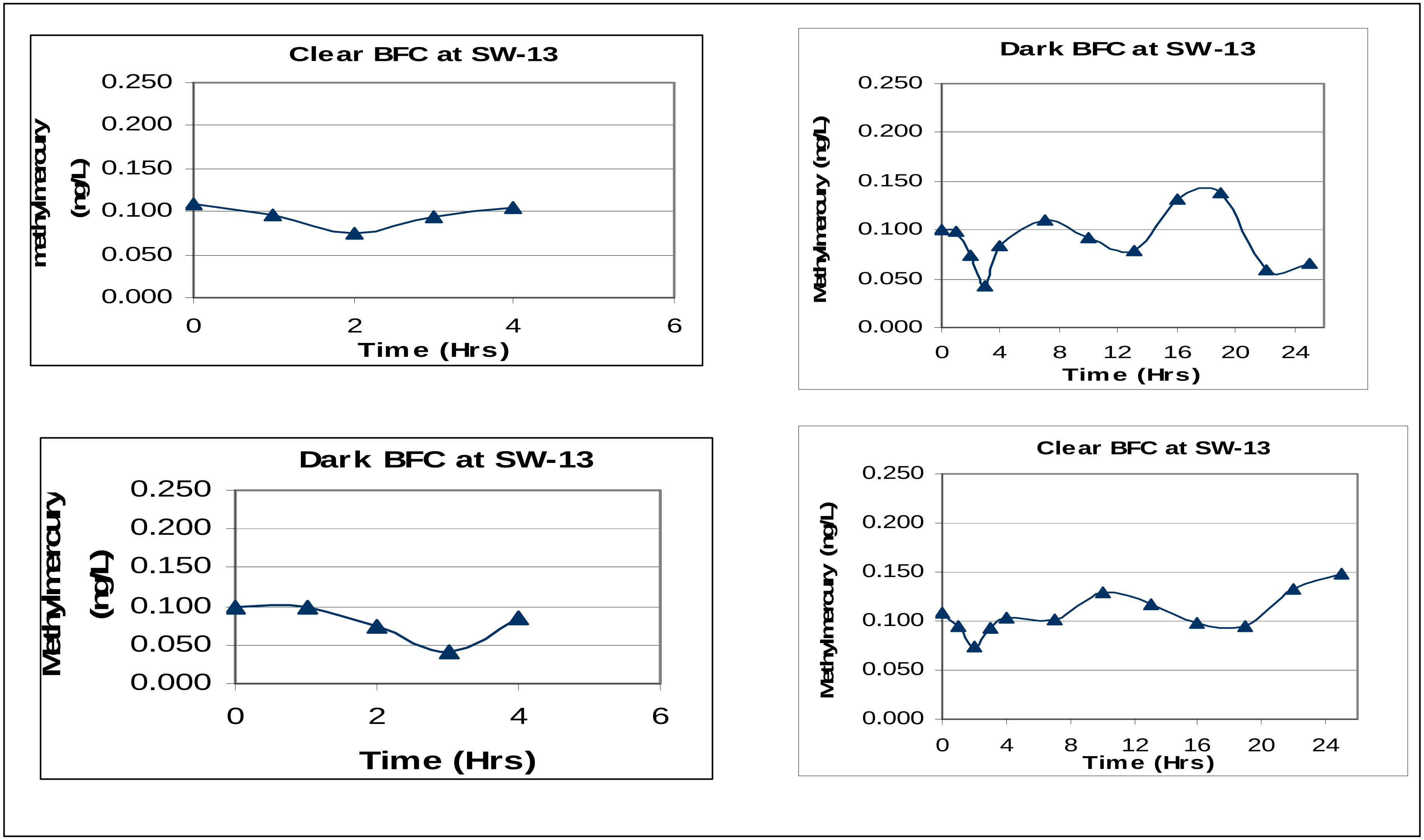


Figure 6. Time vs. Methylmercury within BFCs at SW-13 (August 2005)

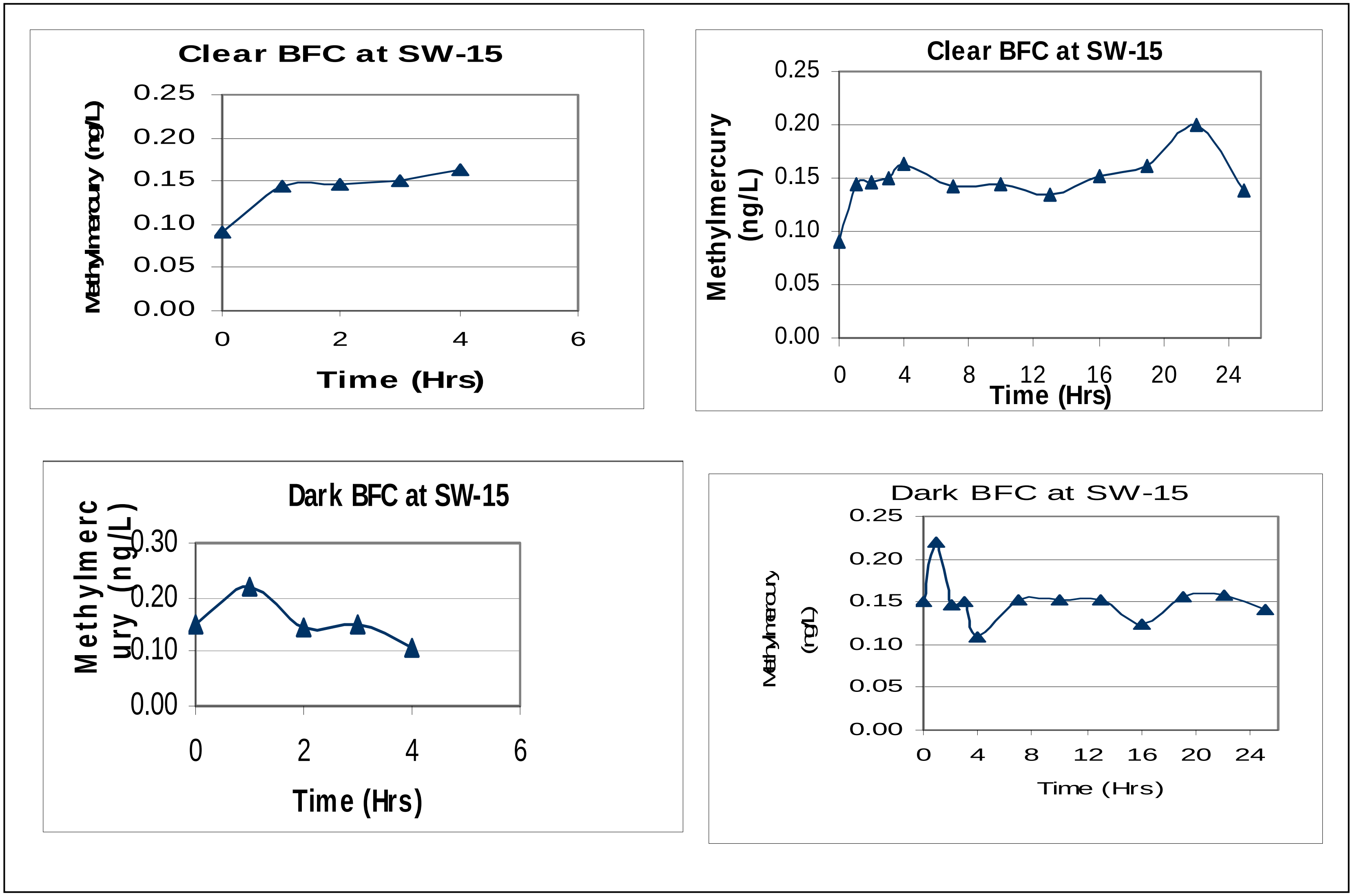
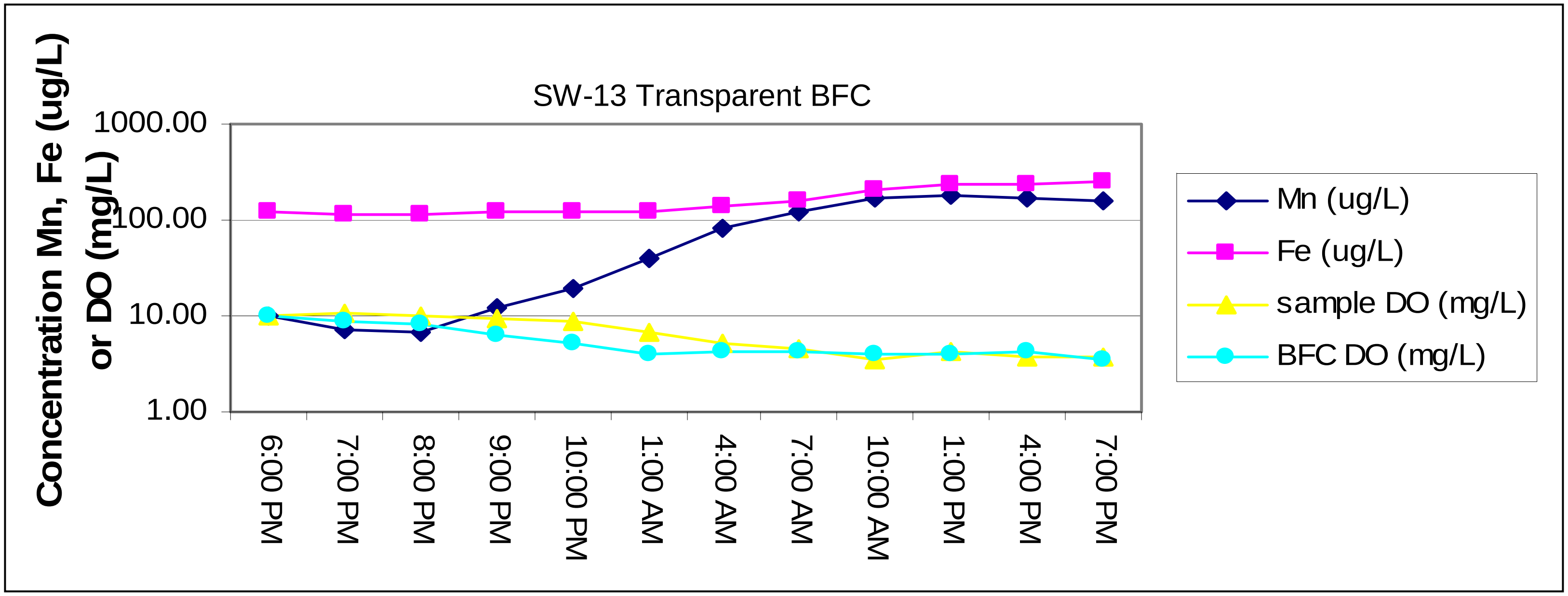
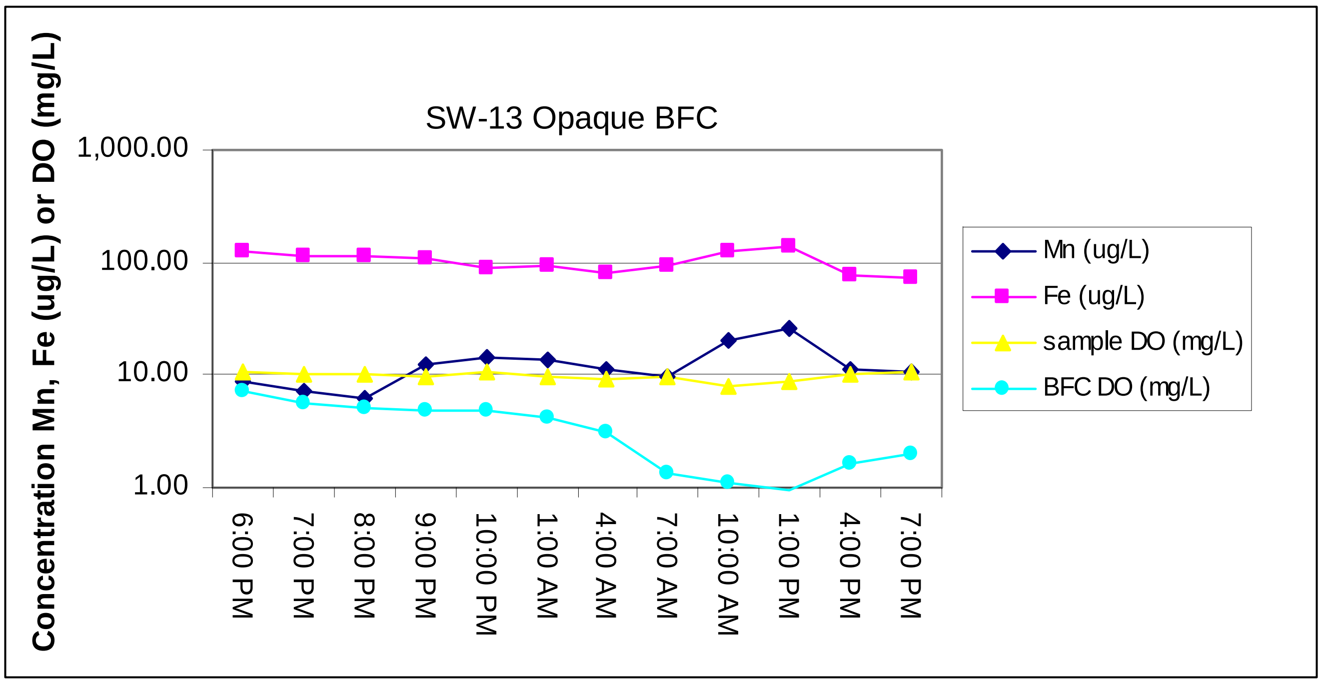


Figure 7. Time vs. Methylmercury Concentration within BFCs at SW-15 (August 2005)





Note: The BFC valves on the opaque chamber were not fully sealed.

Figure 8. Time vs. Manganese, Iron, and DO in BFCs at SW-13

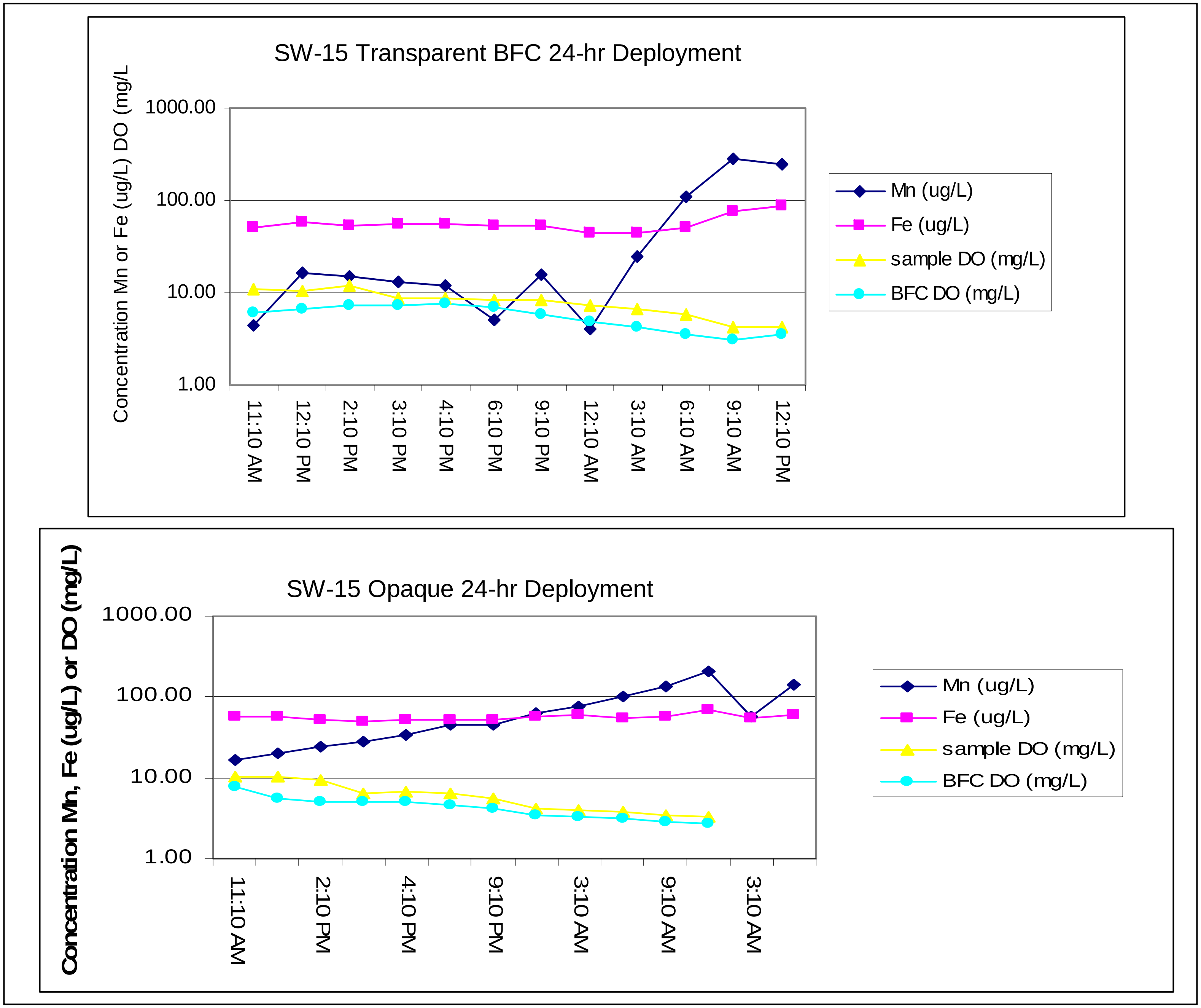


Figure 9. Time vs. Manganese, Iron, and DO in BFCs at SW-15

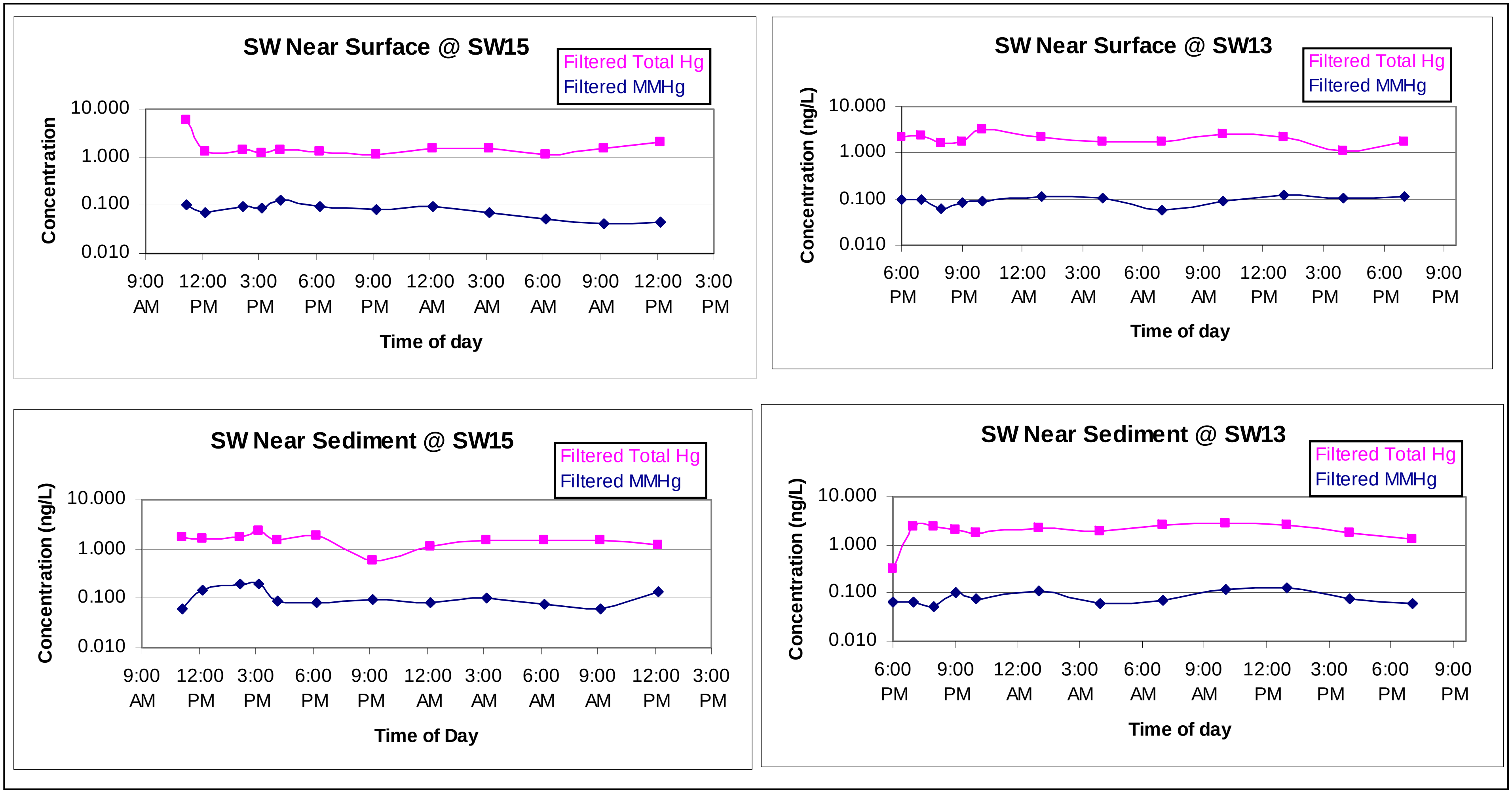


Figure 10. Time vs. Surface Water Dissolved Total Mercury and Methylmercury

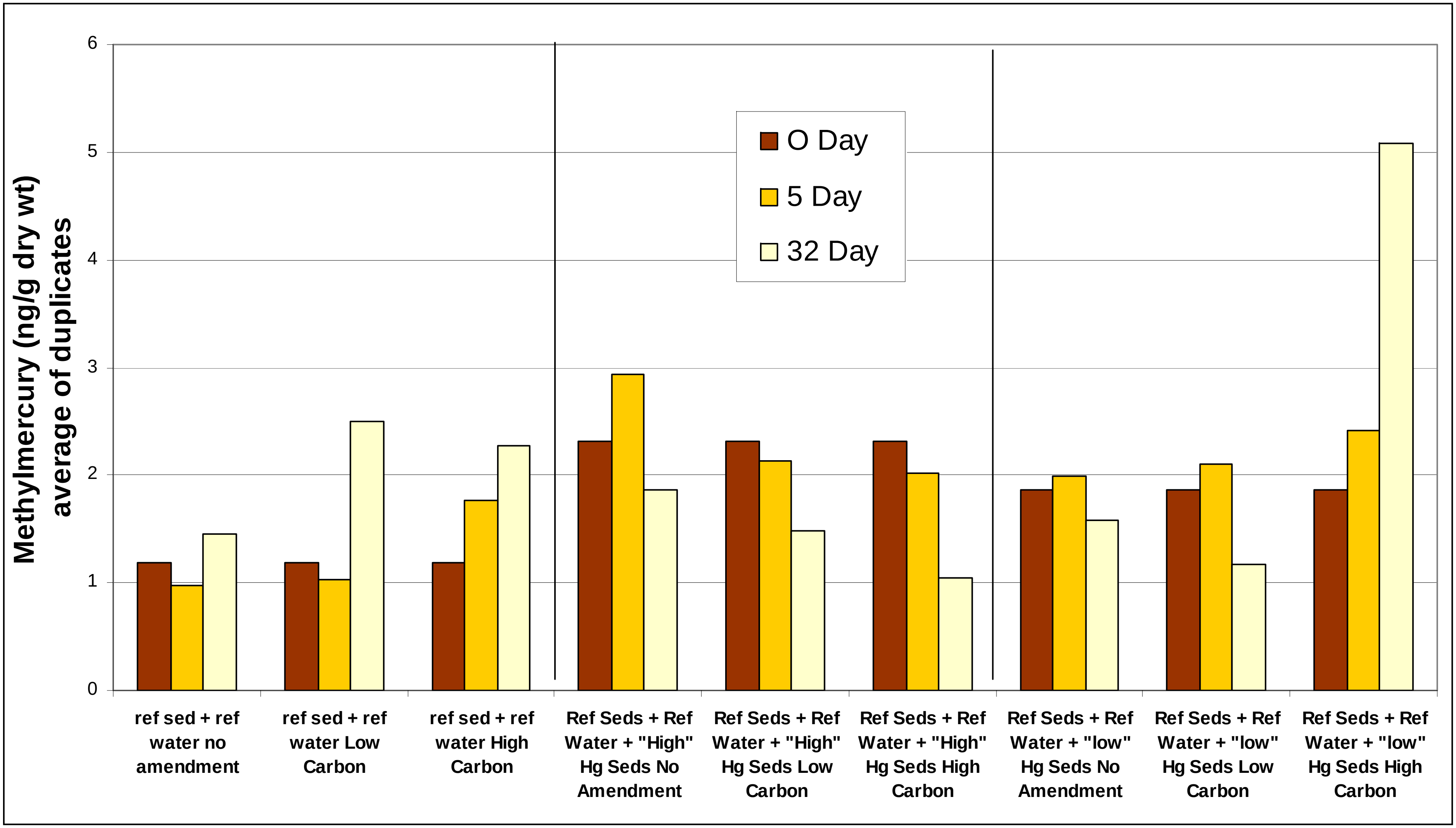


Figure 11. Methylmercury Production in Reference Sediments with and without Delta Sediment-Associated Mercury or Organic Carbon

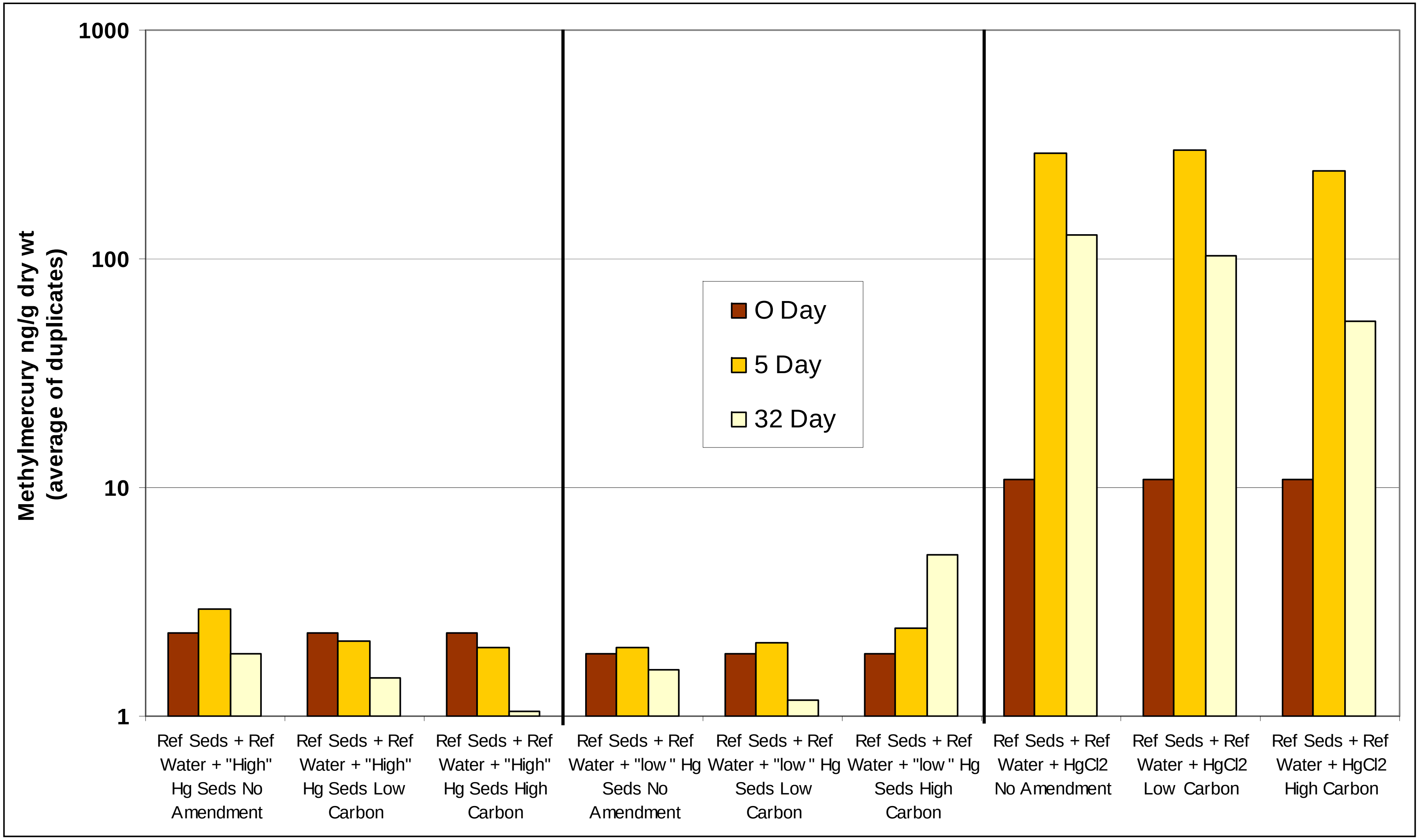


Figure 12. Methylmercury Production in Reference Sediments Amended with Mercuric Chloride Compared to Reference Sediments Amended with Delta Sediment-Associated Mercury

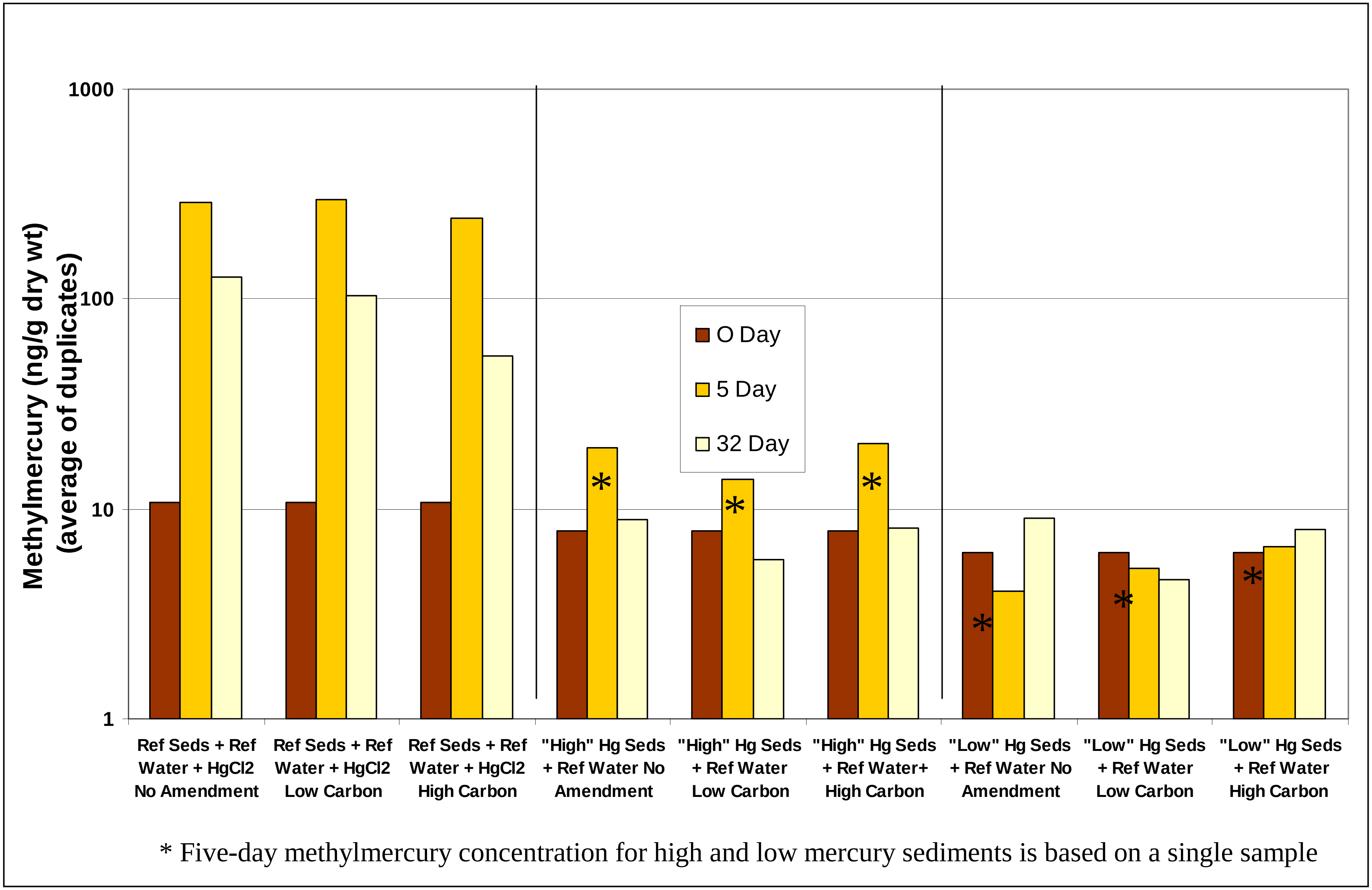


Figure 13. Methylmercury Production in Reference Sediments Amended with Mercuric Chloride Compared to Slurried Delta Sediments

APPENDIX D
DELTA BIOLOGICAL INVESTIGATION REPORT

Delta Biological Investigation Report

DuPont Pompton Lakes Works located in Pompton Lakes, New Jersey, conducted biological sampling activities within the area known as the Acid Brook Delta (the Delta) in August 2005 (see Figure 1). The investigation was designed to support the ongoing geotechnical and sediment investigations in the Delta. The investigation included the collection of data for benthic community analyses and tissue data for benthic invertebrates, young-of-the-year (YOY) fish, and algal mats. The investigation was similar to the ecological investigation conducted in the Delta in 1998 (Exponent and The Academy of Natural Sciences, 1999). This report presents the details of the investigation, including sampling methods, results, conclusions, and recommendations.

Objectives

The objectives of the 2005 Delta biological investigation were as follows:

- Provide current baseline data regarding spatial and temporal distributions of sediment-dwelling benthic invertebrates in the Delta.
- Characterize potential pathways in which mercury may cycle in the Delta by collecting and analyzing benthic invertebrates, YOY fish, and algal mat tissue.
- Assess changes in the condition of aquatic communities in the Delta by comparing 2005 data with data from the 1998 ecological investigation (Exponent and The Academy of Natural Sciences, 1999).

Sampling Methods

Field sampling was conducted between August 22, 2005, and September 1, 2005, in accordance with the procedures presented in the *Delta Biological Investigation Scope of Work* [DuPont Corporate Remediation Group (CRG), 2005]. A brief description of the sampling procedures is presented in the subsections below.

Biological Tissue

Biological tissue samples were collected and analyzed for total mercury and methylmercury to characterize potential pathways from which mercury cycles in fauna and flora in the Delta.

Benthic Invertebrates

Chironomids were selected as the target species for benthic tissue collection because previous studies indicated that they represent an abundant taxon in the Delta and are considered an important component of food webs in lentic environments. Chironomids were collected from 15 of the 24 benthic community sampling stations in the Delta (see Figure 2) and 10 stations from background areas selected in consultation with the New Jersey Department of Environmental Protection (NJDEP) (see Figure 3). Sampling stations in the Delta were co-located with previous and ongoing media investigations to evaluate mercury concentration trends in sediment and benthos. Samples consisted of a composite of 10 individual chironomids from each station. Sediment grab samples were collected using a petite Ponar grab sampler and then placed through a 500-micrometer (μm) bucket sieve. Chironomids were removed and rinsed with laboratory-supplied deionized water and patted dry to remove moisture before being placed in laboratory-supplied sampling containers.

YOY Fish

YOY fish species were selected for tissue analysis because this age group reflects the mercury cycling in the food web during a one-year growing season. The following three YOY fish species were collected and analyzed for total mercury and methylmercury:

- Bluegill (*Lepomis macrochirus*)
- Yellow perch (*Perca flavescens*)
- Largemouth bass (*Micropterus salmoides*)

Target areas for the collection of YOY fish included the shallow vegetated areas (less than 6 feet) and shorelines in both the Delta and background areas north of the Delta (see Figure 4). YOY fish were collected using a boat-mounted electroshocking unit. Ten samples of each species were collected: five samples from the Delta and five samples from background areas. Each sample consisted of a composite of approximately 10 YOY fish of the same species. Individual lengths and weights were recorded for all sample fish. Samples were rinsed with laboratory-supplied deionized water and patted dry to remove moisture before being placed in sample containers.

Algal Mats

At the request of the NJDEP, algal mat sampling was included in the baseline investigation to provide flora tissue data in the Delta. Samples were collected at three stations in the Delta and three stations in the background areas (see Figure 5). Sample stations were co-located with benthic invertebrate sample locations where possible. Samples were collected from within portions of floating algal mats visibly free of macroinvertebrates and detritus. Each sample was rinsed with laboratory-supplied deionized water and patted dry to remove moisture before being placed in sample containers.

Benthic Community

Sediment samples for benthic macroinvertebrate analyses were collected from 24 stations in the Delta (see Figure 2) and a total of 20 stations within three upstream background areas (see Figures 3 and 6) selected in consultation with the NJDEP. Sampling station locations within the Delta were based on a gradient of total mercury sediment concentrations from available data.

Three replicate samples were collected with a petite Ponar grab sampler at each of the 44 Delta and background stations for a total of 132 samples. Samples were rinsed in the field through a 500-µm mesh screen[1], placed in appropriately labeled sample jars, and preserved with 70% reagent alcohol. Samples were returned to the laboratory for processing and identification. During processing, samples were rinsed over a 500-µm mesh sieve, homogenized by hand, and spread evenly over a pan marked with a 3 by 5 grid. A grid was randomly selected based on a random numbers table, and all organisms within the grid were removed. Subsequent grids were selected, and all organisms within these grids were removed until a total of 100 organisms were obtained. Sorted organisms were identified to the lowest taxonomic level practicable, typically genus. Chironomids were identified to family (Chironomidae) and oligochaetes were generally identified to class (Oligochaeta).

[1] All rinse water from Delta locations was retained and brought back to Pompton Lakes Works where it was placed in a 55-gallon drum for disposal.

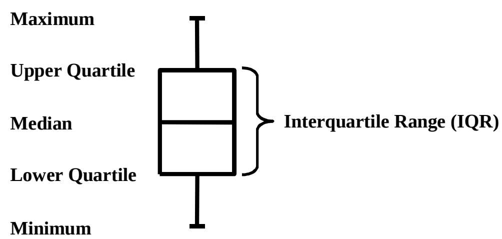
Physical and water quality parameters, including water depth, pH, conductivity, temperature, dissolved oxygen, salinity, and turbidity were collected in situ at every sampling location in the Delta and background areas. Sediment characteristics, including grain size and total organic carbon (TOC) were collected at all background benthic macroinvertebrate community sampling locations.

Data Analysis Methods

This section presents the methods used to evaluate biological tissue and benthic community data collected during the 2005 investigation.

Biological Tissue

Comparisons of benthic macroinvertebrate, fish, and algal mat tissue data between Delta and background area samples were presented as box-and-whisker plots representing the maximum, minimum, upper and lower quartile, and median values for samples collected at Delta and background locations.



The spatial distributions of total mercury and methylmercury concentrations in chironomids were qualitatively evaluated to identify patterns potentially related to mercury distribution within Delta sediments. Spatial evaluations were limited to chironomid tissue data because of the sedentary nature of benthic invertebrates and the direct contact exposure of these organisms to the sediments.

Benthic Community

Benthic communities in the Delta and background sampling locations were evaluated using multimetric and multivariate approaches. The similarity of benthic communities between the Delta and background sampling locations was evaluated based on comparisons of community metrics and hierarchical cluster analysis using Bray-Curtis Dissimilarity coefficients.

Benthic communities were assessed based on metrics identified in various bioassessment guidance documents (Barbour, et al., 1999; Klemm, et al., 1990). General metric categories include diversity indices, taxa richness and composition measures, and tolerance measures. Specific metrics were determined based on their relevance to the study area. Table 1 provides a detailed description of the following 10 benthic community metrics selected for the analysis:

- Taxa Richness
- Density
- Percent Abundance of Harpacticoids
- Percent Abundance of Chironomids
- Percent Abundance of Oligochaetes

- Shannon's Diversity Index (D)
- Shannon's Equitability (E)
- Percent Dominant Taxa
- Percent Tolerant Individuals
- Modified Hilsenhoff Biotic Index

Comparisons of benthic community metrics between Delta and background samples were presented as box-and-whisker plots as described above.

The spatial distribution of benthic metrics within the Delta was qualitatively evaluated to identify potential patterns in community characteristics. Metric values for each station were represented as the mean values calculated from the three replicates analyzed at each station. Four categories of stations were presented in the spatial evaluation: (1) stations with values less than the lower quartile, (2) stations with values between the 25th and 50th percentiles, (3) stations with values between the 50th and 75th percentiles, and (4) stations with values greater than the upper quartile. Spatial patterns in community characteristics were compared to the mercury distribution in sediments to qualitatively evaluate potential relationships between community characteristics and sediment mercury concentrations.

Benthic macroinvertebrate community structure was analyzed using hierarchical cluster analysis based on Bray-Curtis dissimilarity measures. Abundance data from replicate samples were pooled for each station, and log-transformed abundance data were used to calculate Bray-Curtis dissimilarity coefficients. Bray-Curtis dissimilarity coefficients were calculated in SYSTAT 10.2 for each pair of variables (i.e., stations) as follows:

$$\frac{\sum_{t}\left|x_{s1}-x_{s2}\right|}{\sum_{t}x_{s1}+\sum_{t}x}$$

where t are taxa and s_1 and s_2 are the variables for which the coefficient is being calculated (SYSTAT, 2002).

Hierarchical cluster analysis based on Bray-Curtis dissimilarity coefficients was used to determine the similarity of benthic communities among Delta and background stations. Cluster analyses were performed in SYSTAT 10.2 using Bray-Curtis dissimilarity coefficients to measure the distance (or differences) between stations; average linkage (unweighted-pair group method) was selected as the algorithm to determine how clusters were joined. These options were selected because average linkage is a preferred algorithm for ecological data [Pielou, 1984; U.S. Environmental Protection Agency (USEPA), 1998] and Bray-Curtis distance is ideal for species-abundance data (USEPA, 1998).

Results

Generally, total mercury and methylmercury concentrations were greater in biological tissues collected from the Delta relative to background samples. Benthic community results indicate a similar taxonomic composition between benthic communities at the Delta and background stations. More detailed results are presented in the subsections below.

Biological Tissue

Tissue samples of benthic invertebrates, fish, and algal mats were collected from the Delta and background sampling locations and analyzed for total mercury and methylmercury. The subsections below present the results of the biological tissue analyses.

Benthic Invertebrates

Concentrations of total mercury and methylmercury were generally greater in chironomids collected from the Delta relative to background stations (see Figure 7 and Table 2). Total mercury concentrations in Delta chironomids ranged from 40.1 to 940 nanograms per gram (ng/g), with a median concentration of 247 ng/g. In background samples, total mercury concentrations ranged from 5.8 to 21.8 ng/g, with a median concentration of 9.6 ng/g. Methylmercury concentrations in the Delta ranged from 1.13 to 7.78 ng/g, with a median concentration of 3.82 ng/g. Concentrations of methylmercury in chironomid tissue collected at background stations ranged from approximately 0 to 3.23[2] ng/g, with a median concentration of 0.307 ng/g. Four Delta samples and eight background samples had detections below the sample-specific estimated method detection limit (eMDL) for methylmercury; total mercury and methylmercury concentrations in these samples are estimated as the eMDL.

Only a relatively small percentage of total mercury in chironomids was present as methylmercury, the form of mercury preferentially accumulated up the food chain. Methylmercury as a percentage of total mercury ranged from 0.2% to 5% in the Delta and from approximately 0% to 15% in background samples, with an outlying background sample of 48%.

The spatial distributions of total mercury and methylmercury concentrations in chironomids were evaluated to identify patterns potentially related to mercury distribution in sediments. Samples at stations with total mercury concentrations greater than the median concentration in the Delta were generally located on the western side of the Delta, with the upper quartile samples obtained from stations located offshore near the center of the Delta (see Figure 8). Lower concentrations of total mercury in chironomids were generally observed in the northern and eastern portions of the Delta. Methylmercury concentrations in chironomid tissues varied in the Delta, and spatial patterns were not apparent (see Figure 8). Samples with upper quartile concentrations of methylmercury in chironomid tissue were obtained from stations distributed throughout the Delta (one nearshore and three offshore stations). Likewise, samples with lower quartile and interquartile concentrations were obtained from stations distributed throughout the Delta, revealing no apparent spatial patterns.

YOY Fish

Comparisons of YOY fish tissue indicate greater concentrations of total mercury and methylmercury in samples collected from the Delta relative to samples collected from background stations (see Figure 7 and Table 3). The analyses indicate that nearly all mercury contained in YOY fish tissues is methylated, with the exception of yellow perch that had a lower methyl-to-total mercury ratio relative to the other species. Interspecies differences in total mercury and methylmercury concentrations in YOY fish were also observed. Predator species (largemouth bass) had greater concentrations of total mercury and methylmercury relative to benthivores (bluegill and yellow perch)—regardless of sampling location.

[2] The laboratory estimation of the methylmercury concentration in one sample of chironomids resulted in a negative concentration. It is assumed that methylmercury concentrations in this sample are near zero.

- Bluegill
  Total mercury concentrations in YOY bluegill collected from the Delta ranged from 69.8 to 128 ng/g, with a median concentration of 82 ng/g (see Figure 7). In background samples, total mercury concentrations in bluegill ranged from 29.2 to 32.9 ng/g. Methylmercury concentrations in Delta bluegill ranged from 53.6 to 93.0 ng/g, with a median concentration of 85.9 ng/g. Background methylmercury concentrations in bluegill ranged from 33.4 to 36.1 ng/g; the median concentration of methylmercury in bluegill was 35.8 ng/g.

- Largemouth Bass
  Total mercury concentrations in YOY largemouth bass collected from the Delta ranged from 115 to 165 ng/g, with a median concentration of 133.7 ng/g (see Figure 7). Largemouth bass collected from background sampling locations had total mercury concentrations ranging from 52.8 to 65.8 ng/g. Methylmercury concentrations from largemouth bass collected from the Delta ranged from 99.9 to 172 ng/g, with a median concentration of 133.7 ng/g. Background methylmercury concentrations in largemouth bass ranged from 44.5 to 75.7 ng/g, with a median concentration of 72.0 ng/g.

- Yellow Perch
  Tissue from YOY yellow perch collected within the Delta contained total mercury concentrations ranging from 82.1 to 119 ng/g, with a median concentration of 97.6 ng/g (see Figure 7). Total mercury concentrations in yellow perch tissue from background sampling locations ranged from 21.0 to 23.2 ng/g. Methylmercury concentrations in yellow perch from the Delta ranged from 35.5 to 56.5 ng/g; the median concentration in the Delta was 49.5 ng/g. Methylmercury concentrations in yellow perch from background sampling locations ranged from 20.7 to 34.2 ng/g; the median methylmercury concentration was 25.1 ng/g.

Algal Mats

Total mercury and methylmercury concentrations in algal mats are greater in samples collected from Delta locations relative to background sampling locations (see Figure 7 and Table 4). Total mercury concentrations in algal mats collected in the Delta ranged from 44.8 to 147 ng/g, compared to 2.27 to 5.47 ng/g measured in background samples. Methylmercury concentrations in algal mats from the Delta ranged from 4.12 to 6.32 ng/g. Methylmercury concentrations were below the sample-specific eMDL in all algal mat samples from background sampling locations; concentrations reported for these samples are estimated. The percentage of total mercury as methylmercury in algal mat samples was generally consistent between Delta and background samples, with 4.3% to 9.2% of total mercury present as methylmercury in Delta samples and 1.9% to 6.7% as methylmercury in background samples.

Benthic Community

The results of benthic community sampling indicate similar taxonomic composition between benthic communities at Delta and background stations. Raw benthic community data are provided in Table 5 and summarized in Table 6. A total of 37 distinct taxa[3] were identified from 132 samples collected from the Delta and background stations (see Table 6). Of the 37 total taxa, 24 taxa were collected from the Delta stations and 34 taxa were collected from background

[3] A taxon is considered distinct if it is identified to the highest resolution within its respective taxonomic hierarchy.

stations. Thirteen of 34 taxa present in background samples were not present in the Delta samples; however, these taxa were present in only seven or fewer of the 60 background samples. Three of 24 taxa present in Delta samples were not present in background samples; however, these taxa were present in only four or fewer of the 66 Delta samples.

Benthic communities in the Delta and background stations were comprised of three main taxonomic groups: harpacticoid copepods, aquatic worms (Oligochaeta), and midge larvae (Chironomidae). Harpacticoids were present in all 72 samples collected from the Delta; oligochaetes and chironomids were present in 62 and 66 samples from the Delta, respectively (see Table 6). In background samples, harpacticoids were present in 56 of 60 samples, while oligochaetes and chironomids were present in 49 and 53 samples, respectively. These groups were also numerically dominant in Delta and background samples, comprising greater than 50% of the total abundance in 65 of 72 Delta stations and 40 of 60 background stations (see Table 5).

In situ water quality parameters indicate similar ranges of water column conditions between Delta and background benthic community sampling stations (see Table 7). The temperature ranged from 22 to 28.3ºC at Delta stations and 24.7 to 29.1ºC at background locations. pH measurements in the Delta ranged from 7.27 to 9.66; pH at background stations ranged from 7.86 to 9.7. Dissolved oxygen ranged from 8.22 to 15.89 mg/L in the Delta and from 6.2 to 19.83 mg/L at background stations. Turbidity ranged from 5 to 26 NTU in the Delta and from 2 to 43 NTU at background stations. Conductivity ranged from 0.372 to 0.413 mS/cm in the Delta and from 0.398 to .429 mS/cm at background stations. Observed ranges in water quality parameters at Delta and background stations are likely attributed to sampling at various times during the diurnal photosynthetic cycle in the lake. Observed water quality values were consistent with values observed during the August 1998 investigation (Exponent and The Academy of Natural Sciences, 1999).

Sediment characteristics of background benthic community sampling stations are provided in Table 8. Percent fine-grained sediment at 2005 background stations ranged from 4.5 to 95.2%, with a median value of 42.95%. Sediment samples in the Delta collected in the Delta in 1998 consisted primarily of fine-grained sediment, with values ranging from 50% to 95%. TOC concentrations were generally consistent between background sediments sampled in 2005 and Delta sediments in 1998. The median concentration of TOC in background samples was 3.3% compared to 2.6% for Delta samples collected in 1998.

Metric Comparison

Comparisons of benthic community metrics calculated for Delta and background stations indicate similar community characteristics. Taxonomic composition metrics indicate that the communities consist of varying compositions of harpacticoids, oligochaetes, and chironomids. Percent abundances of these main taxonomic groups were generally consistent between Delta and background samples (see Figure 9). Taxa richness values in the Delta were within the range observed in background samples, with median values higher in background samples relative to the Delta. Median densities were similar between Delta and background samples; however, the upper 50th percentile Delta samples generally had greater densities relative to background samples. The percent abundance of the dominant taxon was generally consistent between the Delta and background samples. Values for Shannon's H' and E were generally similar, with values of both indices slightly greater in background samples relative to Delta samples (see Figure 10). Tolerance measures were also similar between Delta and background samples. The range of the percent abundance of tolerant individuals in Delta samples was in the range observed in background samples, with slightly lower median values observed in Delta samples. Similar distributions of modified Hilsenhoff Biotic Index (HBI) values were also observed in Delta and background samples.

The spatial distribution of community metrics within the Delta revealed patterns generally related to physical features of the Delta, particularly in proximity to the shoreline. All stations with taxa richness values in the upper quartile for the Delta were located in nearshore areas, which, for the purpose of this investigation was defined as areas within 100 feet of the shoreline (see Figure 11). Eight of nine nearshore stations had taxa richness values greater than the Delta median. Similar results were observed for diversity, where nearshore stations accounted for all upper quartile values for Shannon's H'. Eight of nine nearshore stations had Shannon's H' values greater than the Delta median. The relationship to nearshore areas was less defined for Shannon's E. Three of six upper quartile stations for Shannon's E were associated with nearshore areas, while seven of nine nearshore stations had Shannon's E values greater than the Delta median. Densities were generally greater nearshore, with three of nine nearshore stations having density values in the upper quartile for the Delta and six of nine stations having densities greater than the Delta median. Increased density and diversity in littoral or nearshore areas are typical of benthic invertebrate communities in lakes.

The percent abundance of the three main taxonomic groups (harpacticoids, oligochaetes, and chironomids) varied slightly in the Delta (see Figure 12). In general, harpacticoids comprised a greater percent abundance of benthic communities in the southern and western portions of the Delta. Chironomids comprised a greater portion of the communities in the northern and eastern portions of the Delta. No spatial pattern was evident in oligochaete distribution. Because harpacticoids were the dominant taxon at many stations, the spatial pattern of the percent abundance of the dominant taxon was similar to the harpacticoid distribution in the Delta. The spatial distribution of tolerance metric values was also related to community composition within the Delta (see Figure 13). Similar to harpacticoid distribution, values of percent tolerant and modified HBI were generally greater at stations in the southern and western portions of the Delta. Values of these tolerance metrics were lower in the northern and eastern portions of the Delta where the percent abundance of harpacticoids was lower.

Cluster Analysis

A second approach to evaluate benthic macroinvertebrate communities in the Delta and background stations used hierarchical cluster analysis to identify similarities between stations. The results of the cluster analysis are presented as a dendrogram (see Figure 14), where the bars connecting stations represent the similarity between them. Stations joining at the left side of the dendrogram are more similar than those joining at the right side of the dendrogram. Percent similarity between station clusters is calculated as 100 - Bray-Curtis percent dissimilarity for each cluster.

Cluster analysis results generally indicate high similarity between the Delta and background stations (see Figure 14). Forty-two of 44 Delta and background stations clustered at a percent similarity greater than 71%; all stations clustered at a percent similarity greater than 66%.

Six main clusters of stations were identified in the analysis. In general, Delta and background stations were intermingled within the six major clusters, indicating minimal discrimination between the stations based on benthic community structure. The six major groups of stations identified in the cluster analysis are described below, and their geographic locations within the Delta are identified (see Figure 15).

- Group 1 consists of Delta nearshore station 537-266 and a background station from Area 3.
- Group 2 consists of Delta nearshore station 537-295 and three background stations from Area 2.
- Group 3 consists of seven Delta stations and five background stations from Areas 2 and 3. Five of the seven Delta stations are located in the southern portion of the Delta.
- Group 4 consists of 12 Delta stations generally located in the northern and eastern portions of the Delta and three background stations from Areas 2 and 3.
- Group 5 consists of three nearshore Delta stations and seven background stations from Area 1.
- Group 6 consists of background station BK-8 from Area 1.

Discussion

The results of the 2005 Delta biological investigation generally support the conclusions of the 1998 ecological investigation (Exponent and The Academy of Natural Sciences, 1999). The 1998 ecological investigation found that none of the measures of benthic community structure evaluated in the Delta corresponded with spatial patterns of mercury concentrations in sediments and concluded that mercury concentrations in sediment did not pose unacceptable risk to benthic invertebrate communities. Benthic macroinvertebrate, fish, and algal mat tissue concentrations measured during the 1998 investigation were elevated in the Delta relative to background samples. However, food-web modeling indicated that methylmercury concentrations did not pose unacceptable risk to the five avian wildlife receptors evaluated. The following sections provide a detailed discussion of the 2005 Delta investigation results in the context of the results of the 1998 investigation.

Biological Tissue

Biological tissue analyses indicate greater concentrations of total mercury and methylmercury in chironomids, YOY fish, and algal mats at Delta stations relative to background stations. The following section provides comparisons of the 2005 tissue data with the limited tissue data collected during the 1998 ecological investigation in the Delta (Exponent and The Academy of Natural Sciences, 1999). It is important to note that analytical variation between the 1998 and 2005 tissue data may be attributed to the use of two different laboratories for the analyses. Although the analytical methods referenced in the 1998 and 2005 studies are similar, it is possible that differences in methods contributed to analytical variation between studies. A discussion of the spatial distribution of mercury concentrations in chironomid tissues is also provided.

In general, tissue concentrations measured in the Delta in 2005 do not indicate an increased accumulation of mercury by chironomids and YOY fish tissue relative to tissue data collected during the 1998 ecological investigation (Exponent and The Academy of Natural Sciences, 1999). Methylmercury concentrations in chironomid tissues collected from the Delta in 1998 were generally within the range of concentrations observed in 2005. Methylmercury concentrations measured in chironomids from the Delta in 1998 ranged from 1.8 to 3.3 ng/g, with a mean concentration of 2.6 ng/g. Methylmercury concentrations in 2005 chironomid samples from the Delta ranged from 1.13 to 7.78 ng/g, with a mean concentration of 3.5 ng/g. Total mercury concentrations in chironomids analyzed from the Delta in 1998 ranged from 43 to 120 ng/g (Exponent and The Academy of Natural Sciences, 1999), while samples analyzed from the Delta in 2005 ranged from 40.1 to 940 ng/g. Greater ranges observed in chironomid concentrations in 2005 are likely attributed to the increase in sample size from three samples in 1998 to 15 samples in 2005. The methylmercury concentration in YOY bluegill in 1998 was 160 ng/g, compared to the 53.6 to 93.0 ng/g range observed in the five samples collected in 2005. Largemouth bass or yellow perch YOY fish tissue data were not collected in 1998; hence, no comparison was made.

The spatial distribution of total mercury in chironomid tissues was generally consistent with the distribution of total mercury in sediments within the Delta. Total mercury concentrations in chironomid tissues from sampling stations located in the western and southwestern portions of the Delta exceeded the median total mercury concentration observed in the Delta (see Figure 8). These areas generally contained higher concentrations of total mercury in sediment. Sampling stations with total mercury concentrations in chironomids that were below the median concentration for the Delta were generally located farther offshore to the east and in the northern portion of the Delta. Total mercury concentrations in sediments in these areas were generally lower relative to areas in closer proximity to the mouth of Acid Brook. Methylmercury concentrations in chironomids did not reveal a spatial pattern consistent with total mercury concentrations in sediment.

The results of algal mat analyses indicate that total mercury and methylmercury concentrations are greater in samples collected from Delta stations relative to background stations. However, mercury concentrations measured in algal mats may not accurately reflect mercury concentrations assimilated into algal tissues. While every effort was made in the field to separate algal tissue from macroinvertebrates, detritus, sediment particles, and other debris contained within the algal mat, it is likely that these components contributed to the total mercury and methylmercury concentrations measured in the algal mat samples. This is likely an issue in shallow habitats, particularly in the Delta, where sediment may be re-suspended and trapped in floating algal mats. Other factors that potentially confound the algal mat sample results include the difficulty of selecting samples in the field that were the same age and identical taxon.

Benthic Community

The results of the benthic community assessment indicate that the benthic community structure is similar for the Delta and background sampling stations. Benthic communities from both areas are comprised primarily of various abundances of harpacticoids, oligochaetes, and chironomids. Benthic community metrics were generally comparable between Delta and background samples. Densities were generally greater in the Delta, while richness and diversity metrics were slightly greater in background stations. Tolerance metric values were consistent between Delta and background stations, indicating that similar stressors may influence Delta and background benthic community composition.

The results of the hierarchical cluster analysis indicate that Delta and background stations are highly similar. In the cluster analysis, Delta and background stations were intermingled within clusters, and 42 of 44 Delta stations clustered at greater than 71% similarity. A similar result was observed in the cluster analysis conducted in the 1998 investigation, in which all Delta and background stations clustered at greater than 75% similarity. Slight differences between the results of the 1998 and 2005 cluster analyses are likely attributed to increased variability in the background data set resulting from increasing the number of background stations from three in 1998 to 20 in 2005.

The results of the 2005 and 1998 investigations indicate a stable benthic community with minimal interannual variation that is consistent between Delta and background stations. The 1998 community was comprised primarily of harpacticoids, oligochaetes, and chironomids, similar to the composition observed in 2005 (see Figure 16). There was some variation in the percent abundance of these three main groups and the percent abundance of the dominant taxon between sampling events. However, the potential shift in community composition observed between sampling events was consistent between Delta and background stations and likely reflects interannual community variation within the entire lake. Similar interannual variability was also observed between Delta and background stations in taxa richness and diversity metrics, including Shannon's H' and Shannon's E (see Figure 17). Interannual shifts observed in tolerance measures, including the percent abundance of tolerant individuals and modified HBI were consistent between Delta and background stations.

Spatial patterns observed in benthic metric values and the results of the hierarchical cluster analysis indicate that benthic community structure in the Delta has not been altered by mercury concentrations in sediment. An evaluation of the spatial distribution of community metric values revealed no patterns consistent with the distribution of mercury in sediments within the Delta. In general, benthic community characteristics appear to be influenced by proximity to the shoreline or water depth and sediment characteristics. Greater values for richness, diversity metrics, and estimated densities were generally observed at nearshore stations, where concentrations of mercury were greater. Specifically, the greatest mean values of taxa richness, Shannon's H', and Shannon's E observed in the Delta were found at Station 537-208; the concentration of total mercury at this location (1,486 mg/kg) was the greatest concentration observed in surficial sediment samples collected in the Delta since 2003. In the cluster analysis, Station 537-208 was joined at 91% similarity with background station BK-14 in Group 2, which included seven background stations with mercury concentrations in sediment that are assumed to be representative of background concentrations (see Figure 14). Spatial patterns of groups identified by the cluster analysis were not consistent with the distribution of mercury in sediment (see Figure 15). These findings are consistent with the findings of the 1998 biological investigation of the Delta that found no degree of correspondence between spatial patterns of major benthic characteristics and spatial patterns of concentrations of substances of concern in the sediment (Exponent and The Academy of Natural Sciences, 1999).

Conclusions

The results of the 2005 Delta biological investigation support the following conclusions:

- Benthic community analyses indicate that a stable benthic community exists in the Delta with a structure similar to background communities.
- Analyses of biological tissues indicate greater concentrations of total mercury and methylmercury in chironomids, YOY fish, and algal mats at Delta stations relative to background stations.

- Tissue concentrations measured in the Delta in 2005 do not indicate an increased accumulation of mercury by chironomids and YOY fish tissue relative to tissue data collected during the 1998 ecological investigation.
- The results of the 2005 Delta biological investigation generally support the conclusions of the 1998 ecological investigation.

Recommendations

The proposed remedial action in the Delta will further augment the conclusions of the 1998 and 2005 investigations regarding the health and condition of aquatic communities in the Delta by reducing exposure to mercury concentrations in sediment. The proposed action will ensure the protection of aquatic communities in the Delta by achieving the following:

- Reducing the spatially averaged total mercury exposure concentrations in sediment from nearshore habitat by approximately 99%
- Reducing the overall spatially averaged total mercury exposure concentrations in surficial sediment by approximately 92%

Future biological monitoring in the Delta will be implemented following the re-establishment of submerged aquatic vegetation (SAV), which is the preferred habitat of YOY fish. The proposed remedial actions would eliminate this habitat and result in YOY preferentially utilizing SAV in areas outside the remediated area. The SAV habitat should be allowed to re-establish in the remediated area so that YOY fish tissue monitoring is representative of exposure throughout the Delta. Future monitoring programs will be conducted in the following phased approach based on the re-establishment of SAV:

- Initial monitoring of the Delta for SAV habitat re-development
- Monitoring of aquatic community conditions after SAV is re-established in the Delta

Data collection and evaluation in future biological monitoring programs will follow the approaches of the 1998 and 2005 investigations to facilitate comparisons with baseline conditions. Future monitoring programs will collect appropriate data to support benthic invertebrate community analyses and tissue analyses for benthic invertebrates and YOY fish. Algal mat sampling is not recommended for future monitoring because of the uncertainty associated with cross-contamination of other environmental media, including sediment particles and aquatic invertebrates.

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TABLES

TABLE 1
DESCRIPTION OF BENTHIC MACROINVERTEBRATE METRICS
AND THE EXPECTED RESPONSE OF EACH METRIC
TO INCREASING DISTURBANCE
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

Benthic Invertebrate Community Metric	Metric Description
Taxa richness	Calculated as the number of distinct taxa identified in the sample. Taxa were excluded from this calculation if other individuals of a similar taxon could be identified to a lower taxonomic level. Lower taxa richness values are generally associated with stressed benthic invertebrate communities.
Density	Calculated as the quotient of the number of organisms in the subsample and the proportion of the sample processed divided by the sampling area of a petite ponar (in square meters). Lower density values are generally associated with stressed benthic invertebrate communities.
Percent abundance of harpacticoids	The percent abundance of harpacticoid copepods.
Percent abundance of chironomids	The percent abundance of individuals in the family Chironomidae.
Percent abundance of oligochaetes	The percent abundance of individuals in the class Oligochaeta.
Shannon Diversity Index (H)	A measure of diversity that accounts for both abundance and evenness of taxa present. Shannon's H is calculated as: $H = -\sum p_i \ln p_i$ where (pi) is the relative proportion of taxon "i". Lower values of Shannon's H are generally associated with stressed benthic invertebrate communities.
Shannon's Equitability (E)	Calculated by dividing Shannon's H by the natural log (ln) of the total number of species in the sample. Values for Shannon's E range between 0 and 1, with 1 being indicative of complete evenness or homogeneity, i.e. the same number of each species. Lower values of Shannon's E are generally associated with stressed benthic invertebrate communities.
Percent dominant taxon	The percent abundance of the single most dominant taxon. Higher values of percent dominant taxon are generally associated with stressed benthic invertebrate communities.
Percent tolerant individuals	The percent abundance of taxa with a tolerance value greater than 7. Tolerance values are based on available information from Barbour et al. (1999). Higher values of percent tolerant individuals are generally associated with stressed benthic invertebrate communities.

TABLE 1
DESCRIPTION OF BENTHIC MACROINVERTEBRATE METRICS
AND THE EXPECTED RESPONSE OF EACH METRIC
TO INCREASING DISTURBANCE
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

Benthic Invertebrate Community Metric	Metric Description
Taxa richness	Calculated as the number of distinct taxa identified in the sample. Taxa were excluded from this calculation if other individuals of a similar taxon could be identified to a lower taxonomic level. Lower taxa richness values are generally associated with stressed benthic invertebrate communities.
Density	Calculated as the quotient of the number of organisms in the subsample and the proportion of the sample processed divided by the sampling area of a petite ponar (in square meters). Lower density values are generally associated with stressed benthic invertebrate communities.
Modified Hilsenhoff Biotic Index (HBI)	An abundance-weighted average tolerance value for benthic macroinvertebrate assemblages. Values are based on tolerance to organic pollution and range from 0 (intolerant) to 10 (tolerant). Tolerance values are based on available information from Barbour et al. (1999). Higher HBI values are generally associated with stressed benthic invertebrate communities.

Notes:
--, Taxonomic composition metric, response to disturbance is not defined.

TABLE 2
MERCURY CONCENTRATIONS IN BENTHIC MACROINVERTEBRATE TISSUE
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

Location	Sample ID	Total Hg (ng/g)	Methyl Hg[1] (ng/g)	Sample Specific eMDL for Methyl Hg (ng/g)
Delta				
537-241	POM-N-CHI-DE1	94.7	*1.13*	2.243
537-208	POM-N-CHI-DE2	512	5.0	3.141
537-261	POM-N-CHI-DE3	438	4.76	0.956
537-239	POM-N-CHI-DE4	125	3.82	1.259
537-228	POM-N-CHI-DE5	574	*1.29*	2.279
537-268	POM-N-CHI-DE6	305	4.19	0.817
537-251	POM-N-CHI-DE7	151	7.78	1.390
537-334	POM-N-CHI-DE8	154	3.42	0.802
537-225	POM-N-CHI-DE9	587	4.27	1.846
537-242	POM-N-CHI-DE10	859	4.27	0.846
537-252	POM-N-CHI-DE11	940	5.66	0.858
537-238	POM-N-CHI-DE12	209	1.42	1.224
537-293	POM-N-CHI-DE13	40.1	*1.44*	3.323
537-262	POM-N-CHI-DE14	138	2.83	0.890
537-287	POM-N-CHI-DE15	247	*1.16*	1.282
Background				
BKGD07	POM-N-CHI-BK01	14.9	*0.437*	1.00
BKGD08	POM-N-CHI-BK02	9.18	*0.590*	2.08
BKGD11	POM-N-CHI-BK03	15.9	*0.831*	1.15
BKGD04	POM-N-CHI-BK04	5.84	*0.167*	1.15
POM-N-CHI-BK05	POM-N-CHI-BK05	13.5	*0.177*	1.96
POM-N-CHI-BK06	POM-N-CHI-BK06	6.72	3.23	1.99
POM-N-CHI-BK07	POM-N-CHI-BK07	8.1	*0.051*	0.717
POM-N-CHI-BK08	POM-N-CHI-BK08	6.23	*0.178*	0.834
POM-N-CHI-BK09	POM-N-CHI-BK09	21.8	*-0.35*	2.68
POM-N-CHI-BK10	POM-N-CHI-BK10	9.94	1.50	0.962

NOTES:
1, Values in *italics* are estimated values less than the MDL

TABLE 3
MERCURY CONCENTRATIONS IN YOUNG OF THE YEAR (YOY) FISH TISSUE
DELTA BIOLOGICAL INVESTIGATION
POMPTON LAKES, NEW JERSEY

Sample ID	Total Hg (ng/g)	Methyl Hg (ng/g)	Notes
Delta			
POM-N-FISHA-DE1	82.0	89.2	1
POM-N-FISHA-DE2	97.7	85.9	
POM-N-FISHA-DE3	69.8	66.8	
POM-N-FISHA-DE4	71.2	53.6	
POM-N-FISHA-DE5	128	93.0	
POM-N-FISHB-DE1	119	49.5	
POM-N-FISHB-DE2	101	56.1	
POM-N-FISHB-DE3	85.1	35.5	
POM-N-FISHB-DE4	82.1	56.5	
POM-N-FISHB-DE5	97.6	49.4	
POM-N-FISHC-DE1	151	172	1
POM-N-FISHC-DE2	165	167	1
POM-N-FISHC-DE3	126	99.9	
POM-N-FISHC-DE4	115	134	1
POM-N-FISHC-DE5	134	116	
Background			
POM-N-FISHA-BK1	29.2	35.8	1
POM-N-FISHA-BK2	31.9	36.1	1
POM-N-FISHA-BK3	31.8	33.4	1
POM-N-FISHA-BK4	32.2	35.8	1
POM-N-FISHA-BK5	32.9	34.5	1
POM-N-FISHB-BK1	23.2	20.9	
POM-N-FISHB-BK2	21.3	25.1	1
POM-N-FISHB-BK3	21.0	20.7	
POM-N-FISHB-BK4	22.5	27.7	1
POM-N-FISHB-BK5	22.5	34.2	1
POM-N-FISHC-BK1	62.5	56.6	
POM-N-FISHC-BK1	65.8	75.7	1
POM-N-FISHC-BK3	61.7	72.0	1
POM-N-FISHC-BK4	52.8	44.5	
POM-N-FISHC-BK5	64.0	74.8	1

NOTES:
FISHA = Bluegill
FISHB = Yellow Perch
FISHC = Largemouth Bass
1, Methylmercury concentration greater than total concentration due to analytical variability

TABLE 4
MERCURY CONCENTRATION IN ALGAL MAT SAMPLES
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

Sample ID	Total Hg (ng/g)	Methyl Hg1 (ng/g)	Sample Specific eMDL for Methyl Hg (ng/g)
Delta			
POM-N-ALGAE-DE1	79.4	5.17	0.253
POM-N-ALGAE-DE2	147	6.32	0.264
POM-N-ALGAE-DE3	44.8	4.12	0.264
Background			
POM-N-ALGAE-BK1	2.38	*0.161*	0.264
POM-N-ALGAE-BK2	2.27	*0.133*	0.264
POM-N-ALGAE-BK3	5.47	*0.108*	0.253

NOTES:
*Values in *italics* are estimated values less than the MDL

TABLE 5
DENSITY OF BENTHIC MACROINVERTEBRATES (INDIVIDUALS PER SAMPLE)
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

CLASS/SUBCLASS / ORDER / SUBORDER / FAMILY	GENUS SPECIES	DELTA STATIONS 537-208			537-209			537-215			537-218			537-225			537-228			537-235			537-238			537-239			537-241			537-242			537-251			537-252			537-261			537-262		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
ARACHNIDA																																														
TROMBIDFORMES																																														
HYDRACARINA				9				6		18		6		6	12		1			27	24			3				18					6				8				2				3	
BIVALVIA																																														
VENEROIDA																																														
SPHAERIIDAE																															3		6			23	15								6	
COPEPODA																																														
HARPACTICOIDA		122	135	198	38	810	218	66	117	216	348	168	161	72	117	20	92	113	222	270	264	158	63	216	130	65	318	186	135	63	93	504	474	62	278	195	353	177	408	204	81	75	80	216	168	60
GASTROPODA																																														
ARCHITAENIOGLOSSA																																														
VIVIPARIDAE																																						3							3	
BASOMMATOPHORA																																														
PHYSIDAE		9	4		19							3	19							63	108	128																								
PLANORBIDAE		5		63	19	15	8			12			4							99	36	75																							3	
HETEROSTROPHA																																														
VALVATIDAE																																														
	VALVATA TRICARINATA																																			8										
HIRUDINEA								6																																						
ARHYNCHOBDELLIDA																																														
HAEMOPIDAE	*HAEMOPIS* sp.	5																																												
INSECTA																																														
COLEOPTERA																			3																											
ELMIDAE	*DUBIRAPHIA* sp.																																													
HYDROPHILIDAE																																														
DIPTERA			4	18					3				4							9																										
CERATOPOGONIDAE		50	41	9	19	45	38	18		30	6			3	12	5	2	5	36		24	15			4	11	6		3			12	6	3		8				3	21	3	1	6		
CHAOBORIDAE	*CHAOBORUS* sp.																																													
CHIRONOMIDAE		77	90	180	203	540	218	180	141	144	114	45	135	195	102	125	4	20	12	9	12	53	34	69	62	62	252	360	84	60	171	60	66	60	428	368	300	90	120	93	12	18	8	57	108	77
STRATIOMYIDAE																																														
SYRPHIDAE												18																																		
EPHEMEROPTERA																																														
CAENIDAE	*CAENIS* sp.			9																																										
NEOEPHEMERIDAE	*NEOEPHEMERA* sp.																																													
ODONATA																																														
ANISOPTERA																																														
GOMPHIDAE	*GOMPHUS* sp.		4																																											
CORDULEGASTRIDAE																																														
	CORDULEGASTER sp.																																													
CORDULIIDAE	*SOMATOCHLORA* sp.																																													
	TETRAGONEURIA sp.			27	4																										3										2					
LIBELLULIDAE																																														
	ERYTHEMIS sp.	5																																												
	PACHYDIPLAX sp.																																													
ZYGOPTERA																																														
COENAGRIONIDAE				27			8																																							
	ENALLAGMA sp.				8																																									
TRICHOPTERA																																														
HYDROPTILIDAE																																												6		
	HYDROPTILA sp.								6	24																																				
	NEOTRICHIA sp.																																													
LEPTOCERIDAE	*LEPTOCERUS AMERICANUS*																																													
	OECETIS sp.																																													
MALACOSTRACA																																														
AMPHIPODA																																														
GAMMARIDAE	*GAMMARUS FASCIATUS*		4	9			8		3												60																									
HYALELLIDAE	*HYALELLA AZTECA*	72	56	270	41	45	8		6		18	3								342	588	278								3								3								
ISOPODA																																														
ASELLIDAE	*ASELLUS MILITARIS*	5	4	27	8															72	72	45																								
NEMATODA		5	11			15	15				102	24	26						3						2	6			6			6	6		30	60	38	6	6	3						
OLIGOCHAETA		95	19	54	8	45	225	324	24	132	12	24	23	24	57	2	1	14	24				3	12	2	8	24	36	72	171	30	18	36	26	15	90	38	21	66		33	6	11		9	14
HAPLOTAXIDA																																														
ENCHYTRAEIDAE																																														
NAIDIDAE																																														
TUBIFICIDAE																																														
RHYNCHOBDELLIDA																																															
GLOSSIPHONIIDAE	*HELOBDELLA STAGNALIS*	5	4		8		8			6		3	4																																	
TURBELLARIA																																														
TRICLADIDA																																														
PLANARIIDAE										18		3								9	12									3																

TABLE 5
DENSITY OF BENTHIC MACROINVERTEBRATES (INDIVIDUALS PER SAMPLE)
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

CLASS/SUBCLASS	ORDER	SUBORDER	FAMILY	GENUS SPECIES	DELTA STATIONS 537-266 A	537-266 B	537-266 C	537-267 A	537-267 B	537-267 C	537-268 A	537-268 B	537-268 C	537-287 A	537-287 B	537-287 C	537-293 A	537-293 B	537-293 C	537-295 A	537-295 B	537-295 C	537-327 A	537-327 B	537-327 C	537-334 A	537-334 B	537-334 C	537-339 A	537-339 B	537-339 C
ARACHNIDA																															
	TROMBIDIFORMES																														
		HYDRACARINA			2			6	36	30								18	9			8		18							
BIVALVIA																															
	VENEROIDA																														
			SPHAERIIDAE			1								2		3			9				45	6	30						
COPEPODA																															
	HARPACTICOIDA				101	9	88	108	924	1020	87	178	66	74	107	6	333	459	432	233	60	75	840	78	360	324	228	210	150	95	255
GASTROPODA																															
	ARCHITAENIOGLOSSA																														
			VIVIPARIDAE			1				30				2						8				6							12
	BASOMMATOPHORA																														
			PHYSIDAE		6		1	3		15						1						4									
			PLANORBIDAE		3	1		9	12	15																					
	HETEROSTROPHA																														
			VALVATIDAE																												
				VALVATA TRICARINATA																4											
HIRUDINEA					2																										
	ARHYNCHOBDELLIDA																														
			HAEMOPIDAE	*HAEMOPIS* sp.																											
INSECTA																															
	COLEOPTERA																														
			ELMIDAE	*DUBIRAPHIA* sp.																											
			HYDROPHILIDAE																												
	DIPTERA				2	1										1														1	
			CERATOPOGONIDAE				3	3		45	7		12	5	2			9			4			18		6			6		15
			CHAOBORIDAE	*CHAOBORUS* sp.									1																4		
			CHIRONOMIDAE		2	4			12	30		16	4	50	8	21	432	243	261			4	555	282	1050	168	246	87	20		3
			STRATIOMYIDAE																												
			SYRPHIDAE																												
	EPHEMEROPTERA																														
			CAENIDAE	*CAENIS* sp.																											
			NEOEPHEMERIDAE	*NEOEPHEMERA* sp.																											
	ODONATA																														
		ANISOPTERA																													
			GOMPHIDAE	*GOMPHUS* sp.																											
			CORDULEGASTRIDAE																												
				CORDULEGASTER sp.																											
			CORDULIIDAE	*SOMATOCHLORA* sp.																											
				TETRAGONEURIA sp.																											
			LIBELLULIDAE		2																										
				ERYTHEMIS sp.																											
				PACHYDIPLAX sp.																											
		ZYGOPTERA																													
			COENAGRIONIDAE		5																										
				ENALLAGMA sp.																				6			6				
	TRICHOPTERA																							12							
			HYDROPTILIDAE																					6							
				HYDROPTILA sp.																											
				NEOTRICHIA sp.																											
			LEPTOCERIDAE	*LEPTOCERUS AMERICANUS*																											
				OECETIS sp.																											
MALACOSTRACA																															
	AMPHIPODA																														
			GAMMARIDAE	*GAMMARUS FASCIATUS*				9	72											15	4	109									
			HYALELLIDAE	*HYALELLA AZTECA*	3			144	84	255								9		4	139	86		6							
	ISOPODA																														
			ASELLIDAE	*ASELLUS MILITARIS*	2			18	36											109	128	71									
NEMATODA					2		1		12	45		2	1	2			18	27	90	4			15	6		12		3	4		3
OLIGOCHAETA					12	13	33		12		6	4	16	21	35	26	117	135	99		19		45	120	45	90	120		16	4	12
	HAPLOTAXIDA																														
			ENCHYTRAEIDAE																												
			NAIDIDAE																												
			TUBIFICIDAE																												
	RHYNCHOBDELLIDA																														
			GLOSSIPHONIIDAE	*HELOBDELLA STAGNALIS*		1				15			1								23	4		12	15						
TURBELLARIA																															
	TRICLADIDA																														
			PLANARIIDAE		11																	15		24							

CLASS/SUBCLASS	ORDER	SUBORDER	FAMILY	GENUS SPECIES	BACKGROUND STATIONS BK-1 A	BK-1 B	BK-1 C	BK-2 A	BK-2 B	BK-2 C	BK-3 A	BK-3 B	BK-3 C	BK-4 A	BK-4 B	BK-4 C	BK-5 A	BK-5 B	BK-5 C
ARACHNIDA																			
	TROMBIDIFORMES																		
		HYDRACARINA							1		5								
BIVALVIA																			
	VENEROIDA																		
			SPHAERIIDAE								5	3	4		6			1	
COPEPODA																			
	HARPACTICOIDA				55		176	135	33	86	110	22	33	87	252	250	40	25	16
GASTROPODA																			
	ARCHITAENIOGLOSSA																		
			VIVIPARIDAE		5	24		6	18	8	25	13	3				13	10	11
	BASOMMATOPHORA																		
			PHYSIDAE		4	6		4	7				3				7	1	1
			PLANORBIDAE			1	2		4			1				5	2		2
	HETEROSTROPHA																		
			VALVATIDAE																
				VALVATA TRICARINATA				11	22	9	45	10	2				5	1	
HIRUDINEA																			
	ARHYNCHOBDELLIDA																		
			HAEMOPIDAE	*HAEMOPIS* sp.						2									
INSECTA																			
	COLEOPTERA																		
			ELMIDAE	*DUBIRAPHIA* sp.															
			HYDROPHILIDAE																
	DIPTERA										5								
			CERATOPOGONIDAE						1		10	2			9	100			
			CHAOBORIDAE	*CHAOBORUS* sp.												5			
			CHIRONOMIDAE						4	2	55	5	8	4		15	5	4	2
			STRATIOMYIDAE																
			SYRPHIDAE																
	EPHEMEROPTERA																		
			CAENIDAE	*CAENIS* sp.															
			NEOEPHEMERIDAE	*NEOEPHEMERA* sp.															
	ODONATA																		
		ANISOPTERA																	
			GOMPHIDAE	*GOMPHUS* sp.															
			CORDULEGASTRIDAE																
				CORDULEGASTER sp.															
			CORDULIIDAE	*SOMATOCHLORA* sp.															
				TETRAGONEURIA sp.															
			LIBELLULIDAE																
				ERYTHEMIS sp.								2							
				PACHYDIPLAX sp.															
		ZYGOPTERA																	
			COENAGRIONIDAE			1			1			1							
				ENALLAGMA sp.													5		
	TRICHOPTERA																		
			HYDROPTILIDAE																
				HYDROPTILA sp.															
				NEOTRICHIA sp.															
			LEPTOCERIDAE	*LEPTOCERUS AMERICANUS*															
				OECETIS sp.															
MALACOSTRACA																			
	AMPHIPODA																		
			GAMMARIDAE	*GAMMARUS FASCIATUS*	9	18	11		5	2		5	1						34
			HYALELLIDAE	*HYALELLA AZTECA*				15	18			11	8			5	7	5	3
	ISOPODA																		
			ASELLIDAE	*ASELLUS MILITARIS*	23	6	2	9	10	33	10	1	2				4		28
NEMATODA						1			1	2	10	10	1		18	70	2	1	
OLIGOCHAETA									11		210	14	27	9	12	50	1	1	
	HAPLOTAXIDA																		
			ENCHYTRAEIDAE					6											
			NAIDIDAE																
			TUBIFICIDAE				2			8									
	RHYNCHOBDELLIDA																		
			GLOSSIPHONIIDAE	*HELOBDELLA STAGNALIS*	2					2	10	2						3	1
TURBELLARIA														3					
	TRICLADIDA																		
			PLANARIIDAE		2		2												2

TABLE 5
DENSITY OF BENTHIC MACROINVERTEBRATES (INDIVIDUALS PER SAMPLE)
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

CLASS/SUBCLASS / ORDER / SUBORDER / FAMILY	GENUS SPECIES	BACKGROUND STATIONS																																												
		BK-6			BK-7			BK-8			BK-9			BK-10			BK-11			BK-12			BK-13			BK-14			BK-15			BK-16			BK-17			BK-18			BK-19			BK-20		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
ARACHNIDA																																														
TROMBIDIFORMES																																														
HYDRACARINA							14	5	23			3		2		5		18	1						1	8	8			3	3	15	3	34	3	8	2	2			2	3	3			
BIVALVIA																																														
VENEROIDA																																														
SPHAERIIDAE							5	8	45	8	54	23	27	13	60					15			3	8																						
COPEPODA																																														
HARPACTICOIDA			80	18	360	234	261	5	90	15	24	88	3	14	45	45	108	54	12	293	1305	300	40	353	31	278	285	203	116	108	23	360	138	236	261	281	135	27			153	86	155	370	261	34
GASTROPODA																																														
ARCHITAENIOGLOSSA																																														
VIVIPARIDAE		2	18	27			36	17	98	75	12		42	2	9	10	3	51	14	90		45	5	38	3	30	30	30	26	8	15	5		4				1	2			3		15		
BASOMMATOPHORA																																														
PHYSIDAE				30				6	15	19			9	1		30	2	12	6	45		23	3	8	12	45	23	8	68	20	98		15	15	3	4	2	1	2	1		8		20		
PLANORBIDAE				9			54	17	120	30	6		9	1	3	95	8	78	32	53	45	75	18	45	9	53	8	23	68	5	38		9			8		1	1			5				1
HETEROSTROPHA																																														
VALVATIDAE																									2																2					
	VALVATA TRICARINATA		3	3			14	5	8		27	15	3	17	45	15	2	12	2	15		8	15	30		15		23			3											3				
HIRUDINEA											15													8																						
ARHYNCHOBDELLIDA																																														
HAEMOPIDAE	*HAEMOPIS* sp.																																													
INSECTA																																														
COLEOPTERA								2																																						
ELMIDAE	*DUBIRAPHIA* sp.			3					8			25		19		65														3	3															
HYDROPHILIDAE																																											3			
DIPTERA													3													8							3													
CERATOPOGONIDAE					25	3		8	53	19	18	3	9	2	3	10	3	3		8		8	3							10	3	10	12			4		4	2	4	25	23	60	30		2
CHAOBORIDAE	*CHAOBORUS* sp.																													5			6		9	4		1		1	2	2		10	15	7
CHIRONOMIDAE				6	10	6	14	59	128	128	48	33	48	8	69	50	5	12	7	53	15	75	10	15	3	23	30	8	64	48	28	25	54	23	9	49	13	11	6	12	16	12	18	20	6	2
STRATIOMYIDAE													9																																	
SYRPHIDAE																																														
EPHEMEROPTERA																																														
CAENIDAE	*CAENIS* sp.								8	4								6																					1							
NEOEPHEMERIDAE	*NEOEPHEMERA* sp.															10				8		15																								
ODONATA																																														
ANISOPTERA																																						3								
GOMPHIDAE	*GOMPHUS* sp.																																													
CORDULEGASTRIDAE																																						1								
	CORDULEGASTER sp.																	12	1																											
CORDULIIDAE	*SOMATOCHLORA* sp.																			8																										
	TETRAGONEURIA sp.																																													
LIBELLULIDAE													6	1																																
	ERYTHEMIS sp.							3												15						8																				
	PACHYDIPLAX sp.																	3																												
ZYGOPTERA													3																																	
COENAGRIONIDAE								2								10				45	15	60	3	15							10			15										10		
	ENALLAGMA sp.						5																																							
TRICHOPTERA																																														
HYDROPTILIDAE					5								9			10				15	15	8																								
	HYDROPTILA sp.							2	23											8			3																							
	NEOTRICHIA sp.																			8																										
LEPTOCERIDAE	*LEPTOCERUS AMERICANUS*																				15	8																								
	OECETIS sp.															10																														
MALACOSTRACA																																														
AMPHIPODA																																														
GAMMARIDAE	*GAMMARUS FASCIATUS*	24		12					8				48	7		15							5	53	1	15																				
HYALELLIDAE	*HYALELLA AZTECA*	9	45	57			9	9	60	8	42	3	30	1	12	80		6	3	8		15	20	38	4	158	240	375	4	3	10		6	15				1		3	2					
ISOPODA																																														
ASELLIDAE	*ASELLUS MILITARIS*	16	95	9				2			9					10							13		1	8	45	8		3																
NEMATODA						3	5	2			3	13		4	12		2	3		8		8		8	2			15		3	5	10			3			4	1		11	3	3	5	3	
OLIGOCHAETA			8				14	5	38	19	24	35	33	23	36	10	20	18	18	60	105	105	105	113		68	68	30	30	30	13	75	51	30	12	19	15	3	5	11	11	5	10	20	15	7
HAPLOTAXIDA																																														
ENCHYTRAEIDAE					15	12																			20																					
NAIDIDAE					5																																									
TUBIFICIDAE					80	42																			5																					
RHYNCHOBDELLIDA																																														
GLOSSIPHONIIDAE	*HELOBDELLA STAGNALIS*		3	12			9		38	53	15	13	18	2	6			12						8		15	8			5	5		3	4				3		4						
TURBELLARIA																																														
TRICLADIDA																																														
PLANARIIDAE				6							3					20			4			15	5	23		38	8	30			3															

TABLE 6
SUMMARY OF TAXA IDENTIFIED FROM POMPTON LAKE DELTA AND BACKGROUND STATIONS
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

CLASS/SUBCLASS	ORDER	SUBORDER	FAMILY	GENUS SPECIES	DISTINCT TAXON?[8]	TOLERANCE VALUE[1]	NUMBER OF SAMPLES TAXON PRESENT	
							DELTA	BACKGROUND
ARACHNIDA					NO			
	TROMBIDFORMES				NO			
		HYDRACARINA			YES	NA	23	25
BIVALVIA					NO			
	VENEROIDA				NO			
			SPHAERIIDAE		YES	8	12	17
COPEPODA					NO			
	HARPACTICOIDA				YES	8[2]	72	56
GASTROPODA					NO			
	ARCHITAENIOGLOSSA				NO			
			VIVIPARIDAE		YES	6	8	43
	BASOMMATOPHORA				NO			
			PHYSIDAE		YES	8	14	39
			PLANORBIDAE		YES	7	16	38
	HETEROSTROPHA				NO			
			VALVATIDAE		NO	NA		2
				VALVATA TRICARINATA	YES	8[3]	2	30
HIRUDINEA					NO	10	2	2
	ARHYNCHOBDELLIDA				NO			
			HAEMOPIDAE	HAEMOPIS	YES	10[4]	1	1
INSECTA					NO			
	COLEOPTERA				NO	NA	1	1
			ELMIDAE	DUBIRAPHIA	YES	6		7
			HYDROPHILIDAE		YES	5		1
	DIPTERA				NO	7	9	4
			CERATOPOGONIDAE		YES	6	43	34
			CHAOBORIDAE	CHAOBORUS	YES	NA	2	12
			CHIRONOMIDAE		YES	6	66	53
			STRATIOMYIDAE		YES	8		1
			SYRPHIDAE		YES	10	1	
	EPHEMEROPTERA				NO			
			CAENIDAE	CAENIS	YES	7	1	4
			NEOEPHEMERIDAE	NEOEPHEMERA	YES	NA		3
	ODONATA				NO			
		ANISOPTERA			NO	NA		1
			GOMPHIDAE	GOMPHUS	YES	5	1	
			CORDULEGASTRIDAE		NO	NA		1
				CORDULEGASTER	YES	3		2
			CORDULIIDAE	SOMATOCHLORA	YES	1		1
				TETRAGONEURIA	YES	9	4	
			LIBELLULIDAE		NO	9	1	2
				ERYTHEMIS	YES	NA	1	4
				PACHYDIPLAX	YES	9.6[5]		1
		ZYGOPTERA			NO	NA		1
			COENAGRIONIDAE		NO	9	3	13
				ENALLAGMA	YES	8	3	2
	TRICHOPTERA				NO	NA	1	
			HYDROPTILIDAE		NO	4	2	6
				HYDROPTILA	YES	6	2	4
				NEOTRICHIA	YES	4		1
			LEPTOCERIDAE	LEPTOCERUS AMERICANUS	YES	4[6]		2
				OECETIS	YES	8		1
MALACOSTRACA					NO			
	AMPHIPODA				NO			
			GAMMARIDAE	GAMMARUS FASCIATUS	YES	6	10	18
			HYALELLIDAE	HYALELLA AZTECA	YES	8	23	39
	ISOPODA				NO			
			ASELLIDAE	ASELLUS MILITARIS	YES	9.4[7]	13	23
NEMATODA					YES	5	36	35
OLIGOCHAETA					NO	5	62	49
	HAPLOTAXIDA				NO			
			ENCHYTRAEIDAE		YES	10		4
			NAIDIDAE		YES	NA		1
			TUBIFICIDAE		YES	10		5
	RHYNCHOBDELLIDA				NO			
			GLOSSIPHONIIDAE	HELOBDELLA STAGNALIS	YES	7	14	26
TURBELLARIA					NO	4		1
	TRICLADIDA				NO			
			PLANARIIDAE		YES	1	8	14

Notes:
1, Tolerance values selected from Rapid Bioassessment Protocol (Barbour et al. 1999) in the following order of preference:
1) Mid-Atlantic (MACS)
2) Midwest (OH)
3) Southeast (NC)
4) Upper Midwest (WI)
5) Northwest (ID)
2, Tolerance value for Copepoda used as a surrogate
3, Tolerance value for Valvata used as a surrogate
4, Tolerance value for Hirudinea used as surrogate
5, Tolerance value for *Pachydiplax longipennis* used as surrogate
6, Tolerance value for Leptoceridae used as a surrogate
7, Tolerance value for *Asellus* used as a surrogate
8, A taxon is considered distinct if it is identified to the highest resolution within its respective taxonomic hierarchy.

TABLE 7
IN SITU WATER QUALITY PARAMETERS
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

Sampling Location	Water Depth (feet)	pH	Conductivity (uS/cm)	Temperature (°C)	Dissolved Oxygen (mg/L)	Turbidity (NTU)
Acid Brook Delta						
537-215	3.2	8.85	0.394	24.6	12.03	14
537-295	3.8	9.09	0.41	25.5	12.92	10
537-327	3.4	9.29	0.397	25.8	13.57	6
537-339	7.0	9.16	0.398	26.3	13.2	7
537-251	3.4	9.2	0.398	25.4	13.13	8
537-334	4.5-5.5	9.11	0.395	26.3	12.52	7
537-239	3.4	9.11	0.401	25.0	11.61	9
537-228	4.0	9.1	0.4	26.9	13.6	8
537-268	6.1	9.19	0.401	26.4	13.07	8
537-241	3.8	8.94	0.408	24.1	11.7	6
537-208	2.5	7.35	0.403	24.4	8.57	11
537-261	5.5	9.13	0.402	25.5	12.18	5
537-209	1	8.58	0.372	26.8	12.54	19
537-235	2.5	9.66	0.413	28.3	15.89	26
537-266	1	9.23	0.402	26.1	13.77	15
537-267	2.5	8.88	0.4	24.9	9.58	10
537-218	2.5	7.27	0.376	22.0	8.22	6
537-225	3.0	8.97	0.398	23.2	11.42	8
537-242	3.5	8.93	0.401	23.5	10.23	22
537-252	7.1	9.35	0.393	24.0	12.85	8
537-238	6.0	9.52	0.395	24.7	14.39	9
537-293	3.5	9.25	0.407	25.7	13.91	8
537-262	5.4	9.46	0.394	24.0	11.83	10
537-287	5.6	9.34	0.398	24.7	12.8	10
Background						
Bkgd-01	2.5	9.44	0.4	27.6	18.5	8
Bkgd-02	3.0-3.5	9.35	0.398	26.7	18.3	4
Bkgd-03	5.0	9.43	0.398	26.6	17.9	7
Bkgd-04	5.8	9.43	0.41	25.8	16.57	5
Bkgd-05	3.0-3.5	9.54	0.406	27.4	15.8	4
Bkgd-06	2.5	9.41	0.423	26.4	15.17	5
Bkgd-07	6.5	9.46	0.411	27.6	16.82	43
Bkgd-08	5.3	9.55	0.413	26.7	19.83	18
Bkgd-09	3.5	9.53	0.41	26.8	18.71	15
Bkgd-10	1.5	9.59	0.406	26.9	17.69	10
Bkgd-11	5.5	9.12	0.412	24.7	12.8	6
Bkgd-12	4	8.82	0.414	25.0	10.61	7
Bkgd-13	3	8.98	0.412	24.8	11.3	7
Bkgd-14	2	9.12	0.413	25.6	11.9	9
Bkgd-15	2	9.23	0.418	26.7	13.13	6
Bkgd-16	3	7.86	0.429	26.4	6.2	19
Bkgd-17	4	9.1	0.424	25.8	10.55	8
Bkgd-18	2	8.51	0.425	25.8	7.96	7
Bkgd-19	3	9.53	0.412	27.8	16.74	8
Bkgd-20	4.5	9.7	0.412	29.1	18.7	2

TABLE 8
SEDIMENT TOC AND GRAIN SIZE DATA
DELTA BIOLOGICAL INVESTIGATION - AUGUST 2005
POMPTON LAKES, NEW JERSEY

Sample ID	Water Depth (feet)	% Greater Than Fine Sand	Fine Sand (% dry weight)	Fine-Grained Sediment1 (% dry weight)	TOC (% dry weight)
2005 - Background					
POM-E-CHI-BK1	2.5	6.9	42.1	51.0	3.56
POM-E-CHI-BK2	3-3.5	18.2	49.6	32.2	11.0
POM-E-CHI-BK3	5	4.7	13.9	81.4	4.82
POM-E-CHI-BK4	5.8	2.1	8.2	89.7	3.28
POM-E-CHI-BK5	3-3.5	26.6	46.5	26.9	2.86
POM-E-CHI-BK6	2.5	80	15.4	4.6	9.15
POM-E-CHI-BK7	6.5	2.8	24.1	73.1	2.73
POM-E-CHI-BK8	5.3	34.9	51.8	13.3	0.84
POM-E-CHI-BK9	3.5	31	51.6	17.4	0.62
POM-E-CHI-BK10	1.5	32.2	44.2	23.6	2.34
POM-E-CHI-BK11	5.5	0.9	3.9	95.2	2.47
POM-E-CHI-BK12	4	20.6	36.1	43.3	6.57
POM-E-CHI-BK13	3	26.1	35.3	38.6	5.9
POM-E-CHI-BK14	2	5.7	36.5	57.8	1.6
POM-E-CHI-BK15	2	47.3	29.1	23.6	7.42
POM-E-CHI-BK16	3	9.5	32.6	57.9	3.7
POM-E-CHI-BK17	4	11.5	34.9	53.6	12.7
POM-E-CHI-BK18	2	11.9	45.5	42.6	1.36
POM-E-CHI-BK19	3	13.3	25.8	60.9	3.38
POM-E-CHI-BK20	4.5	32.2	26.3	41.5	2.88

Notes:
1, Combined silt and clay fractions

FIGURES

URS

N

SCALE: 1 INCH=1000 FEET

1000' 0 1000'

Job: 18984480.00002	ACID BROOK DELTA AND BACKGROUND SAMPLING AREAS POMPTON LAKE DuPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: TFP	
Checked by:	
Date: 02/17/2006	FIGURE 1

Drawn By & Date/Time: tfpower0 Mar 27, 2006 - 2:41pm

Drawing Location & Name: K:\18984480\deltasurface2A.dwg

Drawn By & Date/Time: tfpower0 Feb 17, 2006 - 12:36pm

URS

N

LEGEND:

537-334 — 2005 BENTHIC COMMUNITY SAMPLING LOCATION

POM-N-CHI-DE8 — 2005 BENTHIC TISSUE SAMPLING LOCATION

SCALE: 1 INCH=160 FEET

160' 0 160'

Job: 18984480.00002	BENTHIC MACROINVERTEBRATE SAMPLING LOCATIONS ACID BROOK DELTA DuPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: TFP	
Checked by:	
Date: 02/17/2006	FIGURE 2

Drawing Location & Name: K:\18984480\deltasurface3.dwg

URS

LEGEND:

- BENTHIC COMMUNITY SAMPLE ONLY
- BENTHIC TISSUE & COMMUNITY SAMPLE
- BENTHIC TISSUE SAMPLE ONLY

SCALE: 1 INCH=100 FEET

100' 0 100'

Job: 18984480.00002	BENTHIC MARCOINVERTEBRATE COMMUNITY AND TISSUE SAMPLING LOCATIONS, BACKGROUND AREAS 1 AND 2 ACID BROOK DELTA DuPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: TP	
Checked by:	
Date: 02/17/2006	FIGURE 3

Drawn By & Date/Time: tfpower0 Jul 29, 2005 - 9:45am

Drawing Location & Name: K:\18984480\deltasurface4.dwg

URS

N

LEGEND:

FISH TISSUE SAMPLING LOCATION

SCALE: 1 INCH=1000 FEET

1000' 0 1000'

Job: 18984480.00002	**FISH TISSUE SAMPLING AREAS** POMPTON LAKE DuPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: TFP	
Checked by:	
Date: 02/17/2006	FIGURE 4

Drawn By & Date/Time: tfpower0 Feb 17, 2006 - 12:11pm

URS

N

LEGEND:

● POM-N-ALGAE-BK2 ALGAL TISSUE SAMPLE LOCATION

SCALE: 1 INCH=1000 FEET

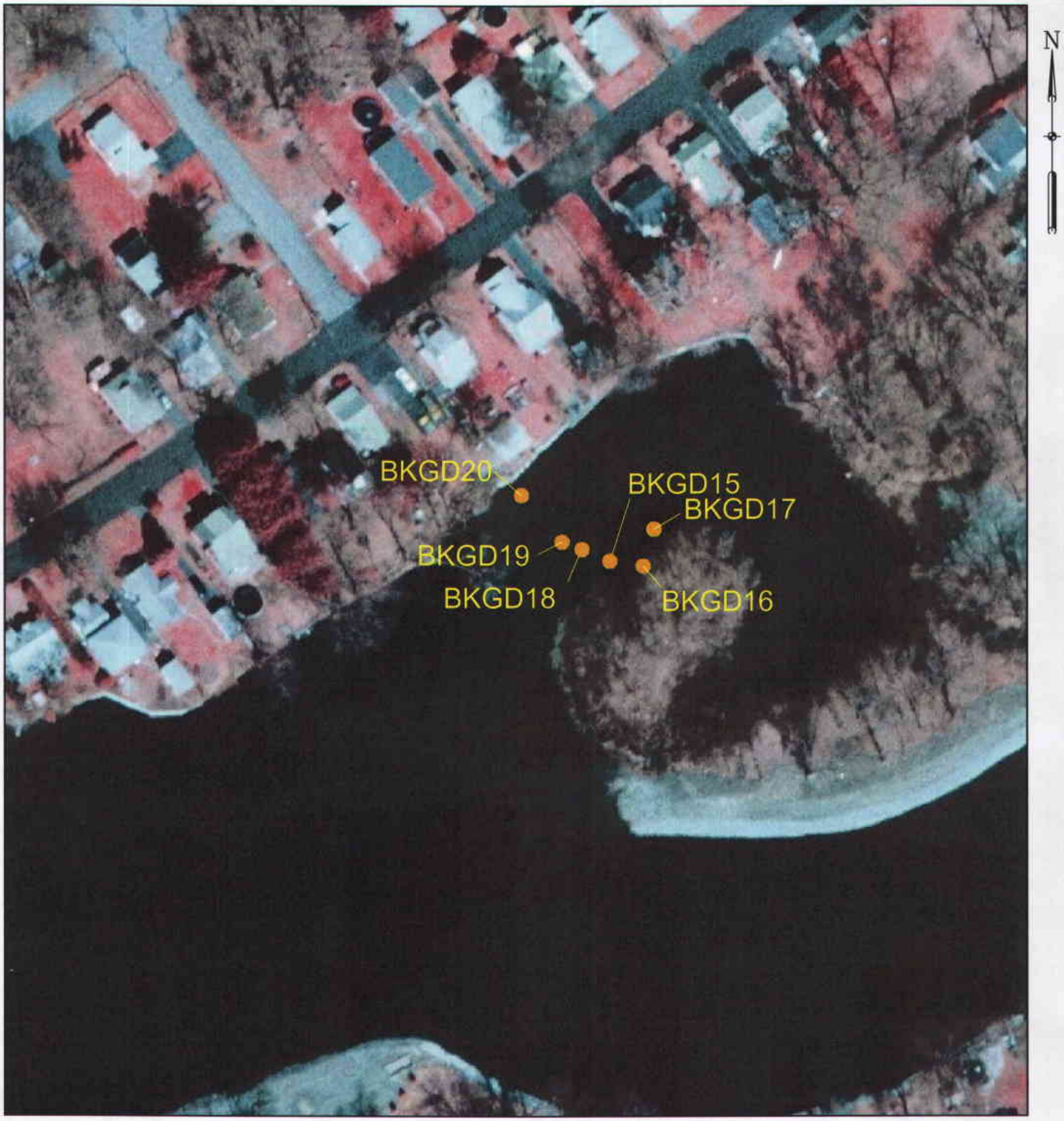
1000' 0 1000'

Job: 18984480.00002	**ALGAL TISSUE SAMPLE LOCATIONS** DELTA AND BACKGROUND DuPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: TFP	
Checked by:	
Date: 02/17/2006	FIGURE 5

Drawing Location & Name: K:\18984480\deltasurface2b.dwg

Drawing Location & Name: K:\18984480\deltasurface4.dwg   Drawn By & Date/Time: tfpower0 Jul 29, 2005 - 9:45am

URS



LEGEND:

● BENTHIC COMMUNITY SAMPLE ONLY

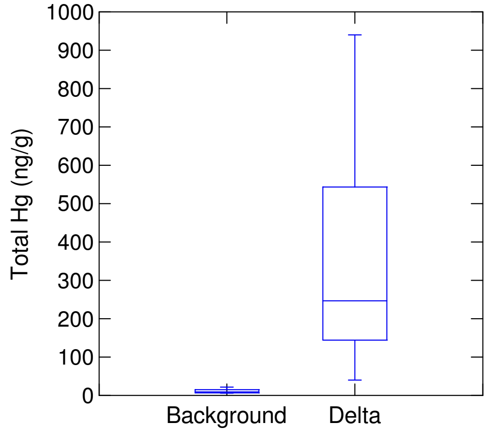
SCALE: 1 INCH=100 FEET

100'   0   100'

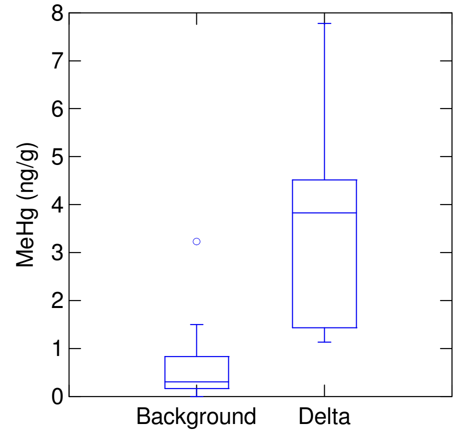
Job: 18984480.00002	**BENTHIC MACROINVERTEBRATE COMMUNITY AND TISSUE SAMPLING LOCATIONS** BACKGROUND AREA 3 ACID BROOK DELTA DuPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: TP	
Checked by:	
Date: 02/17/2006	FIGURE 6

CHIRONOMIDS

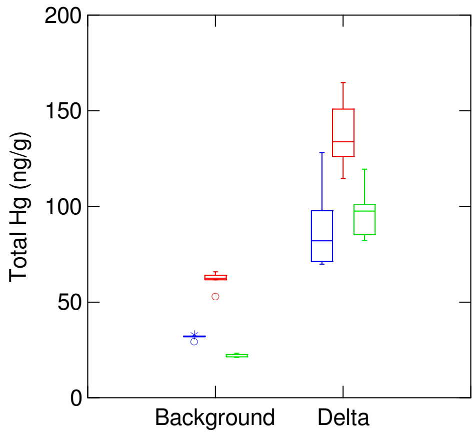
Total Mercury

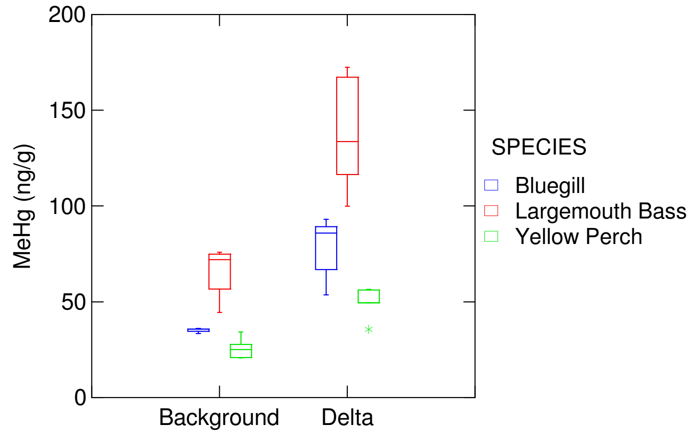


Methylmercury

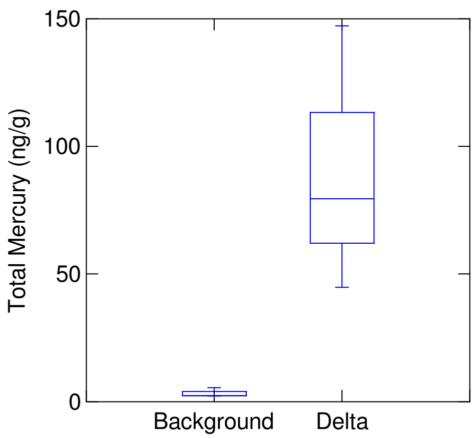


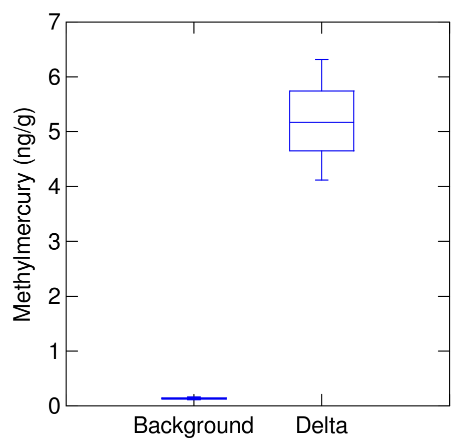
YOY FISH





ALGAL MATS





Notes:

*, Indicates outside values greater than 1.5 times the interquartile range plus/minus the quartile values.

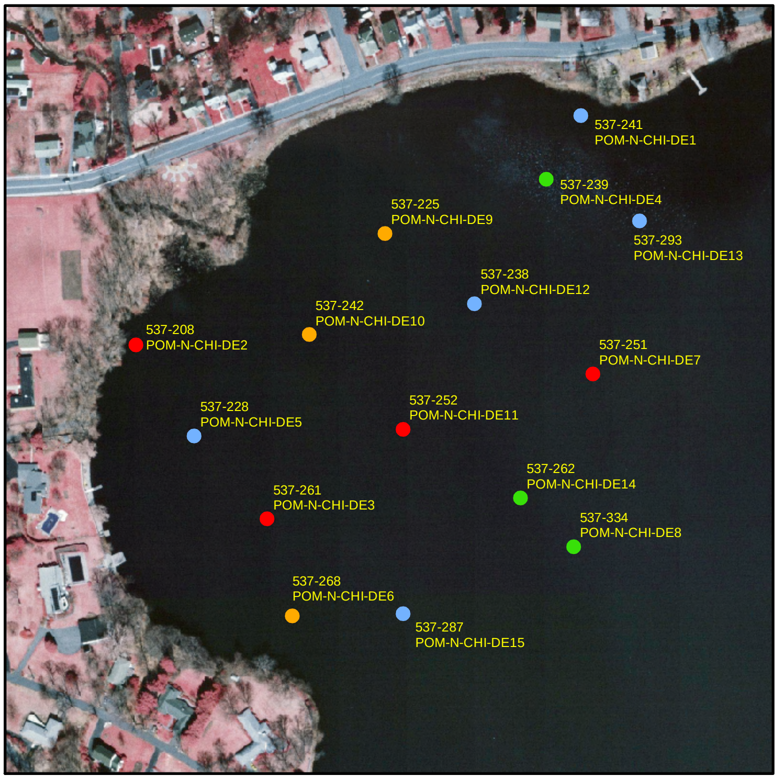
o, Indicates far outside values greater than 3 times the interquartile range plus/minus the quartile values.

Job No.	18984480.00002
Prepared by:	DTL
Date:	1/12/06

BIOLOGICAL TISSUE ANALYSES
DELTA BIOLOGICAL INVESTIGATION – AUGUST 2005
POMPTON LAKES, NEW JERSEY

FIGURE 7

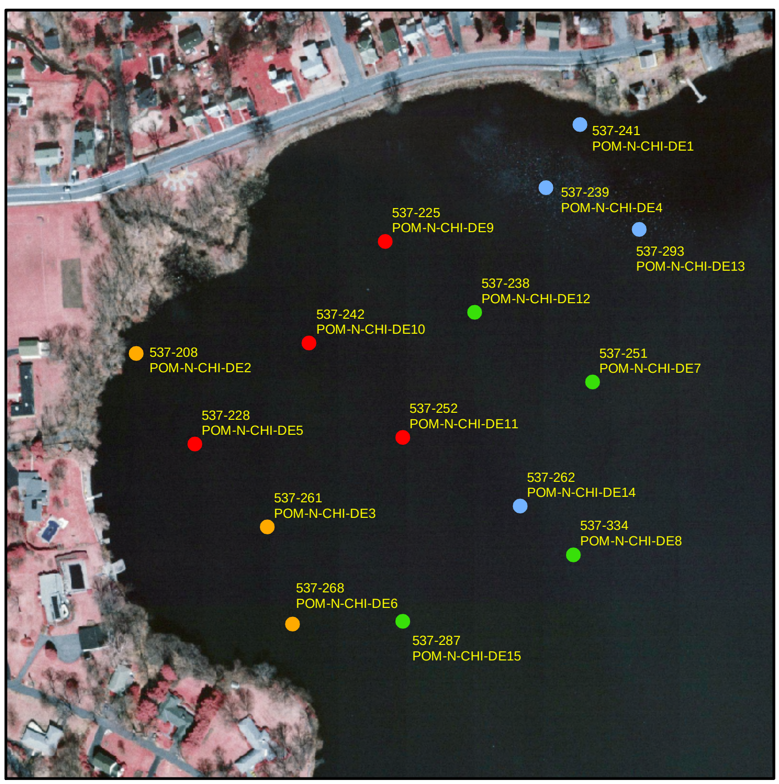
Methylmercury Concentrations (ng/g)



LEGEND

- < 1.5
- 1.5 - 4.0
- 4.0 - 4.5
- >4.5

Total Mercury Concentrations (ng/g)



LEGEND

- <150
- 150 - 250
- 250 - 550
- >550

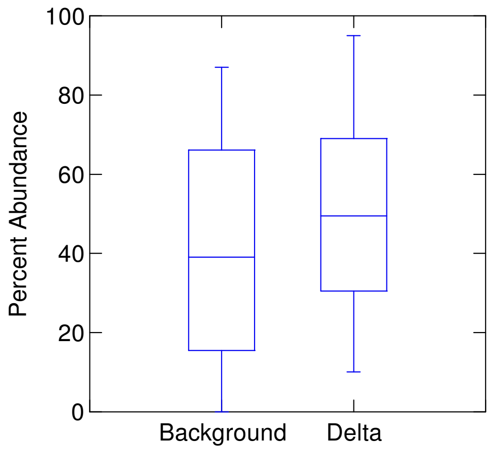
N

URS

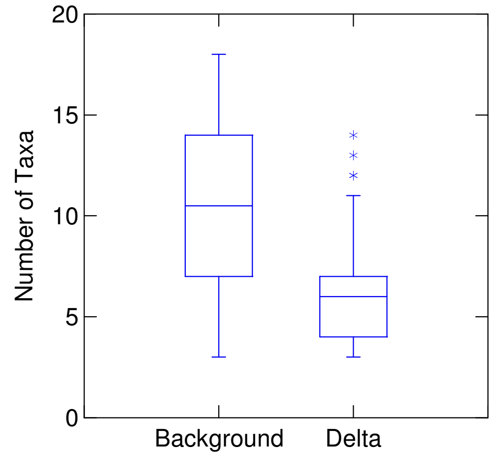
0 200 400 Feet

Job: 18984480.00002	BENTHIC MACROINVERTEBRATE TISSUE CONCENTRATIONS FOR METHYL & TOTAL MERCURY ACID BROOK DELTA DUPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: RRM III	
Check by: DL	
Date: 10/12/2005	FIGURE 8

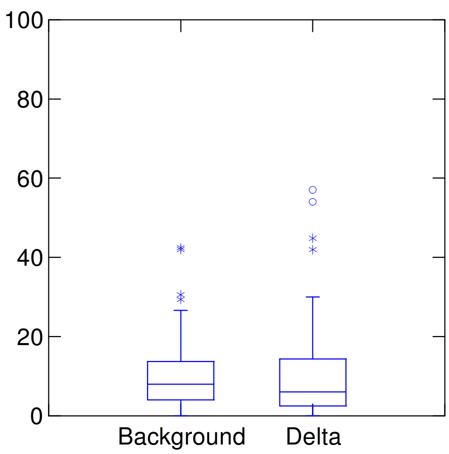
PERCENT HARPACTICOIDA



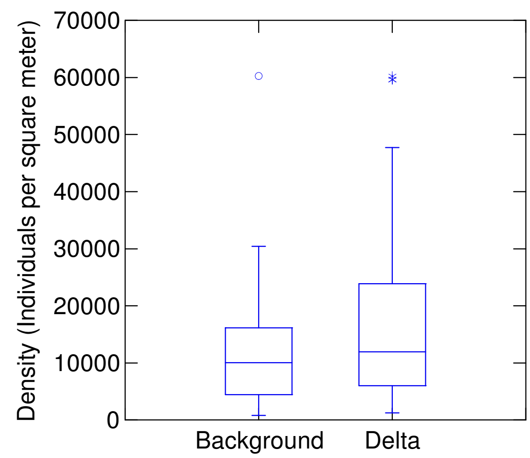
TAXA RICHNESS



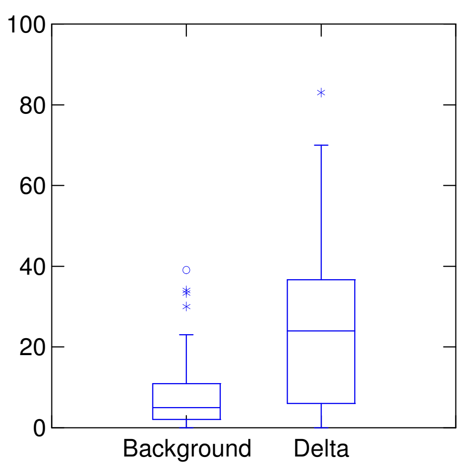
PERCENT OLIGOCHAETA



DENSITY



PERCENT CHIRONOMIDAE



Notes:

*, Indicates outside values that are greater than 1.5 times the interquartile range plus the upper quartile

o, Indicates far outside values that are greater than 3 times the interquartile range plus the upper quartile

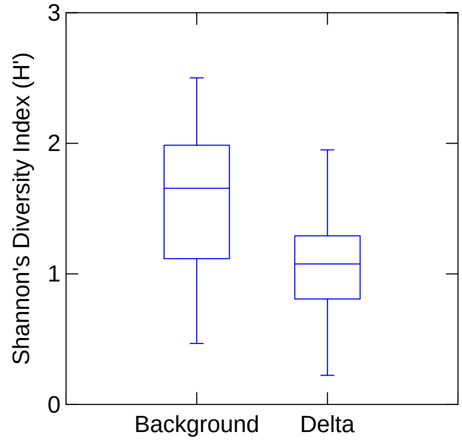
Job No.	18984480.00002
Prepared by:	DTL
Date:	1/12/06

BENTHIC COMMUNITY METRIC VALUES – COMPOSITION AND RICHNESS MEASURES
DELTA BIOLOGICAL INVESTIGATION – AUGUST 2005
POMPTON LAKES, NEW JERSEY

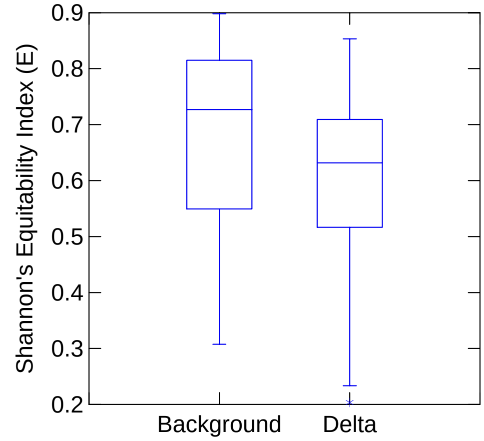
FIGURE 9

URS

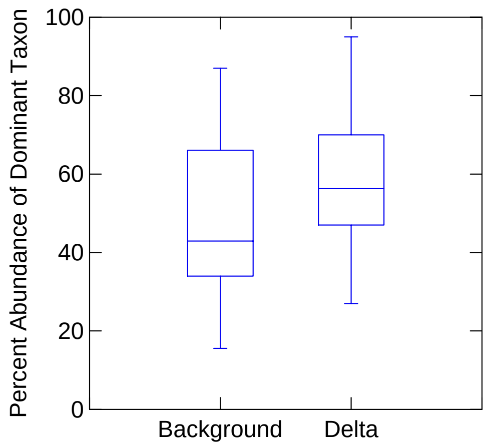
SHANNON'S DIVERSITY INDEX



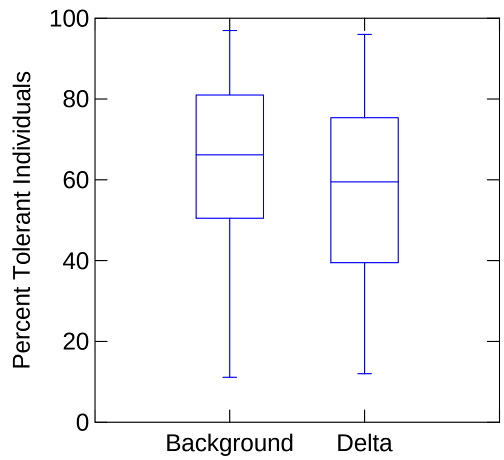
SHANNON'S EQUITABILITY



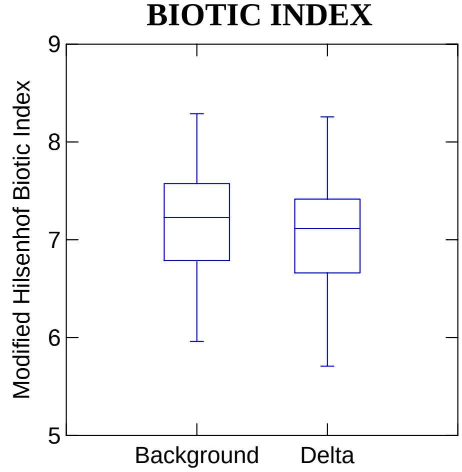
PERCENT DOMINANT TAXA



PERCENT TOLERANT



MODIFIED HILSENHOF BIOTIC INDEX

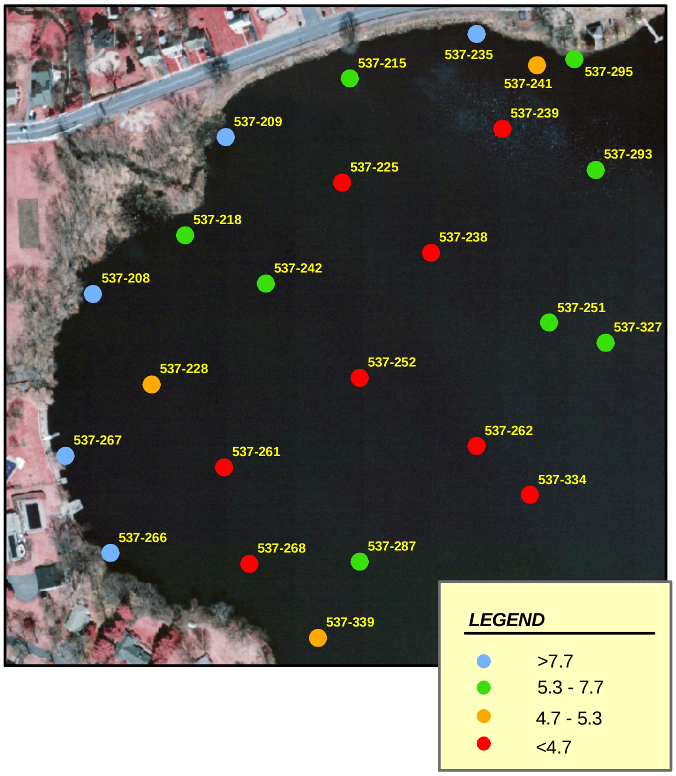


Job No.	18984480.00002
Prepared by:	DTL
Date:	1/12/06

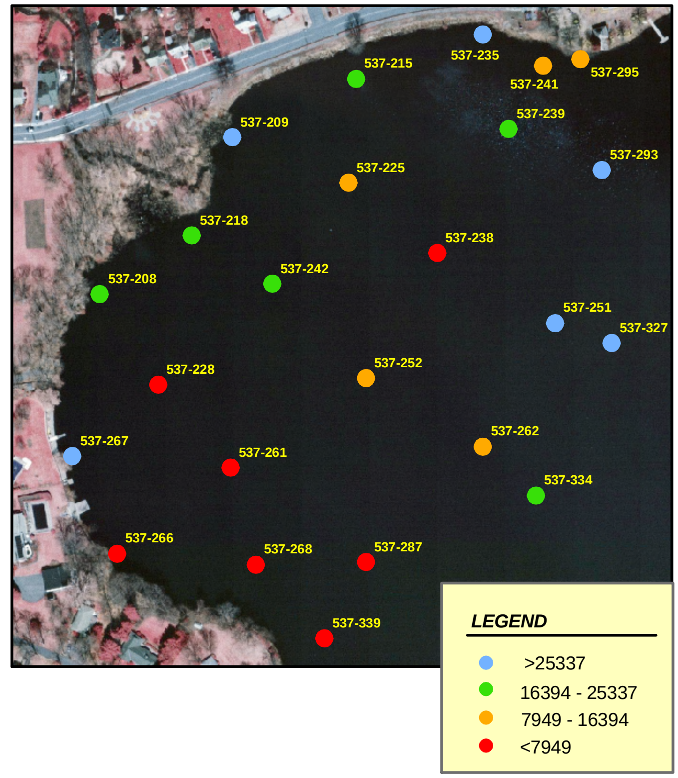
BENTHIC COMMUNITY METRIC VALUES – DIVESITY AND TOLERANCE MEASURES
DELTA BIOLOGICAL INVESTIGATION – AUGUST 2005
POMPTON LAKES, NEW JERSEY

FIGURE 10

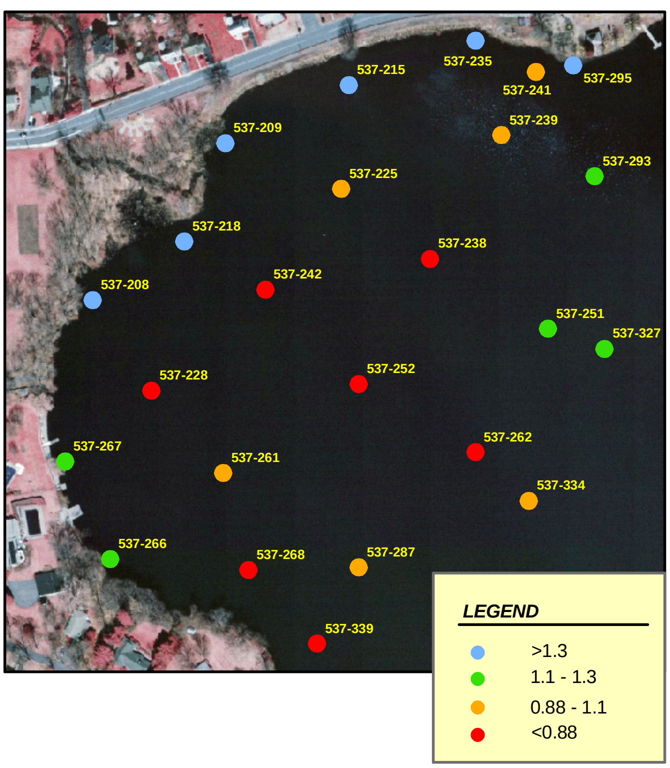
Taxa Richness



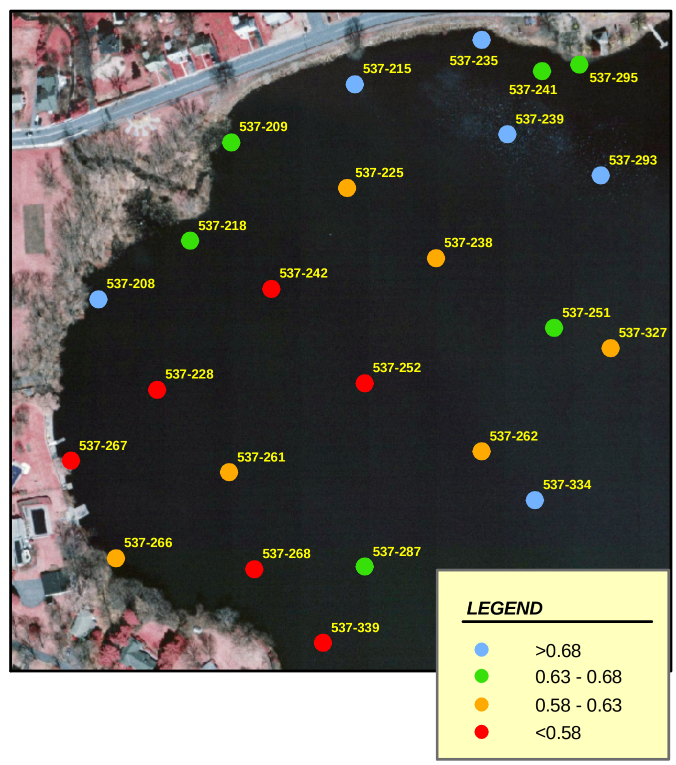
Density



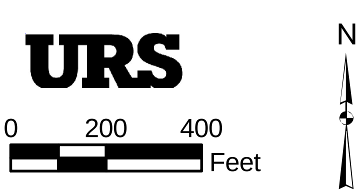
Shannon's Diversity Index (H')



Shannon's Equitability Index (E)

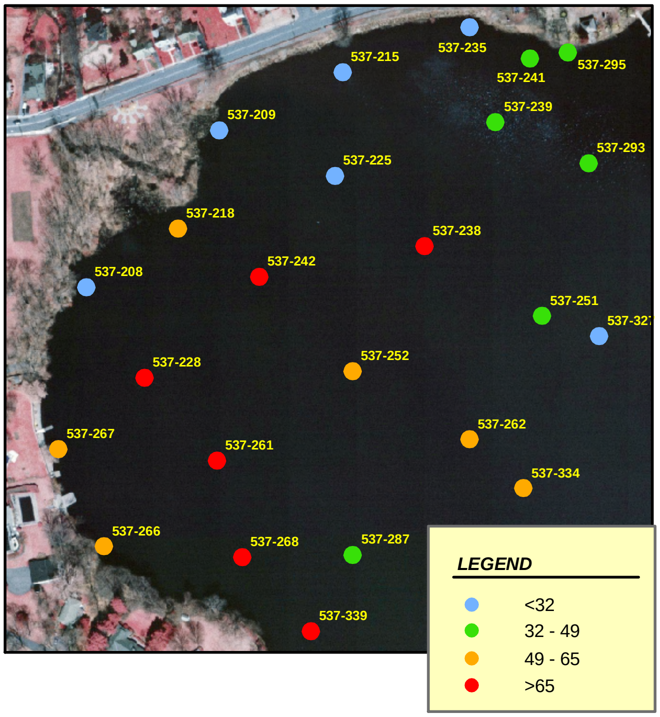


URS

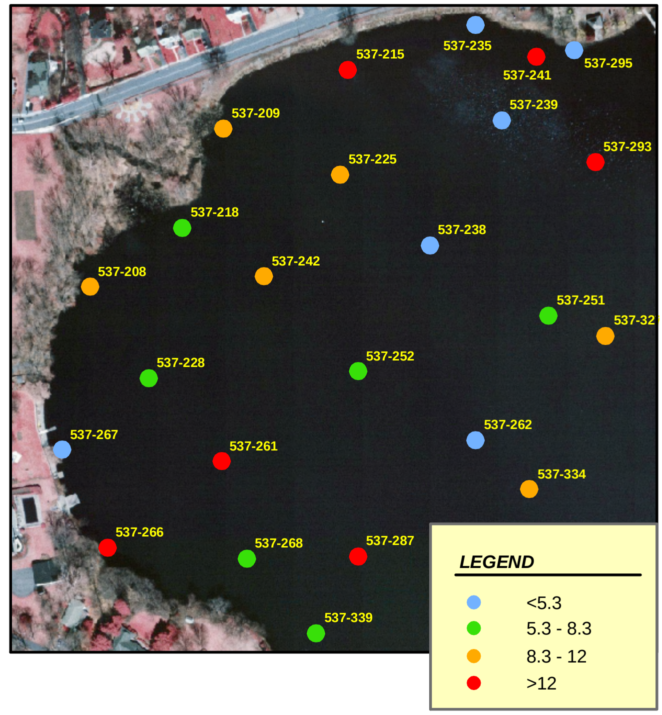


Job: 18984480.00002	SPATIAL DISTRIBUTION OF TAXA RICHNESS, DENSITY, SHANNON'S DIVERSITY INDEX & SHANNON'S EQUITABILITY ACID BROOK DELTA DUPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: RRM III	
Check by: DL	
Date: 1/06/2006	FIGURE 11

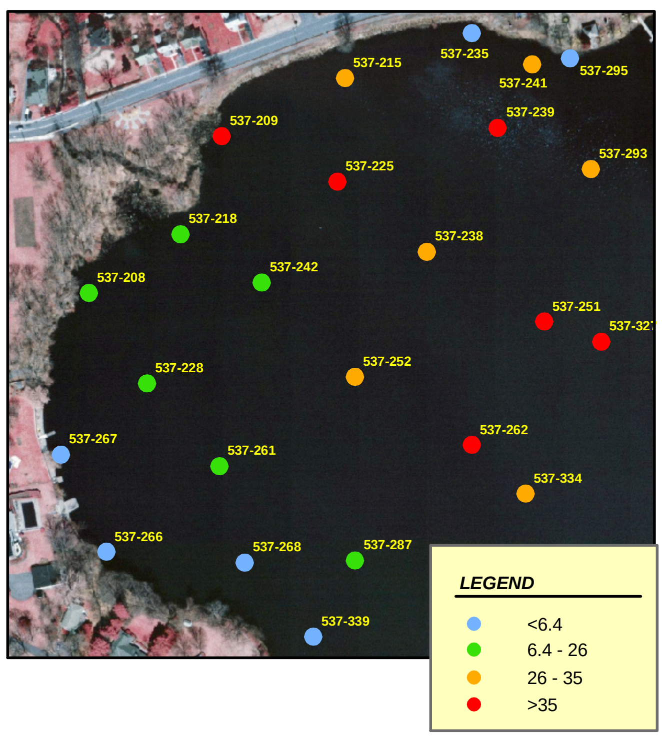
Percent Harpacticoida



Percent Oligochaeta



Percent Chironomidae



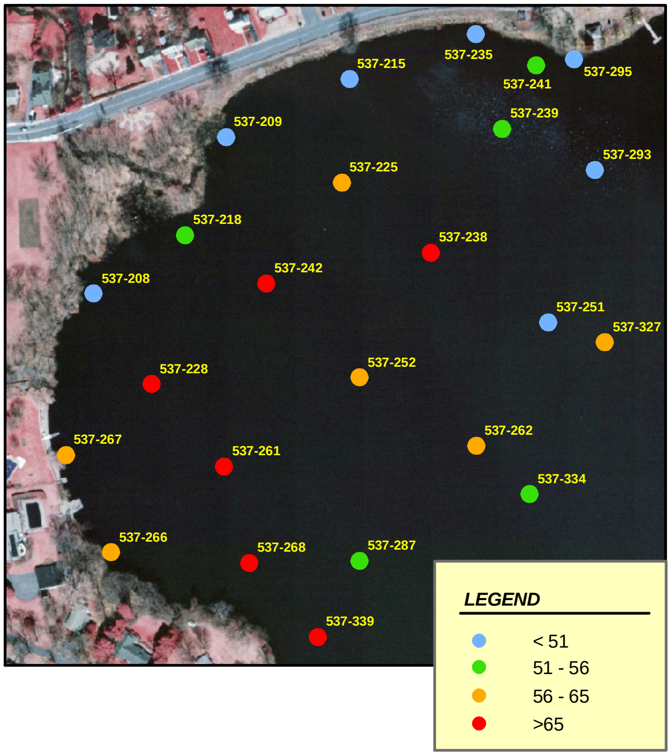
URS

0 200 400 Feet

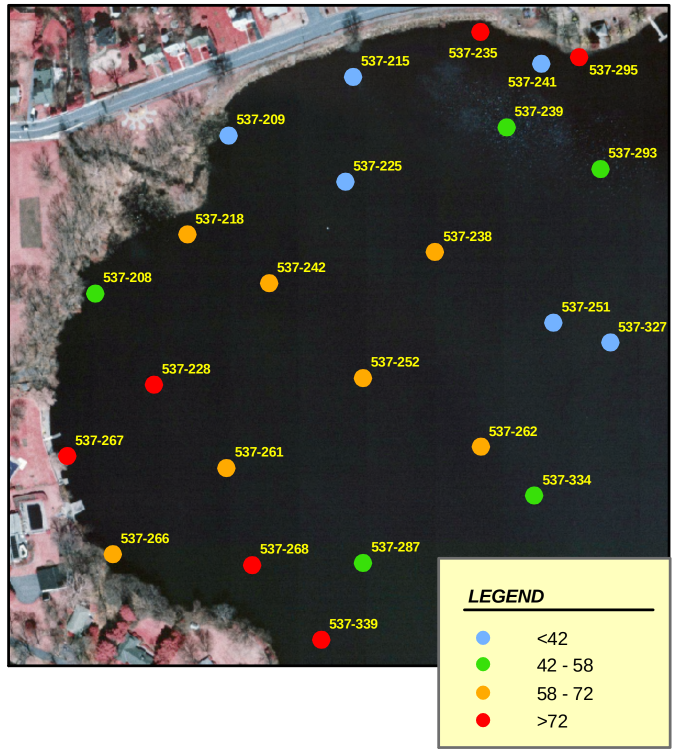
N

Job: 18984480.00002	SPATIAL DISTRIBUTION OF PERCENT ABUNDANCE OF THE THREE MAIN BENTHIC TAXONOMIC GROUPS ACID BROOK DELTA DUPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: RRM III	
Check by: DL	
Date: 12/28/2005	FIGURE 12

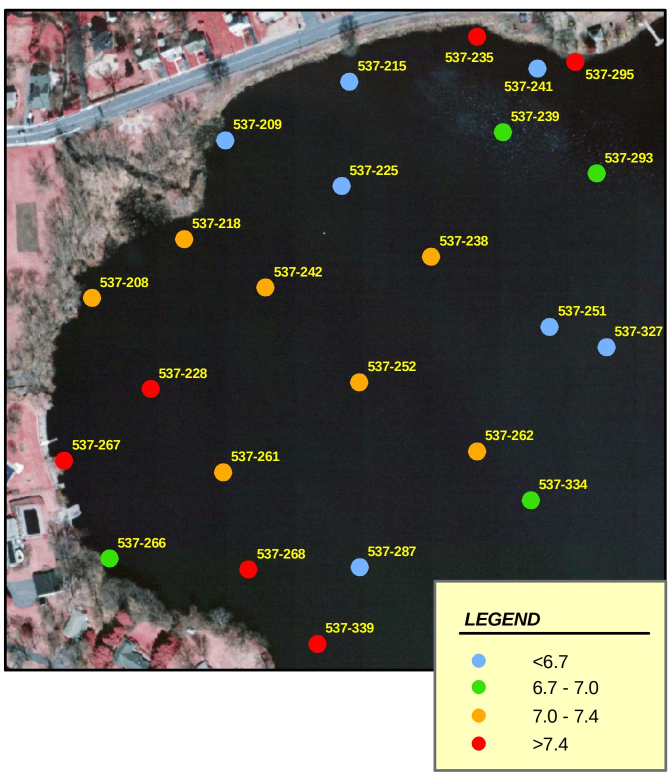
Percent Dominant Taxa



Percent Tolerant Individuals



Modified Hilsenhof Biotic Index

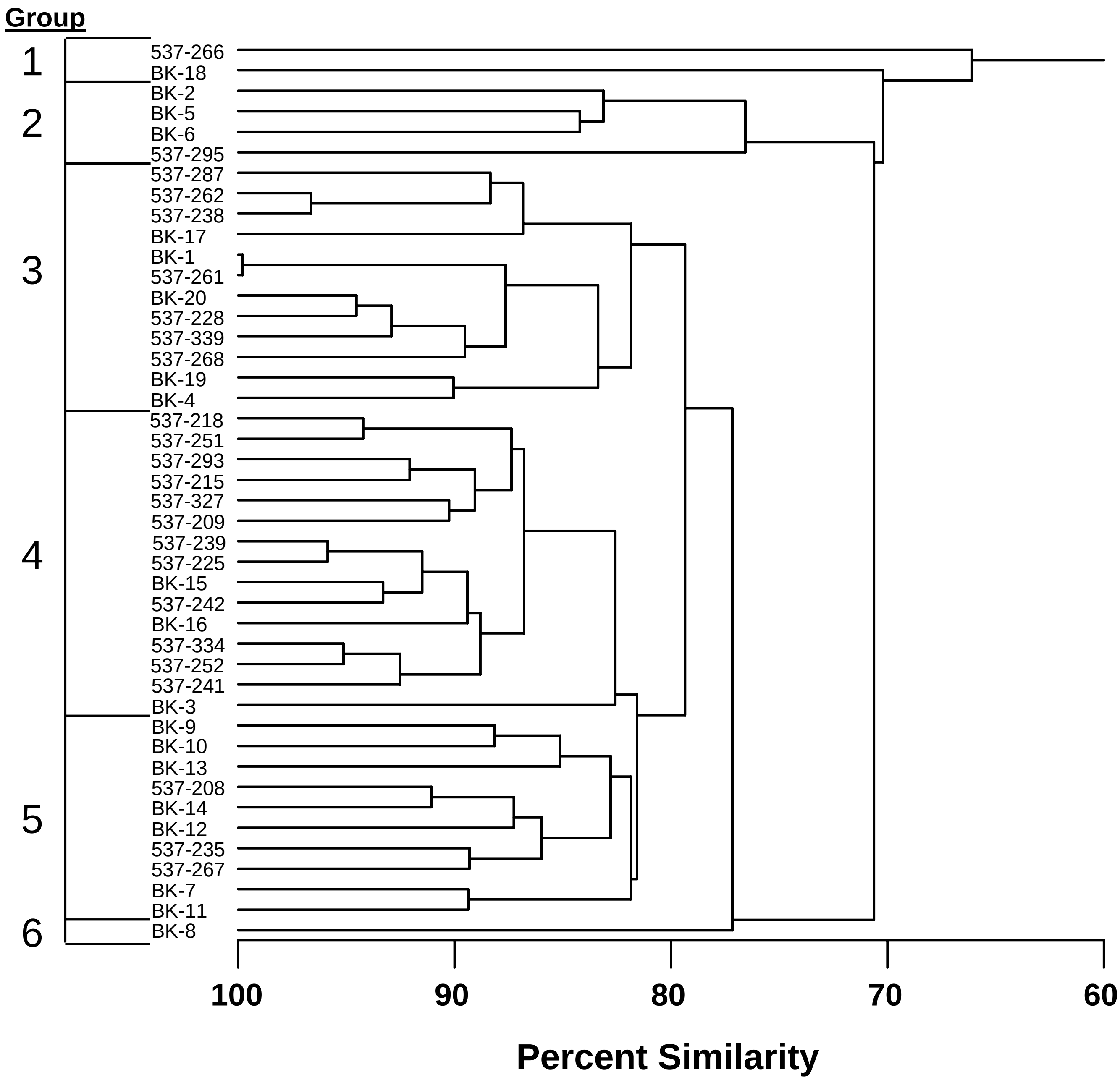


URS

0 200 400 Feet

N

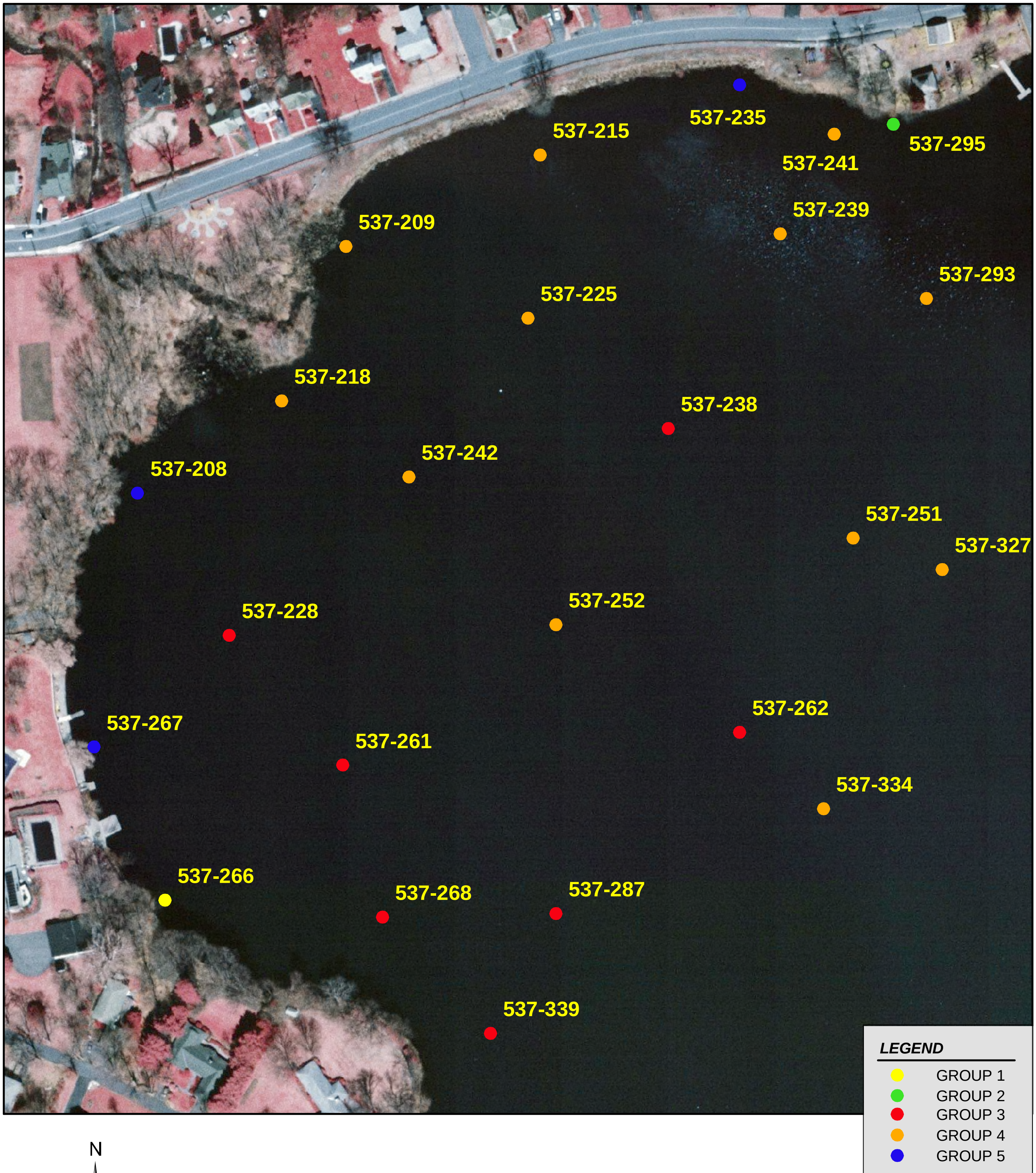
Job: 18984480.00002	SPATIAL DISTRIBUTION OF SELECT BENTHIC TOLERANCE METRICS ACID BROOK DELTA DUPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: RRM III	
Check by: DL	
Date: 12/28/2005	FIGURE 13



Job No.	18984480.00002
Prepared by:	DTL
Date:	1/3/06

BRAY-CURTIS CLUSTER ANALYSIS RESULTS
DELTA BIOLOGICAL INVESTIGATION –
AUGUST 2005
POMPTON LAKES, NEW JERSEY

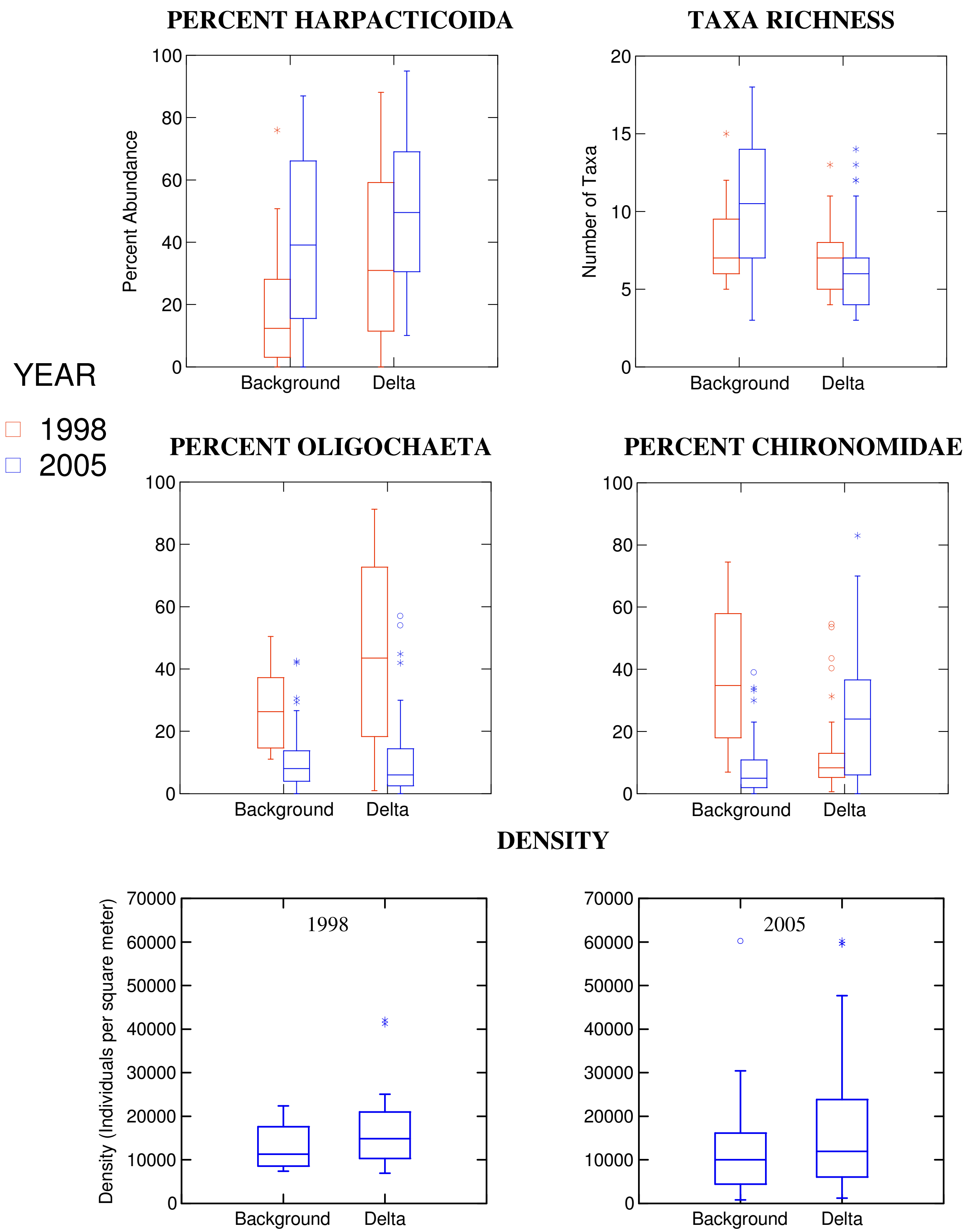
FIGURE 14



N

0 100 200 Feet

Job: 18984480.00002	SPATIAL DISTRIBUTION OF BENTHIC COMMUNITY CLUSTER ANALYSIS GROUPS ACID BROOK DELTA DUPONT POMPTON LAKES WORKS POMPTON LAKES, NEW JERSEY
Prepared by: RRM III	
Check by: GL	
Date: 3/27/2006	FIGURE 15



Notes:

*, Indicates outside values that are greater than 1.5 times the interquartile range plus the upper quartile

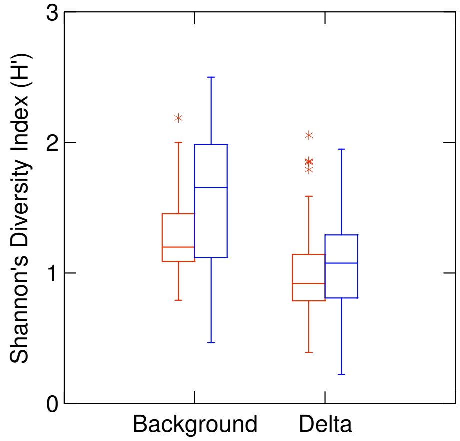
o, Indicates far outside values that are greater than 3 times the interquartile range plus the upper quartile

Job No.	18984480.00002
Prepared by:	DTL
Date:	1/12/06

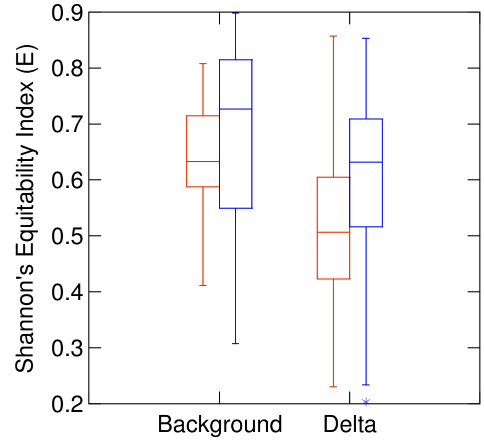
BENTHIC COMMUNITY COMPOSITION AND RICHNESS METRIC VALUES
1998 AND 2005 INVESTIGATIONS
DELTA BIOLOGICAL INVESTIGATION – AUGUST 2005
POMPTON LAKES, NEW JERSEY

FIGURE 16

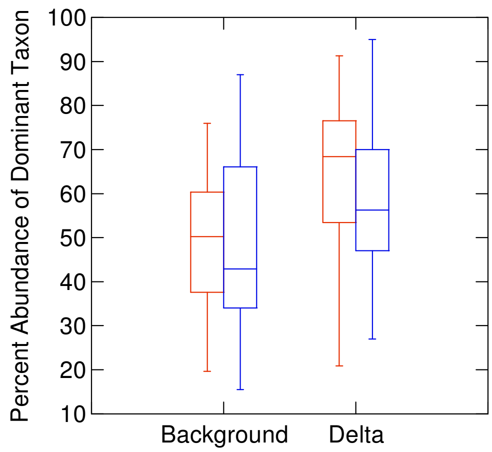
SHANNON'S DIVERSITY INDEX



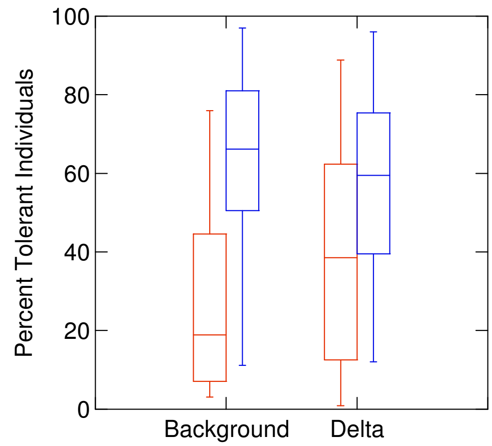
SHANNON'S EQUITABILITY



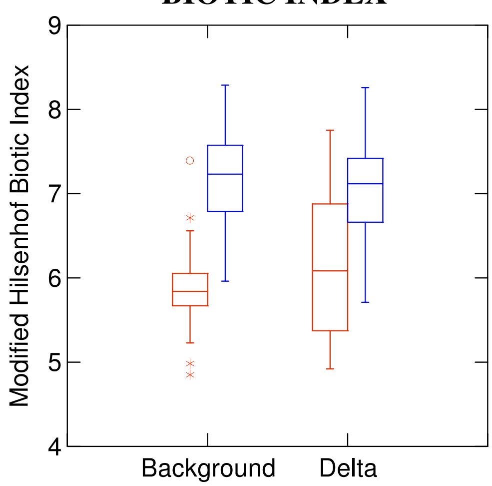
PERCENT DOMINANT TAXA



PERCENT TOLERANT



MODIFIED HILSENHOF BIOTIC INDEX



Notes:

*, Indicates outside values that are greater than 1.5 times the interquartile range plus/minus the quartile values

o, Indicates far outside values that are greater than 3 times the interquartile range plus/minus the quartile values

YEAR

□ 1998
□ 2005

Job No.	18984480.00002
Prepared by:	DTL
Date:	1/12/06

BENTHIC COMMUNITY DIVERSITY AND TOLERANCE METRIC VALUES
1998 AND 2005 INVESTIGATIONS
DELTA BIOLOGICAL INVESTIGATION – AUGUST 2005
POMPTON LAKES, NEW JERSEY

FIGURE 17

APPENDIX E
CIRCULATION STUDY REPORT

OCEAN SURVEYS, INC.

91 SHEFFIELD STREET
OLD SAYBROOK CT 06475

TEL. (860) 388-4631 FAX (860) 388-5879
www.oceansurveys.com

MARINE AND FRESHWATER
SURVEY SERVICES

14 October 2005

Mr. Richard Landis
Dupont
4417 Lancaster Pike, Barley Mill Plaza 27-1359
Wilmington, DE 19805

SUBJECT: FINAL REPORT: BATCH DYE RELEASE WATER TRANSPORT STUDY AND GROUNDWATER FLUX CHAMBER DIVING AND VESSEL SUPPORT POMPTON LAKE, POMPTON LAKES, NJ

Dear Mr. Landis

From 22 August through 25 August 2005, Ocean Surveys, Inc. (OSI) in conjunction with Fathom Research assisted Dupont personnel with the installation and monitoring of Groundwater Flux Chambers in Pompton Lake, NJ. In addition, OSI conducted a series of three batch release dye studies within the lake to support ongoing studies into the possible diffusion/dilution and transport of sediment contaminants residing in the vicinity of Acid Brook and the lower areas of the lake. This report focuses on the dye release studies

<u>Batch Release Dye Study</u>

OSI conducted three batch release dye studies within Pompton Lake from 23-25 August. The batch releases consisted of a mixture of 0.125 to 0.25 liters of raw dye tracer with approximately 11.3 liters (3 gal) of lake water creating an initial concentration of 54 to 108 ppt of dye. Each release was injected into the water using a small electric pump, which injected the dye batch into the surface waters in an approximate 10ft diameter circle. Rhodamine WT dye, which is a biodegradable, fluorescent tracer that is extremely soluble in water and detectable in very small concentrations (less than 0.05 parts per billion), was utilized for this project. The dye was supplied as a 20% aqueous solution by Crompton and Knowles Corporation, Gilbraltar, Pennsylvania. A recovery test of the dyed lake water revealed no impacts or reduction in the Rhodamine dye due to water quality conditions in the Lake.

After each release, the plume began to diffuse/dilute into the surrounding water and was mapped four times. Release #1 was placed just east of the mouth of Acid Brook at 17:20 (UTC) on 23 August and was mapped 4 times on 23 August followed by and additional 5th mapping on the morning of 24 August to monitor the long term movements of the plume. Release #2 was injected nearly 380ft north of the first release on the morning of 24 August at 14:14 (UTC) and Release #3 was placed just south of the Lakeside Ave. (Rt.686) bridge at 12:37 (UTC) on 25 August. Both were mapped 4 times on their release day.

Horizontal mapping of each plume was conducted onboard an aluminum jonboat. Dye concentrations were measured using a digital Turner Designs Model 10 fluorometer system with flow-through sample chamber and integrated thermistor. The fluorescence and temperature data were output to the navigation computer/data logger. A submersible pump, positioned directly under a GPS antenna, was used to continually circulate sample water through opaque polyethylene tubing connected directly to the fluorometer from a fixed depth of 0.5 ft. Positioning data from the DGPS system were merged with dye concentration data in the navigation computer. The horizontal dye mapping consisted of 7 to 14 transects collected along transects orientated perpendicular to the movement of the plume. The number and position of the transects surveyed during each mapping were adjusted to follow the movement and extent of the dye plume.

Vertical profiles of dye concentration were collected using a special vertical profiling array. This array consisted of an intake hose, a surface circulating pump, and a depth sensor attached to the submerged end of the intake hose. A vertical profile was collected by deploying the array over the side of the vessel and allowing it to reach bottom. The hose was then slowly raised to the surface. The sample water was routed through the fluorometer and the data collected digitally along with the depth data output by the depth sensor at the end of the hose. A total of 29 vertical profiles were taken during the 13 mappings, with 1 to 4 profiles being taken per mapping.

Fluorescence Detection and Instrumentation

The Turner Design Model 10 fluorometer was utilized for this project. It provides a relative measure of the quantity of light emitted from a fluorescent solution. A lamp within the fluorometer emits light, which passes through a filter, excluding all but the excitation frequency of Rhodamine WT, and is allowed to strike the sample. Any dye present in the solution will fluoresce. The emitted light spectrum is passed through a secondary filter to a photomultiplier. An electric current is created in the photomultiplier proportional to the intensity of the fluorescent emission, which is converted, through instrument calibration, to Rhodamine WT concentration and recorded digitally for post-processing.

Water sample temperatures were recorded along with the fluorescence data employing a Yellow Springs Instrument Company Series 700 Thermistor located in line with the sample chamber. These temperature data were used during data processing to correct the dye concentration data for temperature variations.

Pre-survey calibrations of the fluorometers were conducted using standard solutions prepared with dye drawn from the same lot as used for the study. These solutions were prepared employing Class A glassware as established by the National Bureau of Standards. The calibration data were then used to create third-order polynomial calibration curves for each fluorometer (primary and backup) that related the fluorescence levels measured by the instruments to actual dye concentrations.

Horizontal Control and Vessel Navigation

A Trimble DMS212 Differential Global Positioning System (DGPS) interfaced with the PC-based hydrographic software package Hypack was used for survey vessel navigation and positioning. The global positioning system consists of 24 earth-orbiting satellites, which broadcast radio signals to the surface. These signals are used by the GPS receiver to calculate its position based on the signal's Doppler shift. Three or more satellite signals are required to accurately calculate the receiver's position. Differential correctors, used to increase vessel position accuracy to ± 1 meter, were received via a radio link to a USCG beacon transmitter. The geodetic positions derived from the DGPS system were converted to the NJ State Plane Coordinate System (NAD83, in feet) for survey operations and preparation of final products.

The Hypack MAX navigation system was used to provide accurate trackline control during each plume mapping. This navigation system receives geodetic position data every second and converts these data into x-y grid coordinates in the specified plane coordinate system. The incoming data are recorded and processed in real time by the Hypack computer. The vessel position, within a previously constructed project drawing of the survey area, is displayed on a computer screen to aid the boat operator in navigation. This system provides a highly accurate visual representation of survey vessel location in real time, combined with data logging capabilities and post-survey data processing and plotting packages.

Data Processing

Survey tracklines were reconstructed from the Hypack MAX logged navigation data. During calculation of the jonboat's position consideration of the water sample time of travel through the intake hose was taken into account to yield the most precise computations possible. The computed x and y data were then plotted on a base map of the survey area.

The data collected during the dye plume mappings must be converted from raw fluorescence data to corrected dye concentrations used in creating the contoured plume maps. This was accomplished by first correcting the fluorescence data to a standard temperature according to the equation:

$$C_T = C_R \times e^{0.015(T_S - T_R)}$$

Where:
C_T = Dye concentration corrected for sample temperature
C_R = Raw concentration output from the fluorometer
T_S = Sample temperature
T_R = Reference temperature

Once the concentration is corrected for temperature, the fluorometer calibration curve is applied. The fluorometer calibration curve is a third-order polynomial equation relating the instrument's fluorescence response to true concentration of Rhodamine WT by weight. The final adjustment made is to subtract out any background fluorescence measured in the receiving waters prior to the initiation of the study.

The dye plume maps have been contoured to indicate the positions of 0.1, 0.5, 1.0, 5, 10, 50, 100, and 500 ppb dye concentration contours. The dye plume maps are attached with this letter and include an overlaid summary of all the plumes for each release followed by drawings of each individual plume.

Vertical profile data collected during each mapping were processed for temperature, instrument calibration, and background fluorescence in the manner listed above. Concentration values and their corresponding depths were then plotted as profiles of dye concentration versus depth. Vertical profile data are presented as depth profiles and are attached with this letter. Vertical profile locations during each mapping are shown on the corresponding dye plume maps.

Discussion

During this study, each plume was primarily influenced by wind speed and direction. The plumes created from Release #1 and #2 responded in very similar manners as they were both injected in shallow water outside of Acid Brook. Light winds and heavy vegetation in these areas may have slowed the diffusion and movement of the plume. Vertical mixing of the dye occurred even slower than the horizontal mixing. Profiles revealed a plume that remained concentrated near the surface with lower concentrations with increased depth. It should be noted that there was no flow present in Acid Brook during the period of these batch dye studies and Ramapo River flows into Pompton Lake were 50% below their typical summertime low flows. On 23 August USGS stream flow measurements of the Ramapo River at Pompton Lakes (#01388000) showed a discharge of 24 ft^3/s compared to an 83-year median stream flow for this station of 52 ft^3/s.

The plume created from Release #3 responded somewhat differently, but was still mainly influenced by wind direction and speed. Winds increased after the dye was released reaching 10kts by the third mapping, spreading the surface plume more quickly. Also, vertical profiles revealed that although wind had transported surface water to the south to southwest, some subsurface dye moved in a northeasterly direction toward Lakeside Ave. bridge and the eastern shoreline of the lake. This may be the result of a shadow effect from the bridge causing a localized upwelling event.

The conditions encountered during these dye plume studies showed the influence wind can have on the movement of water in the Lake. Also, vegetation restrictions on the movement of the plume near Releases #1 and #2 revealed a characteristic of the Lake during summertime conditions. Some of the other factors that could influence the diffusion/dilution of the plume would include an increase in river from in either or both the Ramapo River and Acid Brook. Decreased levels of vegetation in the spring may increase water movements in the Lake and lower water temperatures may result in a more vertically mixed water column. Future consideration might be given to additional dye batch releases in the Lake under these conditions. Additionally, a release within Acid Brook during a period of significant flow would help reflect its influence and dilution into the lower areas of Pompton Lake.

Pompton Lake, Pompton Lakes, NJ

If you have any questions or need further information please feel free to contact me.

Sincerely,

Ken Cadmus
Project Manager, Oceanographic Dept.

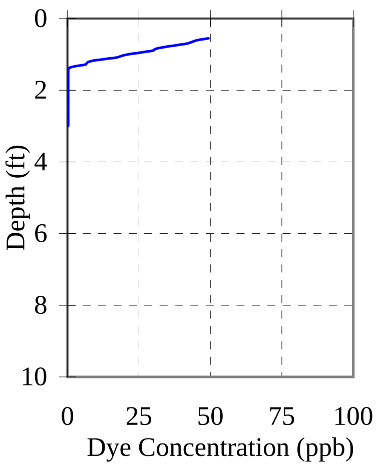
KC/ms
Enclosure

Dye Vertical Profiles

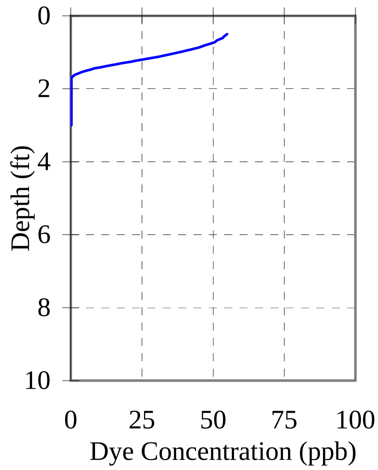
Pompton Lake, NJ

Dye Release #1 - 23 August 2005

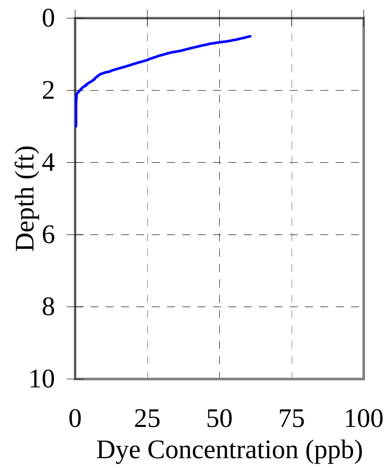
VP 1-1



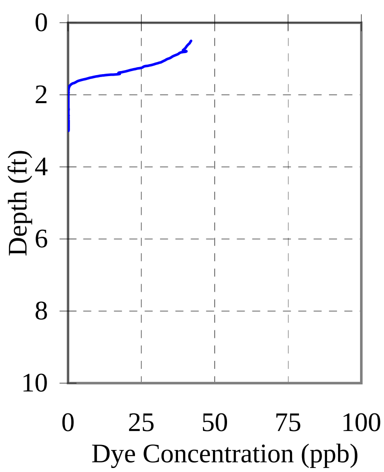
VP 1-2



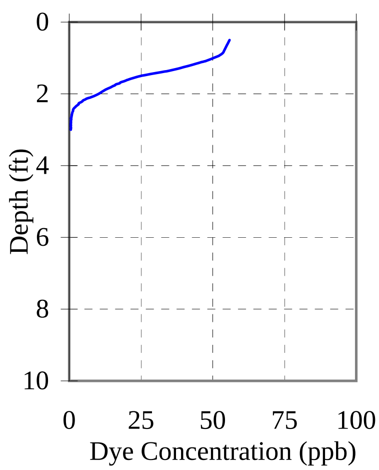
VP 1-3a



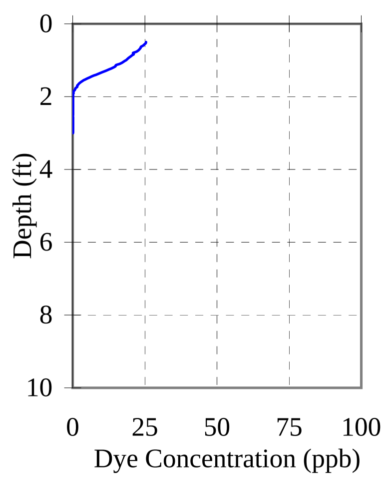
VP 1-3b



VP 1-4a



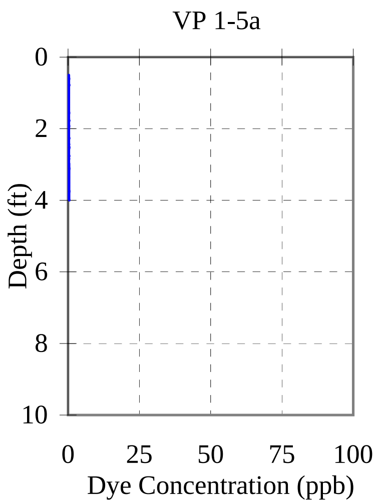
VP 1-4b

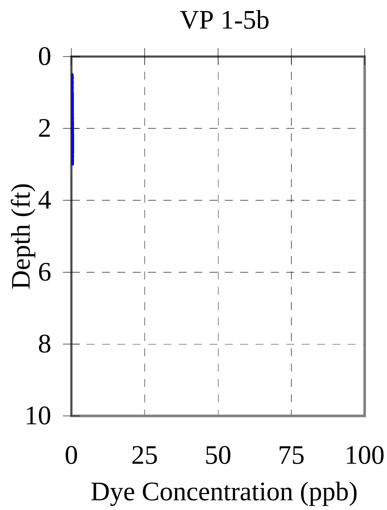


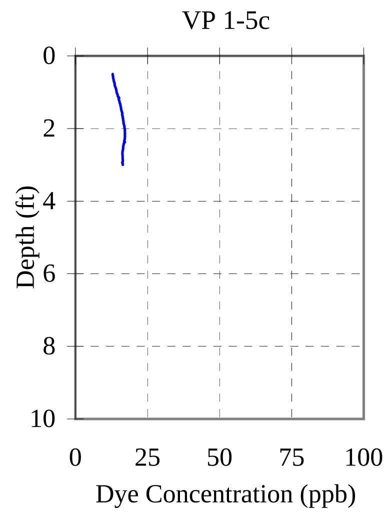
Dye Vertical Profiles

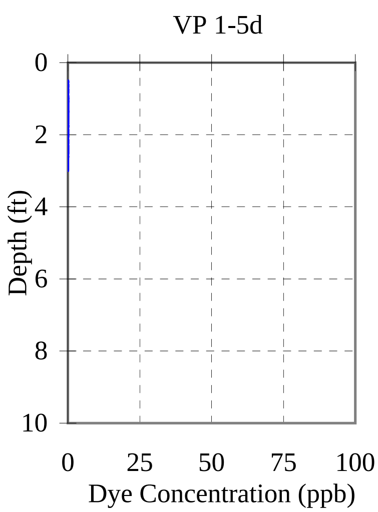
Pompton Lake, NJ

Dye Release #1 - 24 August 2005





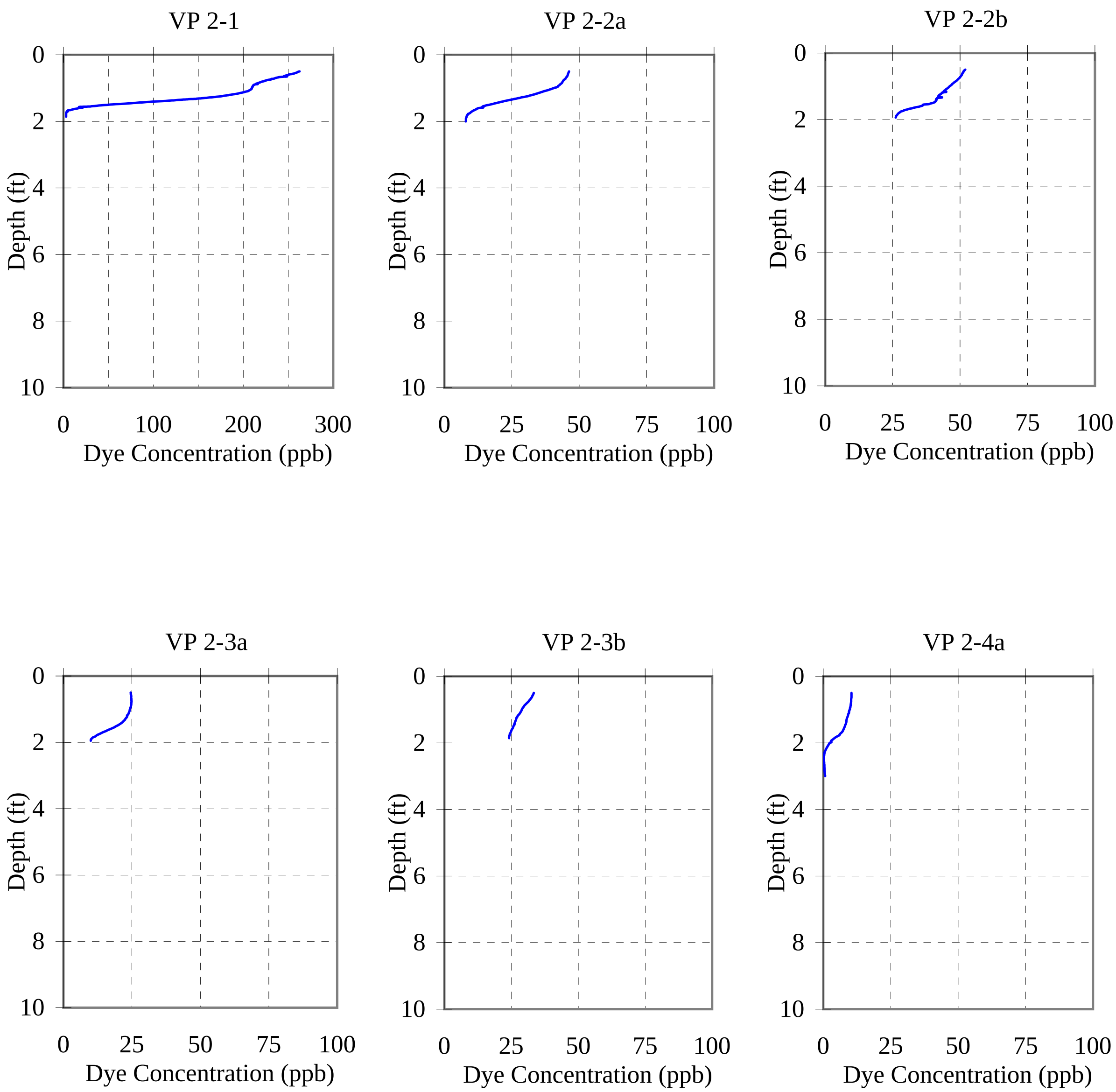




Dye Vertical Profiles

Pompton Lake, NJ

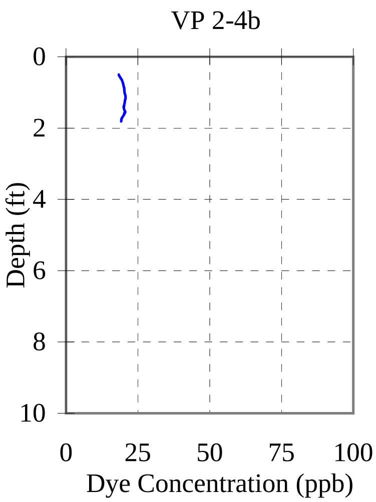
Dye Release #2 - 24 August 2005

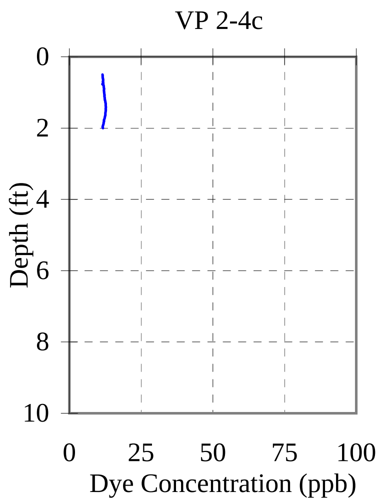


Dye Vertical Profiles

Pompton Lake, NJ

Dye Release #2 - 24 August 2005 (continued)

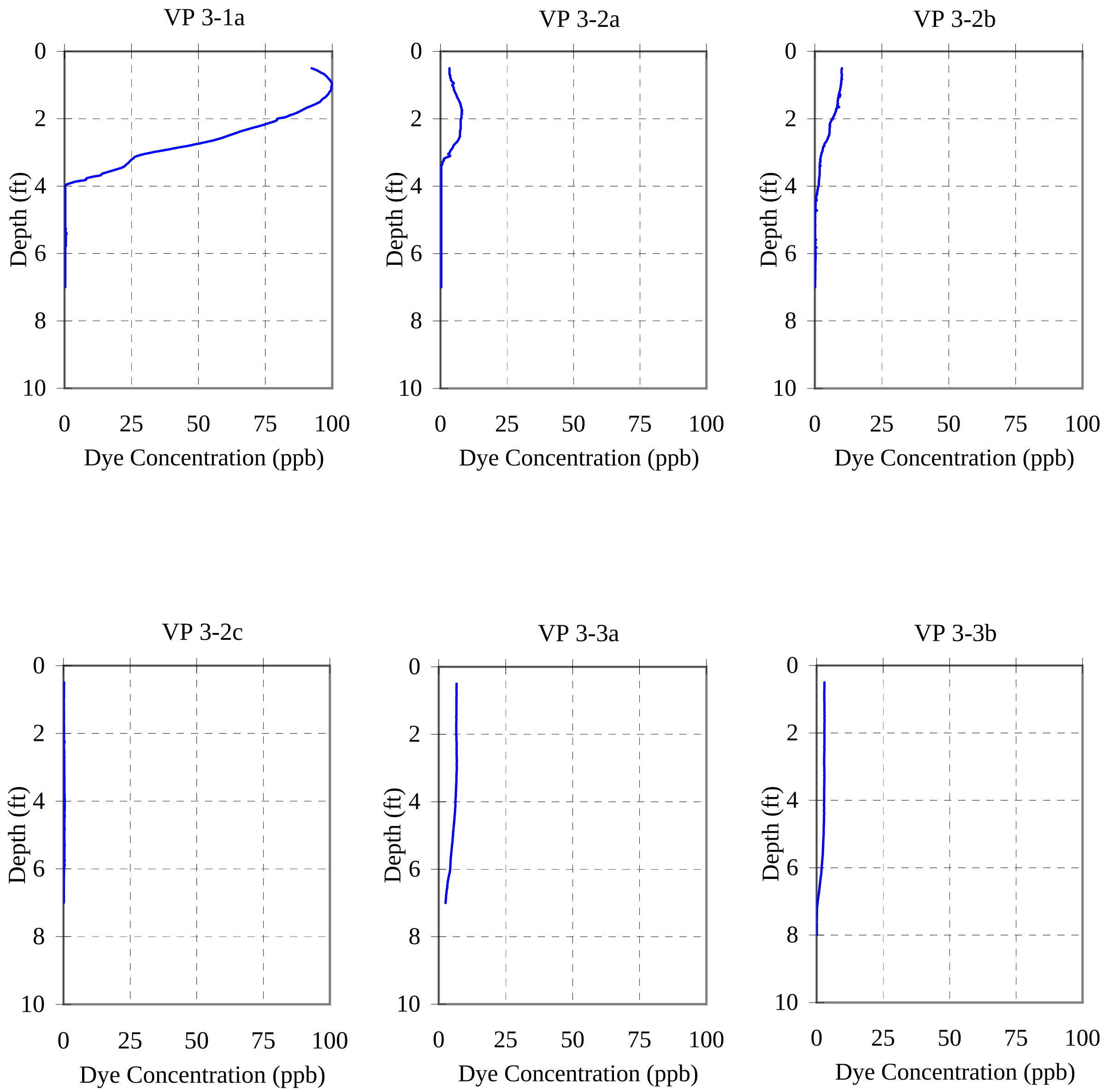




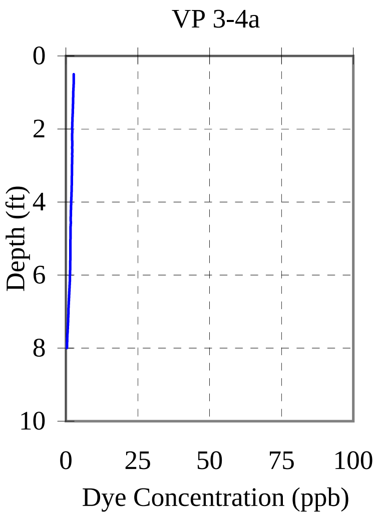
Dye Vertical Profiles

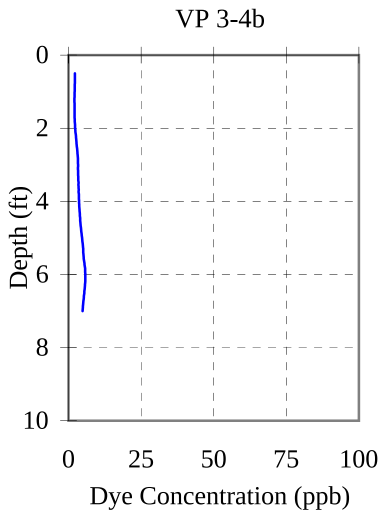
Pompton Lake, NJ

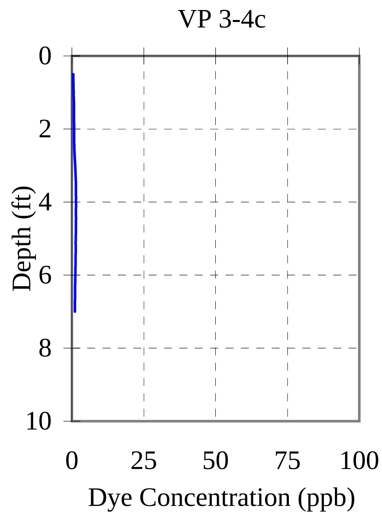
Dye Release #3 - 25 August 2005

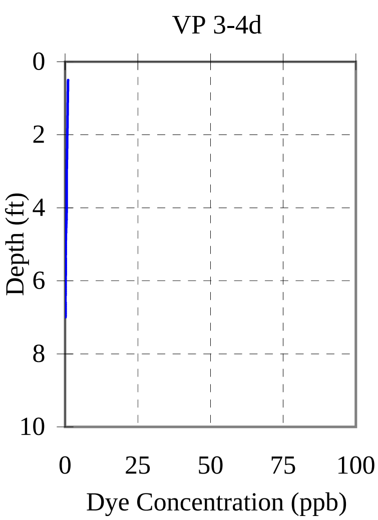


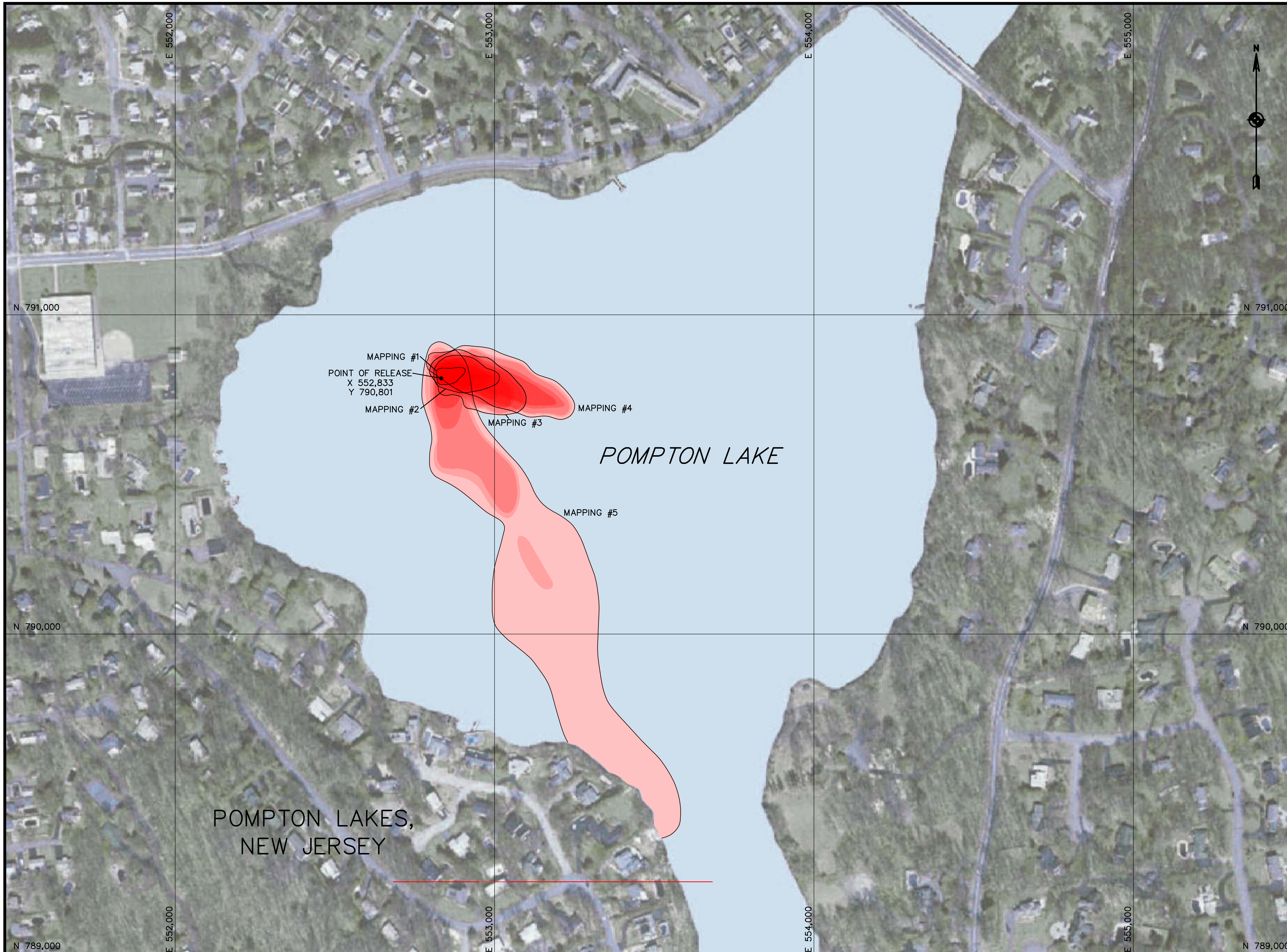
Dye Vertical Profiles
Pompton Lake, NJ
Dye Release #3 - 25 August 2005 (continued)

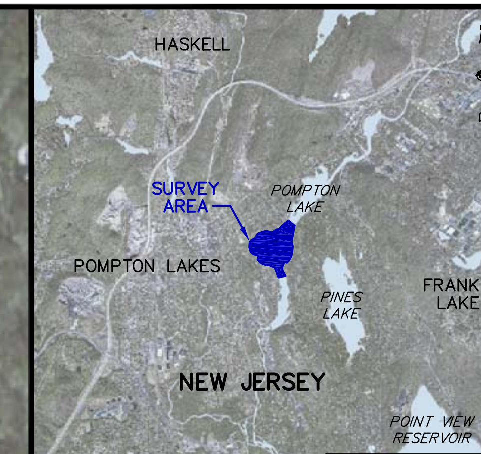




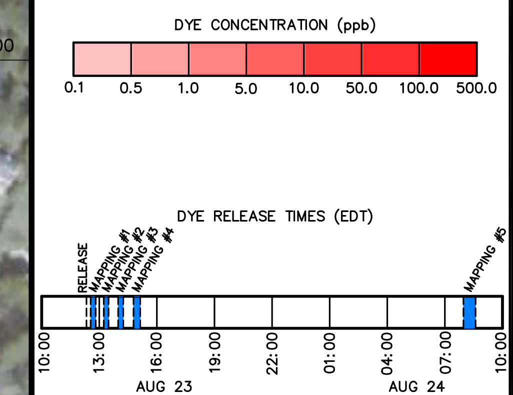








LOCATION MAP



NOTES:

1. GRID SYSTEM IS IN FEET AND IS THE NEW JERSEY STATE PLANE COORDINATE SYSTEM, NAD83.
2. ALL TIME REFERENCES ARE BASED ON EASTERN DAYLIGHT TIME (EDT).
3. SHORELINE AND ONSHORE FEATURES ARE APPROXIMATE AND WERE TAKEN FROM DIGITAL ORTHOPHOTO QUADRANGLES FLOWN IN 2002 AND OBTAINED FROM THE NEW JERSEY GEOGRAPHIC INFORMATION NETWORK (NJGIN).
4. THE INFORMATION PRESENTED ON THIS CHART REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 23–24 AUGUST 2005 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER WITHOUT LIABILITY TO OSI.

SCALE: 1"=300'

300 0 300

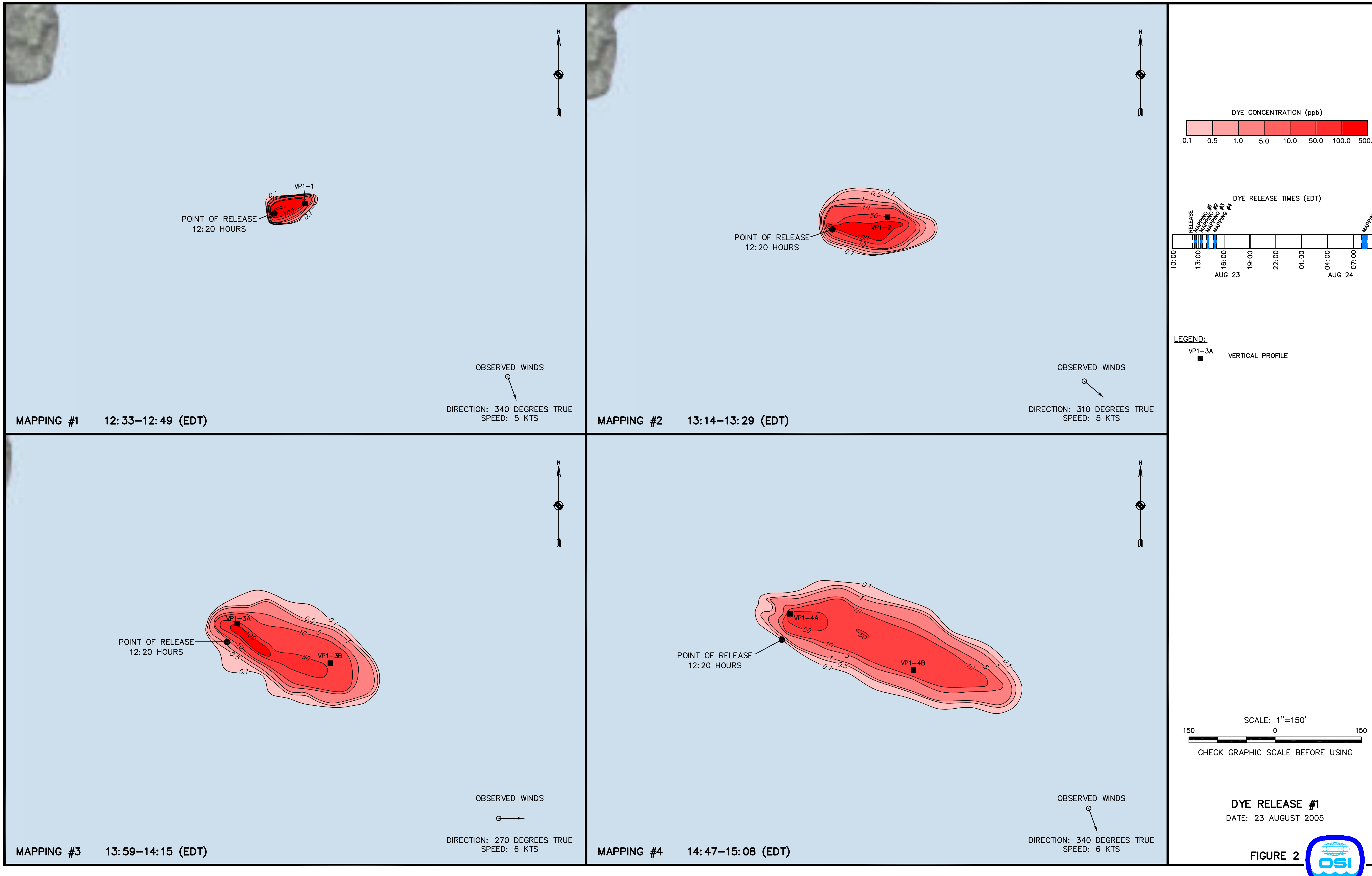
CHECK GRAPHIC SCALE BEFORE USING

DYE RELEASE #1 MAPPINGS #1–5

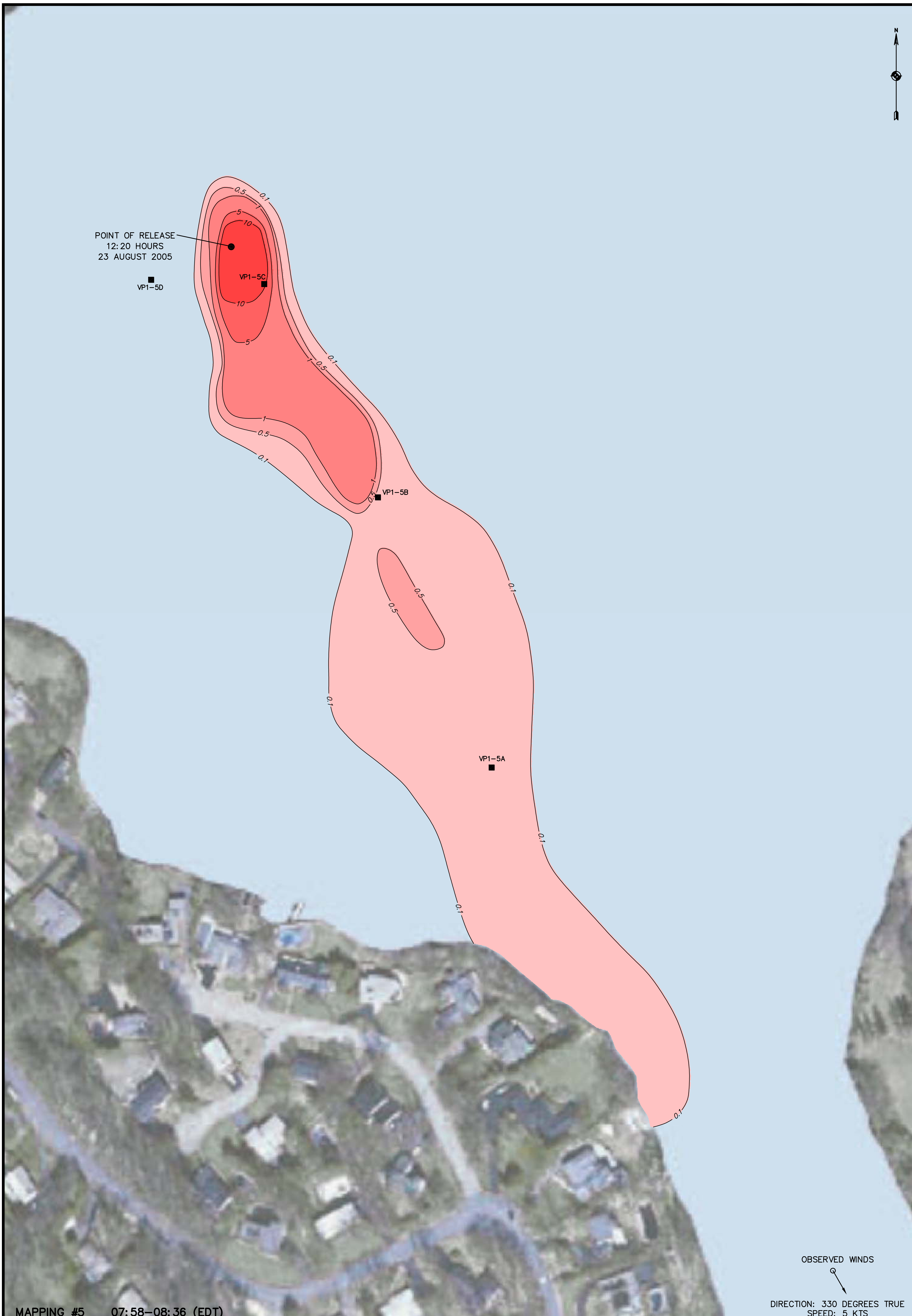
DATE: 23–24 AUGUST 2005

FIGURE 1

OSI



MAPPING #1 12:33–12:49 (EDT)
POINT OF RELEASE 12:20 HOURS
VP1–1
OBSERVED WINDS
DIRECTION: 340 DEGREES TRUE
SPEED: 5 KTS
MAPPING #2 13:14–13:29 (EDT)
POINT OF RELEASE 12:20 HOURS
VP1–2
OBSERVED WINDS
DIRECTION: 310 DEGREES TRUE
SPEED: 5 KTS
MAPPING #3 13:59–14:15 (EDT)
POINT OF RELEASE 12:20 HOURS
VP1–3A
VP1–3B
OBSERVED WINDS
DIRECTION: 270 DEGREES TRUE
SPEED: 6 KTS
MAPPING #4 14:47–15:08 (EDT)
POINT OF RELEASE 12:20 HOURS
VP1–4A
VP1–4B
OBSERVED WINDS
DIRECTION: 340 DEGREES TRUE
SPEED: 6 KTS
N
DYE CONCENTRATION (ppb)
0.1 0.5 1.0 5.0 10.0 50.0 100.0 500.0
DYE RELEASE TIMES (EDT)
RELEASE
MAPPING #1
MAPPING #2
MAPPING #3
MAPPING #4
MAPPING #5
10:00 13:00 16:00 19:00 22:00 01:00 04:00 07:00 10:00
AUG 23
AUG 24
LEGEND:
VP1–3A
VERTICAL PROFILE
SCALE: 1"=150'
150 0 150
CHECK GRAPHIC SCALE BEFORE USING
DYE RELEASE #1
DATE: 23 AUGUST 2005
FIGURE 2



DYE CONCENTRATION (ppb)

0.1 0.5 1.0 5.0 10.0 50.0 100.0 500.0

SCALE: 1"=150'

150 0 150

CHECK GRAPHIC SCALE BEFORE USING

DYE RELEASE TIMES (EDT)

RELEASE MAPPING #1 MAPPING #2 MAPPING #3 MAPPING #4 MAPPING #5

10:00 13:00 16:00 19:00 22:00 01:00 04:00 07:00 10:00

AUG 23 AUG 24

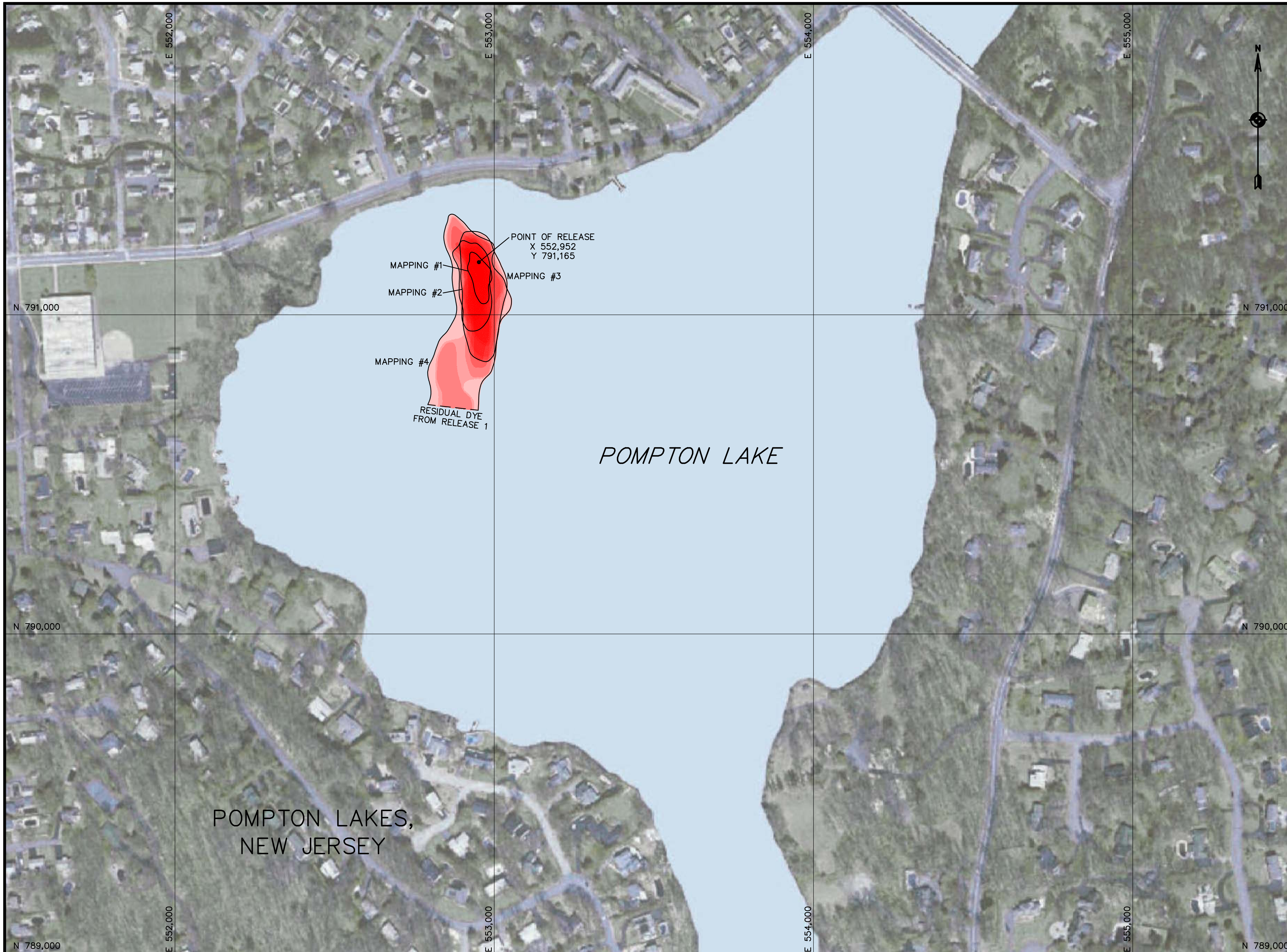
LEGEND:

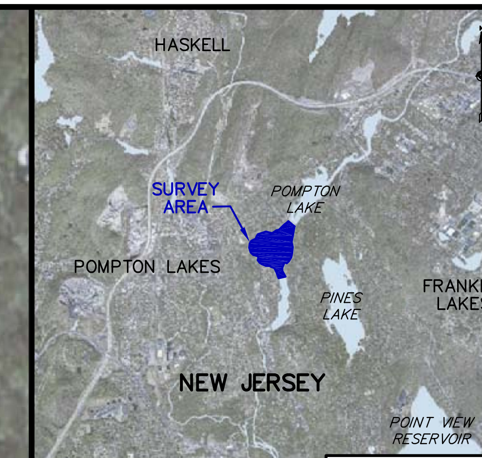
VP1-3A VERTICAL PROFILE

DYE RELEASE #1

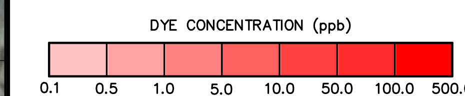
DATE: 24 AUGUST 2005

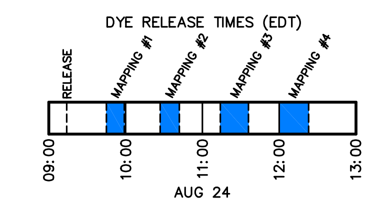
FIGURE 3





LOCATION MAP





NOTES:

1. GRID SYSTEM IS IN FEET AND IS THE NEW JERSEY STATE PLANE COORDINATE SYSTEM, NAD83.

2. ALL TIME REFERENCES ARE BASED ON EASTERN DAYLIGHT TIME (EDT).

3. SHORELINE AND ONSHORE FEATURES ARE APPROXIMATE AND WERE TAKEN FROM DIGITAL ORTHOPHOTO QUADRANGLES FLOWN IN 2002 AND OBTAINED FROM THE NEW JERSEY GEOGRAPHIC INFORMATION NETWORK (NJGIN).

4. THE INFORMATION PRESENTED ON THIS CHART REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 24 AUGUST 2005 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER WITHOUT LIABILITY TO OSI.

SCALE: 1"=300'

300 0 300

CHECK GRAPHIC SCALE BEFORE USING

DYE RELEASE #2 MAPPINGS #1–4

DATE: 24 AUGUST 2005

FIGURE 4

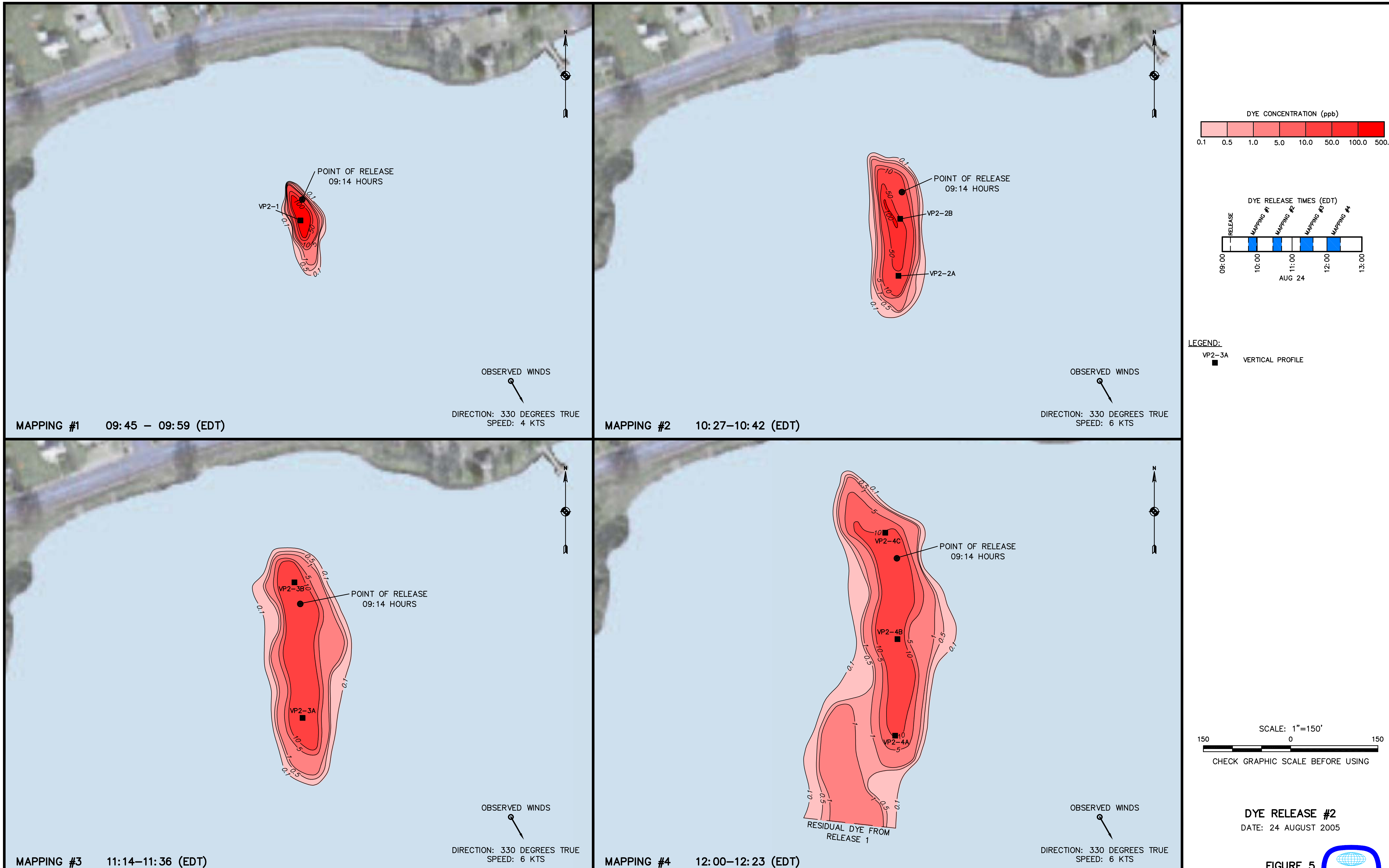
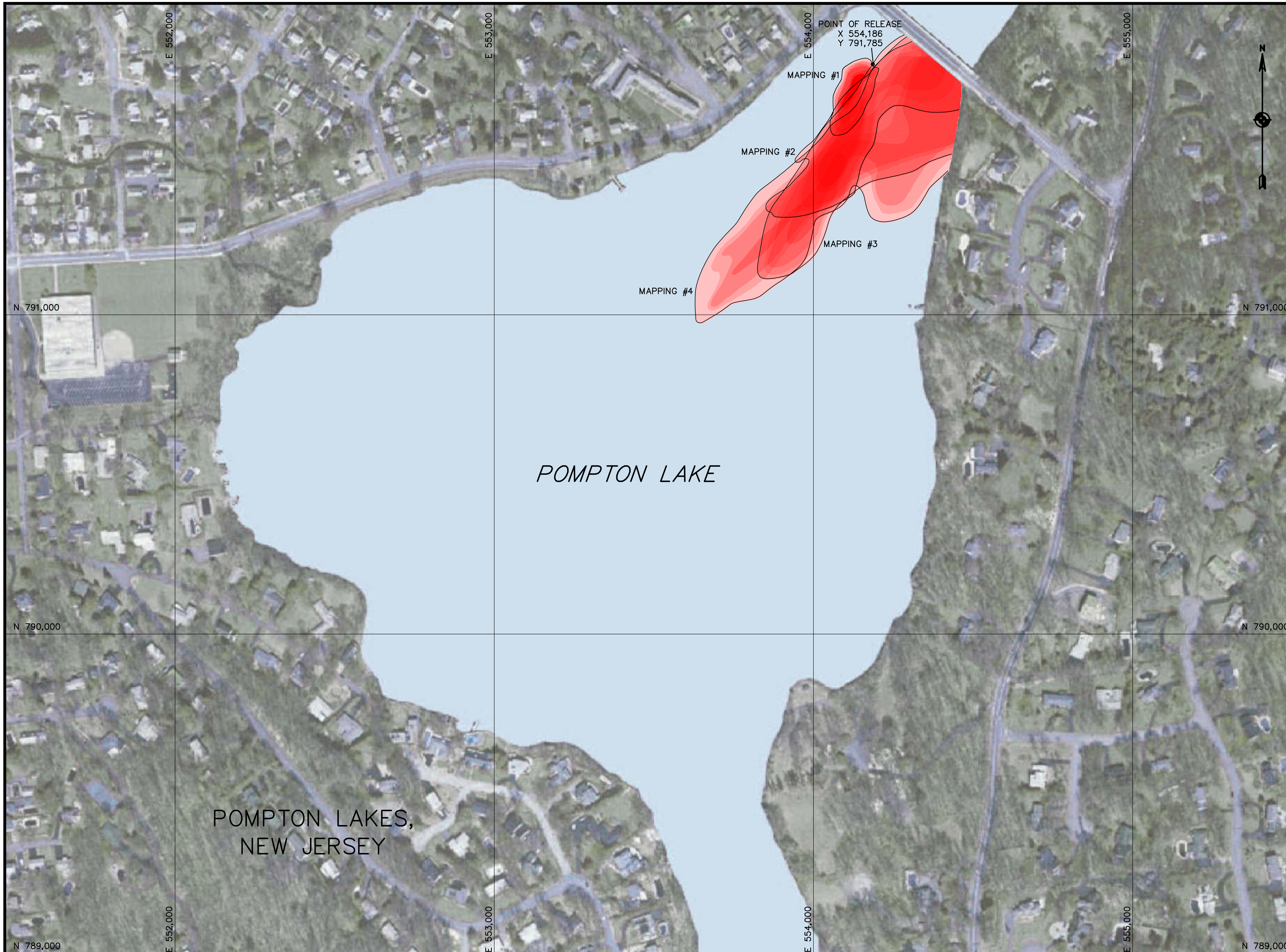
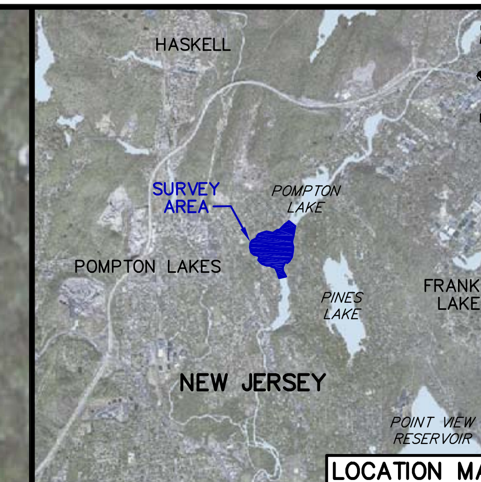

POINT OF RELEASE
09:14 HOURS
VP2-1
OBSERVED WINDS
DIRECTION: 330 DEGREES TRUE
SPEED: 4 KTS
MAPPING #1 09:45 – 09:59 (EDT)
POINT OF RELEASE
09:14 HOURS
VP2-2B
VP2-2A
OBSERVED WINDS
DIRECTION: 330 DEGREES TRUE
SPEED: 6 KTS
MAPPING #2 10:27–10:42 (EDT)
POINT OF RELEASE
09:14 HOURS
VP2-3B
VP2-3A
OBSERVED WINDS
DIRECTION: 330 DEGREES TRUE
SPEED: 6 KTS
MAPPING #3 11:14–11:36 (EDT)
POINT OF RELEASE
09:14 HOURS
VP2-4C
VP2-4B
VP2-4A
RESIDUAL DYE FROM
RELEASE 1
OBSERVED WINDS
DIRECTION: 330 DEGREES TRUE
SPEED: 6 KTS
MAPPING #4 12:00–12:23 (EDT)
DYE CONCENTRATION (ppb)
0.1 0.5 1.0 5.0 10.0 50.0 100.0 500.0
DYE RELEASE TIMES (EDT)
RELEASE
MAPPING #1
MAPPING #2
MAPPING #3
MAPPING #4
09:00 10:00 11:00 12:00 13:00
AUG 24
LEGEND:
VP2-3A
VERTICAL PROFILE
SCALE: 1"=150'
150 0 150
CHECK GRAPHIC SCALE BEFORE USING
DYE RELEASE #2
DATE: 24 AUGUST 2005

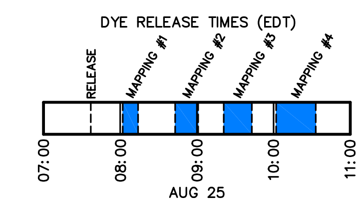
FIGURE 5





DYE CONCENTRATION (ppb)

0.1 | 0.5 | 1.0 | 5.0 | 10.0 | 50.0 | 100.0 | 500.0



NOTES:

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4. THE INFORMATION PRESENTED ON THIS CHART REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 25 AUGUST 2005 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER WITHOUT LIABILITY TO OSI.

SCALE: 1"=300'

300 0 300

CHECK GRAPHIC SCALE BEFORE USING

DYE RELEASE #3 MAPPINGS #1–4

DATE: 25 AUGUST 2005

FIGURE 6

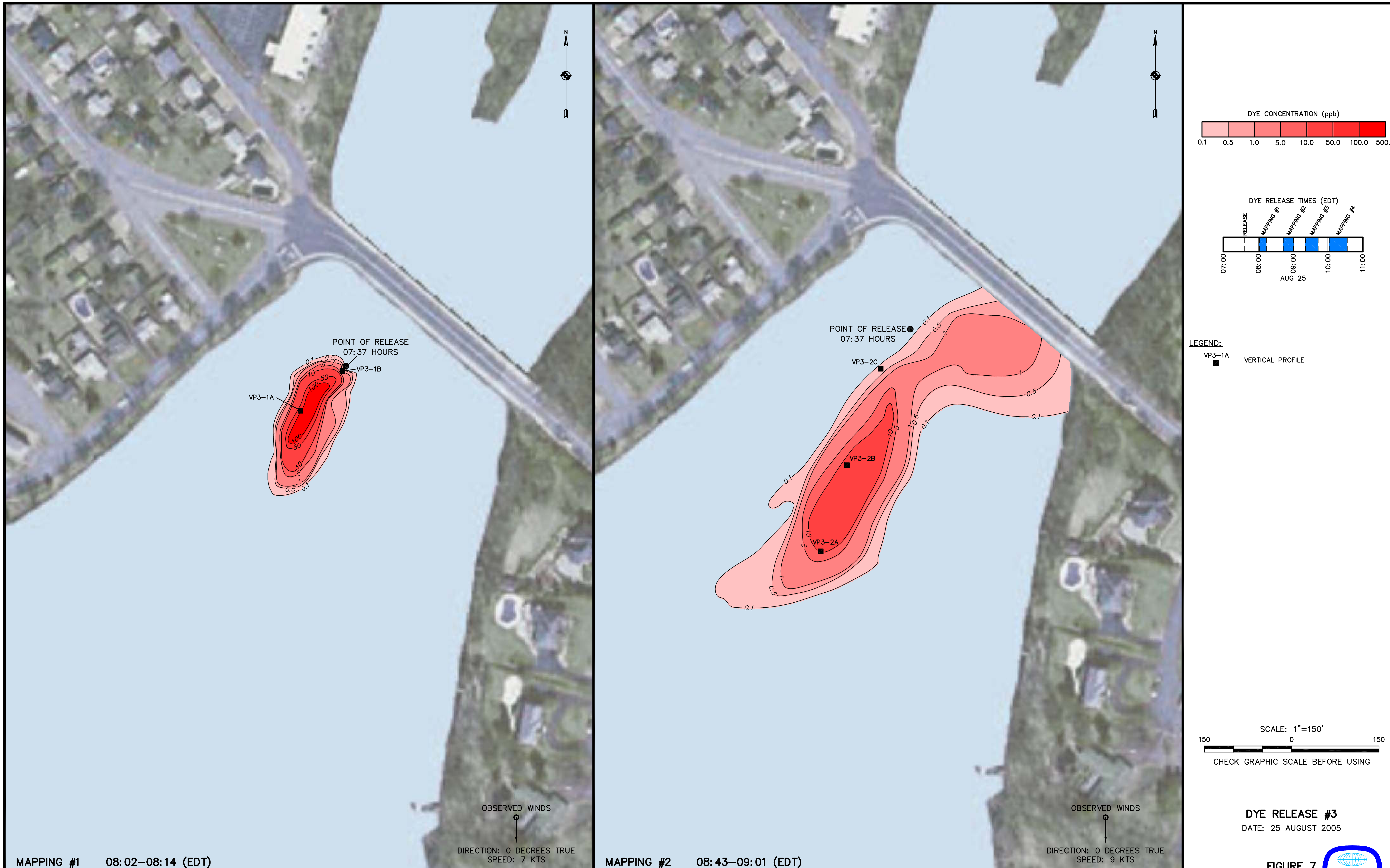
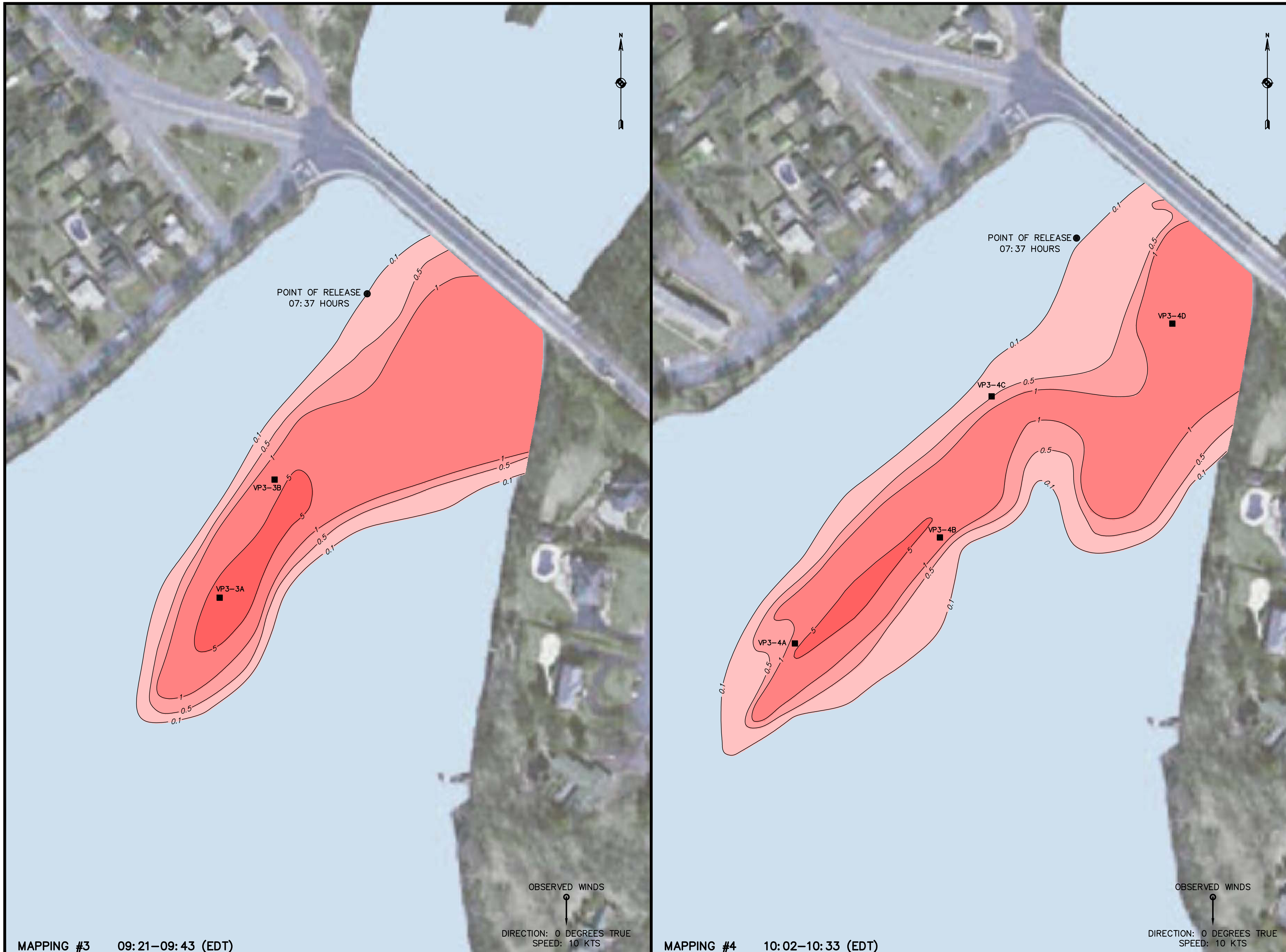

POINT OF RELEASE
07:37 HOURS
VP3-1A
VP3-1B
OBSERVED WINDS
DIRECTION: 0 DEGREES TRUE
SPEED: 7 KTS
MAPPING #1 08:02-08:14 (EDT)
POINT OF RELEASE
07:37 HOURS
VP3-2C
VP3-2B
VP3-2A
OBSERVED WINDS
DIRECTION: 0 DEGREES TRUE
SPEED: 9 KTS
MAPPING #2 08:43-09:01 (EDT)
DYE CONCENTRATION (ppb)
0.1 0.5 1.0 5.0 10.0 50.0 100.0 500.0
DYE RELEASE TIMES (EDT)
RELEASE
MAPPING #1
MAPPING #2
MAPPING #3
MAPPING #4
07:00 08:00 09:00 10:00 11:00
AUG 25
LEGEND:
VP3-1A
VERTICAL PROFILE
SCALE: 1"=150'
150 0 150
CHECK GRAPHIC SCALE BEFORE USING
DYE RELEASE #3
DATE: 25 AUGUST 2005

FIGURE 7



DYE CONCENTRATION (ppb)

0.1 0.5 1.0 5.0 10.0 50.0 100.0 500.0

DYE RELEASE TIMES (EDT)

RELEASE MAPPING #1 MAPPING #2 MAPPING #3 MAPPING #4

07:00 08:00 09:00 10:00 11:00

AUG 25

LEGEND:

VP3-1A ■ VERTICAL PROFILE

SCALE: 1"=150'

150 0 150

CHECK GRAPHIC SCALE BEFORE USING

DYE RELEASE #3

DATE: 25 AUGUST 2005

FIGURE 8

OSI